Cost Control Techniques on Civil Engineering Projects in Oyo State, Nigeria

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ABSTRACT

The study assessed the effects of cost control techniques on civil engineering projects delivery in Oyo State; determined the level of awareness and implementation of cost control techniques; and examined the problems encountered by stakeholders during the implementation. These were with a view to enhancing project success.

Primary data were used for the study. These were obtained using a structured questionnaire survey to elicit information on effect of cost control techniques on civil engineering projects for successful delivery of road. The respondents comprised 11 Civil Engineers, 28 Quantity Surveyors, 3 Builders, 3 Architects project financier and 5 Project Managers, making a total of 50 respondents. Data collected were analysed using descriptive and inferential statistics.

The study established that the top four techniques with the highest extent of awareness in the delivery of civil engineering projects measured on a six Likert-scale were: Budget Monitoring, Cost Estimating and Budgeting, Controlling of cost of materials, equipment and labour and Controlling of Overheads and indirect cost with mean score of 3.88, 3.79, 3.77,

3.64 and 3.67 respectively. On the other hand, the top four techniques with highest extent of usage were: Budget Monitoring, Cost Estimating and Budgeting, Value Engineering and Controlling of cost of Materials, Equipment and Labour. The respective mean scores of these techniques were 3.67, 3.54, 3.54, 3.55 and 3.48 respectively. Using Statistical Package for Social Sciences, it was observed that projects that cost control techniques were implemented kept the cost of construction down and in some cases were completed within the estimated contract sum while those that did not apply cost control techniques recorded cost overrun. Similar, project that cost control techniques were implemented were completed earlier than the projected duration and some within the duration. In contrast, it was established that the four major factor challenges influencing the implementation of these techniques are unstable instability in the price of materials, Delay/Non payment of work done, Government policy, Variation, at 54%, 40%, 40% and 40% respectively.

The study concluded that the implementation of cost control techniques on civil engineering project delivers projects within budget and at the specified time.

INTRODUCTION

Civil Engineering encompasses a diverse range of projects focused on designing, constructing, and maintaining physical infrastructure. These projects include transportation engineering (roads, bridges, railways, stadiums, airports), structural engineering (buildings, dams, retaining walls), water resources and environmental engineering (water supply, wastewater treatment, environmental remediation), geotechnical engineering (foundations, slope stability), construction engineering (project management, cost control, quality control), coastal engineering (protection structures, ports), materials engineering, urban planning and development, and energy infrastructure (power plants, transmission lines).

Globally, construction industries are characterised to be dynamic and faced with lots of uncertainties, this has made cost control and management difficult to achieve, inevitably causing poor cost performance (Sinesilassie et al., 2018) and project cost overrun. Several Civil Engineering construction project developments fail because of excessive pressure on designers to optimize value in terms of time, cost limit, and quality (Anyanwu, 2013). Civil engineering projects, according to Lock (2020), incur special risks and problems of organisation, which often require massive capital investment, are deserving of rigorous management of progress, finance (cost) and quality.

Cost control describes a situation where the project costs associated with construction are managed through the use of scientifically proven tools and techniques. Effective cost control is a fundamental aspect of Civil Engineering that ensures financial stability, budget adherence, quality adherence, overall project success helps control cost which can lead to project delays, quality issues, disputes, and financial losses if not put under control. It also plays a crucial role in managing risks and maintaining the trust and confidence of stakeholders. Effective cost control therefore becomes an important course of study so as to achieve project goals and ensuring economic viability especially in this present Nigeria economy where cost of construction materials is most unstable.

Despite the enormous benefits attached to the cost control and management practices, the implementation of it is lacking in many countries, specifically on the African Continent (Matins, 2018). The effect of poor cost control appears more felt in developing countries, because overruns might be double or more of the estimated costs (Ullah et al., 2016). This situation has generated a lot of attention from stakeholders in the Nigeria construction industry, rooted as it is in poor management of information for estimating and cost control. There has being a lingering lack of cost control which have led to a decrease in project production, increase in project abandonment and rate of national growth. Buildings are increasingly becoming complex and building clients more exacting in their demand for better value for their money (Cunningham, 2015).

The existing cost control practices in the Nigerian construction industry are not known for yielding efficient result, leading to almost all projects ending above the initial contract sum (Kokate & Darade, 2018). Thus control practices should take adequate account of the type of environment, the peculiar nature of projects and the set objectives among other things. Therefore, the significance of this proposal is to appraise the Implementation of Cost Control Techniques Used on Civil Engineering Projects in Oyo State, Nigeria. The research groups were Architects, Quantity Surveyors, Builders and Civil Engineers as these sets of professionals are involved in the use of cost control techniques.

It has become imperative that the success of any project depends on how that project can achieve its primary objectives which invariably depends on the use of cost control techniques. Kumar et al (2015) established that built professionals; Builders, Architects, Quantity Surveyors, Engineers and Project Managers uses cost control techniques at ensuring successful building project delivery depending on the nature, size and complexity of the project. This study covers Nigeria as a whole while this study will be carried out in the city of Ibadan and focused on Civil engineering project. Yismalet & Alemu (2018) established that for cost not to be overrun and abandoned, proper cost control techniques must be used. He went further to mentioned that, Nigeria in relation to other part of the world, delivery on successful construction project is still low as the focus as being on the available techniques without further analysis on usage with respect to project peculiarities, this study was based on Building projects in Nigeria while mine will be restricted Civil Engineering Projects in Ibadan, Oyo State. Therefore, this study will identify effective cost control techniques on Civil Engineering Projects for successful delivery and stakeholder's satisfaction in Ibadan, Oyo State.

LITERATURE REVIEW

Cost control can work through effective planning of the project schedule; this can be done with qualitative techniques as well, and gives the client/consultants/contractor effective control over the available resources. Clients are mostly preoccupied with getting their projects completed as planned, in terms of cost, time and quality. The most well recognized means of achieving this is through effective control of cost of project, using a variety of proven tools and techniques. This benefits both the client (who gets the project he wanted at the planned cost) and the contractor (who is able to make a profit on the effective delivery of the project to the client) (Kumar et al., 2015).

Controlling project's costs occurs when the sequence of all work items in the project are established and standardized, as it's the nature of projects to be dynamic, due to the following factors: (i) Resource availability, (ii) The Economy, (iii) Unexpected weather conditions, and (iv) Technical difficulties or construction methods. Others include (v) Revision of activity duration estimates, (vi) Relative priorities of projects, (vii) Budget considerations, (viii) The project completion time, and (ix) Technical specification of the project (Anyanwu, 2013).

Cost Control Techniques

All stakeholders in the construction industry are affected in one way or the other, almost always adversely, when the costs of projects go over budget: clients, professionals and investors. Akinradewo & Aigbavboa (2019) identified that those cost overruns that arise at the design stage stem mainly from inadequate management of available information amongst the design team. At the construction stage, from factors like economy policies resulting to inflation, variations, additional works and a general poor management of the project. Maintaining the cost of a construction project within the confines of a budget relies on the use of responsive cost management system; the choice of such a system is determined by a host of factors; how big the company is, work details (building or civil engineering, forms of contract) (Eldash, 2013).

The control of a project's costs is a daunting task, requiring as it does knowledge, expertise and skills on techniques for the control of cost. Therefore construction professionals must have some theoretical understanding of techniques for the control of cost and their application to the elements of a project. Applying a cost control system to a project needs that the cost manager is able to choose the best applicable techniques, apply it at the proper time, and know what to do with the information generated by the application of the cost control techniques thus applied. Malkanthi et al. (2017) have argued that the problem is not a lack of knowledge of cost control techniques, but rather the discipline to strictly implement such techniques. Their argument appears borne out by the observation by Olawale & Sun (2010) that notwithstanding the large number of software packages available for automating cost control activities, such as Microsoft Project, Asta Power Project, Primavera, orion , cost and time targets are still being missed on many construction projects.

The application of the tools may be use singularly or in combination of more, while there is argument on the importance of devising formal procedures for administering cost control on projects, the regular, unstructured day-to-day informal activities that concern cost control are even more important. Chigara et al. (2013) drew up three rules for determining the cost effectiveness of a cost control system: running the system should cost less than the benefits realised from the use of the system, results should be delivered in as short a time as possible, and the setup of the system should embrace simplicity rather than complexity.

Aziz et al. (2013) however suggested that professionals take a proactive procedure to control costs by creating and implementing an effective strategic plan, which should be part of the organization's policy, have a proper project planning and scheduling, effectively and efficiently manage the project site, have frequent meetings- as most of the cost overruns were recorded to arise from the contractor's site management related factors.

Olawale & Sun (2010) observed that the level of implementation of cost control techniques was overwhelming in UK (84% of the respondents); the predominant techniques employed were also found to vary widely but included; cost-value appraisal, project profit and loss calculation, profit and loss at valuation dates, unit costing and earned value analysis. --However, in Lesotho, Africa, awareness of cost control appears to be a challenge; majority of the respondents in a study done by Molatseli et al. (2015) claimed not to understand what cost control means.

In another study of Otim et al. (2018), the problem of cost control was found to be an absence of technical knowledge and generally poor management of the construction process. In addition, the site workers are not made aware of the performance targets, thereby leading to a frustration of efforts on implementing the cost control practices.

Alabi Sunday (2021) identified that on Civil Engineering projects, implementing cost control techniques in Nigeria, is associated with several challenges ranging from lack of familiarity with available tools and

technology, insufficient financial commitment to projects, and significant fluctuations in raw material prices ranking as the top challenges.

Problems Encountered during Implementation of Cost Control Practices

Controlling the cost of a project is one of the most difficult of project management tasks usually carried out by contractors and professionals and the benefits not fully enjoyed (Adejei et al., 2017). The following are problems encountered during the implementation of cost control on civil engineering projects;

- **Using out-dated techniques**
  This is described as the process where construction professionals in charge of managing project costs rely on analogue technology such as calculators, notebooks, and writing pads to record and analyse costs. This is as opposed to the use of modern ICT technologies that can be applied to the same purpose (Adejei et al, 2017). Construction firms are encouraged to invest in updated cost control techniques that align with industry best practices. This includes but not limited to adopting integrated project management software, leveraging real-time data analytics, and staying informed about the latest industry trends and standards.

- **Limitation of past experiences on new projects**
  In a world of every changing trend, continuous organization learning and new methods of construction, reliance on past work experience, methods and estimation fail to solve the present situation of cost variance (Adejei et a.l, 2017). Overreliance on past experience in the implementation of cost control techniques in construction projects presents several challenges. These include the unique nature of each project, the impact of technological advancements, fluctuations in the market, incomplete lessons learned, limited innovation, potential complacency, insufficient data analysis, complexities in modern project environments, personnel changes, and the risk of repeating mistakes without learning from failures.

- **Lack of technical know-how**
  Effective use of cost control requires both technical and managerial knowledge; where one of these is absent the effectiveness of the system is reduced. To remain competitive and innovative, every construction firm must acquire, manage and apply knowledge of how to control the costs of construction projects (Adejei et a.l, 2017). The lack of technical know-how during the implementation of cost control techniques in construction presents various challenges. These include inaccurate cost estimates, inefficient resource allocation, difficulties in data analysis, failure to identify cost drivers, resistance to technological advances, risks of inadequate planning, challenges in quality management, limited understanding of regulations, communication issues, and reduced effectiveness of cost control tools.

- **lack of suitable cost control process for the firm**
  Each organization is distinct in mode of operations, goals, objectives, culture, resources and work needs. Failing to develop a cost control template that will best suits the organization, has been described as a square peg in a round hole (Adejei et a.l, 2017). Construction firms needs to develop and implement standardized procedures that align with the industry best practices. This involves clearly defining roles and responsibilities, establishing accountability mechanisms, integrating cost control with overall project management, improving data management systems, and fostering a culture of continuous improvement. This approach ensures a more effective and streamlined implementation of cost control techniques across construction projects.

- **Difficulty in monitoring the varied sources of day to day cost data**
  A construction project relies on a daily/ intervals heavy inflow of data, materials inventories, labour reports, invoices, procurement orders and so on, keeping record and update with all of these information can be difficult, especially for small and medium firms, and this data becomes the facts needed to make up the cost data, future estimates and variances (Adejei et a.l, 2017). Monitoring the varied sources of day-to-day cost data poses challenges in construction cost control. Issues include data fragmentation, lack of a centralized system, inconsistent data formats, data entry errors, limited automation, challenges in real-time updates, integration issues, difficulty in tracking changes, limited visibility for stakeholders, and security concerns.

- **Variations in contract**
  A change in design, contract scope, specification, work methods, conditions of site implies additional or a change in costs estimated and budgeted for. This makes controlling the budgeted cost difficult, as a new

estimate and cost plan may have to be formulated (Adejei et a.l, 2017). Variations in construction contracts pose challenges to cost control techniques. Issues include changes in project scope, unclear contractual terms, unforeseen conditions, inadequate risk assessment, change orders, discrepancies in specifications, market fluctuations, disputes and negotiations, inefficient change management processes, and communication challenges.

- **Delayed/ No payments for works don**

  Every contractor seeks to remain in business, a delay or lack of payment reduces the cash flow, and capacity of the contractor to do more work, there by delaying the contract, increasing overhead costs, wastage of materials and ultimately project abandonment (Adejei et a.l, 2017). Delay and late payment for work done are significant challenges in the implementation of cost control techniques in construction. These issues lead to disruptions in cash flow, increased project costs, strain on relationships between stakeholders, difficulties in planning and budgeting, higher borrowing costs, contractual disputes, reduced motivation and productivity, adverse impacts on small businesses, and challenges in meeting financial obligations.

- **Unavailability of cost data**

  Cost data like prices of materials, labour cost, inflation index, present value of money, forex index, are very vital to estimating cost forecasting, and valuations of works. A lack of these data means, arriving at a realistic estimate and forecast will be hard or impossible. The unavailability ofcost data is a significant challenge in implementing cost control techniques in construction. This problem includes issues such as incomplete financial records, limited historical data for benchmarking, inaccurate cost estimates, challenges in forecasting future costs, impaired decision-making, difficulty in identifying variances, obstacles to performance evaluation, delayed decision-making, inefficiencies in cost tracking, and the risk of misallocating resources.

- **Lack of keeping records of site performance**

  Record of works done, materials purchased, cash received and spent, equipment costs, overhead costs are necessary for knowing the financial status of the project and the firm. The lack of keeping records of site performance poses challenges in the implementation of cost control techniques in construction. Issues include limited visibility into efficiency, inability to analyze trends and inefficiencies, challenges in resource allocation, risk of overlooking cost drivers, ineffective benchmarking, limited basis for decision-making, delayed issue identification, inefficient dispute resolution, and compromised continuous improvement.

- **Unstable prices of construction materials**

  Construction materials have been noted to consume a considerable amount of a project costs, an unforeseen change in the price of certain materials like cements, reinforcements, timbers and so on, have a high effect on the total cost of the project, when prices change without been forecasted for, controlling it becomes hard. The unstable prices of construction materials present a significant challenge during the implementation of cost control techniques in construction. This issue leads to budget uncertainty, risks of cost overruns, difficulties in cost estimation, impacts on profit margins, delayed decision-making, complexities in supplier and contractor negotiations, challenges in risk management, difficulties in procurement planning, potential supply chain disruptions, and adverse effects on subcontractors.

- **Lack of details in designs**

  Cost estimates and financial forecast are majorly made on the available designs, as the quantity surveyor cannot measure for things not seen. A deficiency in details in design leaves the cost engineer in the dark, thereby making cost control difficult to achieve. The lack of details in designs is a significant problem in implementing cost control techniques in construction. This issue leads to inaccurate cost estimation, scope ambiguity, difficulties in value engineering, unforeseen changes, challenges in procurement, increased construction risks, delayed decision- making, disputes and change orders, impaired cost control planning, and quality control challenges.

- **Late / No involvement of QS in the construction process**

  A quantity surveyor is the professional responsible for making cost estimates, forecasting and other cost related documents, involving a QS in the project helps to identify the various cost implications. In simpler words, the bulk of cost control lies on the professional shoulders of theQ.S. involving the professional late or not involving him/her, is highly detrimental to any process of cost control. The late or absent involvement of Quantity Surveyors (QS) in the construction process poses significant challenges for

implementing cost control techniques. Issues include limited cost planning, inaccurate cost estimation, scope creep challenges, difficulties in value engineering, lack of contractual guidance, implications for risk management, procurement challenges, delayed decision-making, limited monitoring and reporting, and reduced overall effectiveness of cost control.

- **Lack of professional training on Cost Control practices**

  Cost control is best achieved by selecting the right man with the right skills, for the right job, the right equipment and tools for the right work and the right quality of materials, in the right quantity. These criteria require professional training and learning, a lack in this expertise makes cost controlling hard. The lack of professional training on cost control practices is a significant challenge in construction. Issues include inadequate skill sets, limited understanding of cost control techniques, inaccurate cost estimation, inefficiencies in resource allocation, risk of cost overruns, ineffective budget management, limited use of technology, difficulty in change management, lack of standardized practices, and missed opportunities for continuous improvement.

- **Complexity of the project**

  Construction projects may become complex presenting a challenge for an effective cost control, especially when not envisioned in the designing and planning stage. This increases the negativity effect in controlling the costs (Olawale & Sun, 2010). The complexity of construction projects poses significant challenges in the implementation of cost control techniques. Issues include difficulties in scope definition, increased risk factors, inherent uncertainties, coordination challenges, technology and innovation costs, higher change order frequency, resource allocation challenges, specialized expertise requirements, extended project durations, and difficulty in benchmarking.

- **Unstable government regulations**

  Unstable government regulations present a significant problem in implementing cost control techniques in construction. Issues include uncertain compliance requirements, potential legal and financial risks, varied permitting processes, impact on project timelines, supply chain disruptions, challenges in budgeting and planning, contractual ambiguities, investment uncertainty, inefficiencies in adaptation, and impacts on sustainability initiatives.

- **Choice of contract procurement methods**

  The choice of the contract procurement determines how the nature and methodology in which the project will be executed. For example, a design and build contractor is expected to develop the design with the client"s budget (design to cost), any alterations from the clients comes as variations. Management contracting and Construction Management techniques emphasise quality and speed, which invariably increases project costs (Sanni& Hashim, 2013). In the same vain, design, Build and Bid provides opportunity for completion which invariable contract the project to the best qualified contractor. The choice of contract procurement method is therefore a challenges in implementing cost control techniques in construction in Nigeria. Issues include limited understanding of procurement methods, risk allocation challenges, complexity in decision-making, impacts on project timelines, contractual ambiguities and disputes, effects on cash flow, influence on contractor selection, regulatory compliance challenges, and resistance to change.

- **Risk and uncertainties**

  Risks and uncertainty are related, and have been noted to have adverse effects on delivery of construction projects. Construction works are highly dynamic, thereby making it a risky business. The occurrences of site accidents, force majeure, inflations, change in materials prices etc makes controlling cost difficult (Olawale & Sun, 2010). Problems such as inaccurate cost estimation, budget overruns, project delays, supply chain disruptions, fluctuating market conditions, legal and regulatory risks, technology and innovation risks, environmental and geotechnical risks, labor market fluctuations, and impacts on financing makes cost control implementation difficult.

RESEARCH METHODS

The study population comprised of stakeholders engaged in Civil Engineering Projects in Ibadan, Oyo State, Nigeria. The target population of respondents comprised of stakeholders that participated essentially on the supply side of project delivery. This consists of Architects, Structural Engineers, Builders, Quantity Surveyors, Project Managers and Clients. Table below shows the population of the sample

population for this research work was construction professionals working in both public and private sector in Ibadan.

For the purpose of this research, 80 professionals ranging from Architects, Builders, Civil Engineers and Quantity Surveyors in selected Private sector & Public sector within Ibadan were sourced while 50 responded. The sample technique adopted for selecting respondents for this research was purposive sampling technique. All the stakeholders that participated on the selected projects were targeted as respondents. As such, a total enumeration of the study population was embarked upon. This is a method of sampling that ensures that every member of the population is given an equal chance of being selected (Malkanthi et al., 2017)

Primary data was used in this study. The primary data were collected using questionnaire survey. To achieve the stated objectives, questionnaires were administered on the identified stakeholders involved in cost in Civil Engineering projects.

The awareness of cost control techniques and the level at which stakeholders implements it was weighed using the mean score obtained via the ratings supplied on the copies of questionnaire while analysis of variance was used to know the performance of these techniques with respect to cost and time in civil engineering projects. Mean was also used to weigh the mapping between the challenges faced while implementing these techniques; A 6-point Likert-type scale was employed for data collection and a mean analysis was done using the mean score analysis formula given question was based. The percentile was used to analyse demographic characteristics of the respondents.

$$MS \quad \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1 + 0n_0}{n_5 + n_4 + n_3 + n_2 + n_1 + n_0}$$

where MS = Mean Score

Where n_0 = no of respondent who answered "No Awareness/Implementation"

n_1 = no of respondent who answered "very low"

n_2 = no of respondent who answered "low"

n_3 = no of respondent who answered "Moderate"

n_4 = no of respondent who answered "high"

n_5 = no of respondent who answered "very high"

Relative Importance Index (RII)

This was used to rank the various reasons given by the respondents on the likert scale in their order of importance in order to ascertain the respondents level of awareness and perception on Cost Control Techniques and its implementation in the study area. The formula is given as below.

$$RII = \frac{\sum \times}{}$$

Where $\sum$ = Summation of given items

W = Weighted Sum

N = Total number of respondents

A = Number of decisions available (i.e. highest weight).

RESULT AND DISCUSSION OF FINDINGS

Response Rate

The questionnaire addressed the implementation of cost control techniques on Civil Engineering Projects in Ibadan, Oyo State, Nigeria. Data were obtained on the profile of the Three (3) categories of stakeholders, comprising of Government, Contractors and Consultants and Developers. The information obtained was used in carrying out this study. Out of 80 questionnaires distributed to the identified stakeholders, 50 were retrieved and used for analysis. This represents 62.5% response rate and this is considered appropriate following Danity (2008) and Sutrisna (2009) that the response rate between 30 to 40% is adequate to avoid bias. Presented below are the analysis of data collected, starting from the general particulars of the respondents to data related to individual objectives of this study. The data analysed were collated in summary Tables, interpreted and discussion of findings made in the light of existing literature

The information provided included type of the organization, profession of respondent, years of work experience, level of professional membership as well as number of projects handled. The responses were analysed and the result presented in Table below. It is evident from the Table that 24% (12) of the stakeholders were from Government representatives, 34% (17) were Contractors representives and 26% (13) were Developers" representatives and 16% (8) from consultants.

Table : Profile of Respondents

Background Information	Parameter	Frequency	Percent
Type of Organization	Government	12	24
	Contractor	17	34
	Developer	13	26
	Consultant	08	16
	Total	**50**	**100**
	Quantity Surveyors	28	56
	Engineers	11	22
	Builders	03	6
	Project Managers	05	10
Total		**50**	**100**
Experience	11-15 years	7	14
	16-20 years	9	18
	Above 20 years	26	52
	Total	**50**	**100**
On cost control techniques	6-10 years	16	32
	11-15 years	12	24
	16-20 years	6	12
	Above 20 years	8	16
	Total	**50**	**100**
Professional Membership of Respondent	Probationers	4	8
	Corporate Members	33	66
	Fellows	13	26
	Total	**50**	**100**
Number of Projects handled	1-5 projects	5	10
	6-10 projects	8	16

	11-15 projects	12	24
	16-20 projects	6	12
	Above 20	19	38
	Total	**50**	**100**

Regarding respondents discipline, 56% (28) of them are Quantity Surveyors by profession, 10% (5) Project Managers, 6% (3) Builders, 6% (3) Architects, 22% (11) Engineers. Their years of professional experience revealed that 16% (8) of the surveyed respondents had between 6-10 years of industry experience, 14% (7) had 11-15 years of experience, 18% (9) had 16-20 years and 32% (16) had above 20 years of industry experience with average year of industry experience of 19 years.

Considering their experience on Cost Control techniques on Civil Engineering Projects, the result indicated that that 16% (8) of the surveyed respondents had between 1-5 years of experience, 32% (16) had 6-10 years of experience, 24% (12) had 11-15 years of experience, 12% (6) had 16-20 years of experience while 16% (8) had over 20 years of experience with average 12 years of cost control techniques experience. This is an indication that most of the respondents had more experience on cost control techniques on Civil Engineering Project. Generally, the respondents consisted of 70% (35) professional Corporate Members, 4% (2) at Probationer members and 26% (13) Fellows. A total of 6% of the respondents handled 1-5 projects; 16% handled 6-10 projects, 24% handled 11-15 projects and 1.2% handled above 15-20 while 42% handled over 20 projects.

Number of projects handled in the last ten years?
50 responses

- 1 – 5 projects
- 6 – 10 projects
- 11 – 15 projects
- 16 – 20 projects
- Above 20
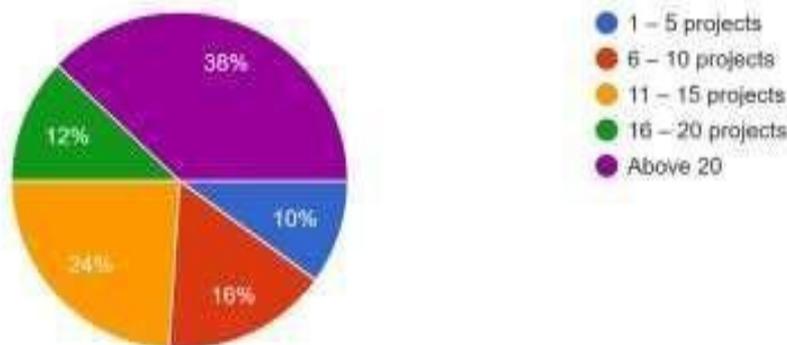
Awareness of Cost Control Techniques applied on Construction Projects

The objective of this research was set to assess the extent of implementation of cost control techniques available for use in civil engineering project in Ibadan, Oyo State, Nigeria. The study considered four categories of stakeholders (Government, Developers , Contractors and Consultants). In order to achieve the objective, respondents were requested to provide their experience on level of implementation of these techniques. The scorings provided by the respondents were subjected to Mean Score Analysis (MSA), Relative Importance Difference, (RII). The result from Table 4.1 showed that, there were twenty (20) cost control techniques tested in all, as presented in Table 4.2 the three highest ranked techniques were Budget Monitoring – MS = 3.88; Cost Estimating and Budgeting – Unit Costing – MS = 3.79; and Controlling the cost of materials, Equipment and Labour – MS = 3.77. while the techniques Use of S-curve for cost/time monitoring MS = 2.33; and Monte Carlo simulation of project costs MS = 2.35 did not appear to be widespread, as both recorded low extent.

The opinions of the professionals working on each of the civil engineering projects were sought on a Likert-type scale of 0-5 on the level of awareness on each of the identified 22 cost control techniques as shown in Table . The data set in Table 4.2 shows that budget monitoring, cost estimating and budgeting, controlling cost of materials, equipment and labour were most known with mean score of 3.88, 3.79, 3.77 respectively and ranking 1,2,3 respectively. This result is in line with (Anyanwu, 2013) statement that budgets represent the boundaries

within which the design must be carried out. Design options which fall outside these boundaries may need to be readjusted and projects should be monitored and ensure that the total of those various elements budgeted for are not exceeded, otherwise the client might provide allowance for additional resources to accommodate the design.

Table 4.2:Level of Awareness of Cost Control Techniques

S/N	COST CONTROL TECHNIQUE	MEAN SCORE	RII	RANKING	EXTENT OF IMPORTNCE
2	Cost Estimating and Budgeting	3.79	0.631	2	High Extent
3	Cost of Materials, Equipments and Labour	3.77	0.628	3	High Extent
4	Controlling Overheads and Indirect Costs	3.67	0.611	4	High Extent
5	Others	3.67	0.611	4	High Extent
6	Contingency	3.65	0.608	6	High Extent
7	Cash Flow Analysis work program3.63	3.63	0.605	7	High Extent
8	Schedule Monitoring	3.58	0.597	8	High Extent
9	Controlling Sub Contractor Cost	3.56	0.593	9	High Extent
10	Cost Reporting	3.52	0.587	10	High Extent
11	Work Breakdown Structure	3.48	0.580	11	High Extent
12	Value Engineering	3.48	0.580	11	High Extent
13	Cost Forecasting	3.44	0.573	13	High Extent
14	Contract Variance Unit Costing	3.42	0.570	14	High Extent
15	Cost Value Reconciliation	3.40	0.567	15	High Extent
16	Earned Value Analysis	3.24	0.540	16	High Extent
17	Resources Management Strategy	3.08	0.513	17	High Extent
18	Variance Analysis	2.88	0.480	18	Moderate Extent
19	Use of Sofware	2,81	0.468	19	Moderate Extent
20	Monte Carlos Stimulation	2.35	0.392	20	Low Extent
21	Cost Recording	2.35	0.392	20	Low Extent
22	S- Curve	2.33	0.388	22	Low Extent

Source of Variation	SS	df	MS	F	P-value	F critical
Between Groups	4.131964	2	2.065982	57.58435		
Within Groups	0.681672	19	0.035877			
Total	4.813636	21		8.61932E-09	3.521893	

It can be observed that F-Calculated 57.58435 is greater than F-Critical 3.521893 and P-Value of 8.61932E-09 is very close to zero and less than P-Critical of 0.05. This implies that there is a statistically significant difference in Level of awareness of Cost Control Techniques. $(F(2,19) = 57.58435, p < 0.05)$.

Analysis provided in table 4.3 shows that budget monitoring, cost estimating and budgeting as well as value engineering are mostly used in executing civil engineering projects in Ibadan, Oyo State.

Table 4.3:   Level of Implementation of Cost Control Techniques

S/N	COST CONTROL TECHNIQUE	MEAN SCORE	RELATIVE IMPORTANCE INDEX	RANKING
1	Budget Monitoring	3.67	0.612	1
2	Cost Estimating and Budgeting	3.54	0.59	2
3	Value Engineering	3.54	0.59	2
4	Controlling Materials, Equipment and Labour Cost	3.48	0.58	4
5	Cash Flow Analysis work Program	3.46	0.576	5
6	Cost Forecasting Technique	3.33	0.555	6
7	Work Breakdown Structure	3.33	0.555	6
8	Contingency Allowance for Project Budget	3.33	0.555	6
9	Schedule Monitoring	3.31	0.551	9
10	Cost Reporting	3.29	0.548	10
11	Controlling Sub Contractor Cost	3.27	0.545	11
12	Controlling Overheads and Indirect Costs	3.17	0.528	12
13	Cost Value Reconciliation	3.13	0.521	13
14	Cost Recording	3.10	0.516	14
15	Resources Management System	3.08	0.513	15
16	Contract Variance Unit Costing	3.06	0.51	16
17	Use of Software	2.92	0.486	17
18	Variance Analysis	2.85	0.475	18
19	Earned Value Analysis	2.83	0.471	19
20	Others	2.48	0.413	20
21	Use of S – Curve for Time Monitoring	2.35	0.391	21
22	Monte Carlos Stimulation	2.29	0.381	22

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1.523718	2	0.761859	9.702817	0.001249	3.521893
Within Groups	1.491868	19	0.078519			
Total	3.015586	21				

Challenges facing implementation of Cost Control Techniques

Table 4.4 shows the survey on the absence of professional training on cost control techniques, categorized by roles of the respondents and it revealed that 18 respondents representing 36% selected Always, 12

respondents representing 24% selected Often, 17 respondents representing 34% selected Seldom while 3 respondents representing 6% selected Never: These represent the frequency with which the challenges are encountered by the respondents.

Table 4.4: Absence of professional training on cost control technique

Respondents	Always	Often	Seldom	Never	Total
Project Managers	3	2	4	1	10
Quantity Surveyor	5	3	6	0	14
Architect	3	2	3	0	8
Engineers	5	3	2	1	11
Builders	2	2	2	1	7
Total	18	12	17	3	50
Percentage	36%	24%	34%	6%	100%

Table 4.5 shows the survey on the Complexity/size of Projects, and it revealed that 16 respondents representing 32% selected Always, 12 respondents representing 24% selected Often, 11 respondents representing 22% selected Seldom while 11 respondents representing 22% selected Never. This is in line with Cunnighan(2015) statement that Civil Engineering projects are becoming complex and clients are more exacting in their demand for better value.

Table 4.5: Complexity/size of Projects

Respondents	Always	Often	Seldom	Never	Total
Project Managers	3	1	4	2	10
Quantity Surveyors	6	4	1	3	14
Architect	2	3	2	1	8
Engineers	3	1	2	5	11
Builders	2	3	2	0	7
Total	16	12	11	11	50
Percentage	32%	24%	22%	22%	100%

Table 4.6: shows the survey on the Delay/Non -payment of work done as a challenge, and it revealed that 20 respondents representing 40% selected Always, 14 respondents representing 28% selected Often, 9 respondents representing 18% selected Seldom while 7 respondents representing 14% selected Never.

Table 4.6 : Delay/Non -payment of work done

Respondents	Always	Often	Seldom	Never	Total
Project Managers	4	4	2	0	10
Quantity Surveyors	7	4	2	1	14
Architects	1	3	3	1	8
Engineers	5	1	2	3	11
Builders	3	2	0	2	7
Total	20	14	9	7	50
Percentage	40%	28%	18%	14%	100%

Table 4.7 : shows the survey on the Instability in prices of construction materials , and it revealed that 27 respondents representing 54% selected Always, 17 respondents representing 34% selected Often, 4 respondents representing 8% selected Seldom while 2 respondents representing 4% selected Never.

Table 4.7: Instability in prices of construction materials

Respondents	Always	Often	Seldom	Never	Total
Project Managers	5	3	2	0	10
Quantity Surveyors	8	5	0	1	14
Architects	4	3	0	1	8
Engineers	6	4	1	0	11
Builders	4	2	1	0	7
Total	**27**	**17**	**4**	**2**	**50**
Percentage	**54%**	**34%**	**8%**	**4%**	**100%**

This table 4.8 shows the survey on the Lack of technical know-how, and it revealed that 14 respondents representing 28% selected Always, 14 respondents representing 28% selected Often, 12 respondents representing 24% selected Seldom while 10 respondents representing 20% selected Never.

Table 4.8: Lack of technical know how

Respondents	Always	Often	Seldom	Never	Total
Project Managers	3	2	2	3	10
Quantity Surveyors	4	5	4	1	14
Architects	2	1	2	3	8
Engineers	2	4	3	1	11
Builders	3	3	1	2	7
Total	14	14	12	10	50
Percentage	**54%**	**34%**	**8%**	**4%**	**100%**

This table 4.9 shows the survey on the Insufficient details in design, and it revealed that 17 respondents representing 34% selected Always, 15 respondents representing 30% selected Often, 12 respondents representing 24% selected Seldom while 6 respondents representing 12% selected Never.

Table 4.9: Insufficient details in design

Respondents	Always	Often	Seldom	Never	Total
Project Managers	3	3	2	2	10
Quantity Surveyors	4	5	4	1	14
Architects	3	5	0	0	8
Engineers	4	3	3	1	11
Builders	3	3	3	2	7
Total	17	15	12	10	50
Percentage	**34%**	**30%**	**24%**	**20%**	**100%**

This table 4.10 shows the survey on the Choice of procurement method, and it revealed that 11 respondents representing 22% selected Always, 21 respondents representing 42% selected Often,12 respondents representing 24% selected Seldom while 6 respondents representing 12% selected Never.

Table 4.10: Choice of procurement method

Respondents	Always	Often	Seldom	Never	Total
Project Managers	2	4	2	2	10
Quantity Surveyors	3	6	4	1	14
Architects	2	3	3	0	8
Engineers	2	5	3	1	11

Builders	2	3	0	2	7
Total	11	21	12	6	50
Percentage	**22%**	**42%**	**24%**	**12%**	**100%**

This table 4.11 shows the survey on the Unstable government policy/economy, and it revealed that 20 respondents representing 40% selected Always, 18 respondents representing 36% selected Often, 11 respondents representing 22% selected Seldom while 1 respondents representing 2% selected Never.

Table 4.11: Unstable government policy/economy

Respondents	**Always**	**Often**	**Seldom**	**Never**	**Total**
Project Managers	4	4	2	0	10
Quantity Surveyors	6	5	3	0	14
Architects	3	2	3	0	8
Engineers	4	4	2	1	11
Builders	3	3	1	0	7
Total	20	18	11	1	50
Percentage	**40%**	**36%**	**22%**	**2%**	**100%**

This table 4.12 shows the survey on the Variation in contract, and it revealed that 20 respondents representing 40% selected Always, 18 respondents representing 36% selected Often, 11 respondents representing 22% selected Seldom while 1 respondents representing 2% selected Never.

Table 4.12: Variation in contract

Respondents	**Always**	**Often**	**Seldom**	**Never**	**Total**
Project Managers	4	4	2	0	10
Quantity Surveyors	6	5	3	0	14
Architects	3	2	3	0	8
Engineers	4	4	2	1	11
Builders	3	3	1	0	7
Total	20	18	11	1	50
Percentage	**40%**	**36%**	**22%**	**2%**	**100%**

Other Challenges
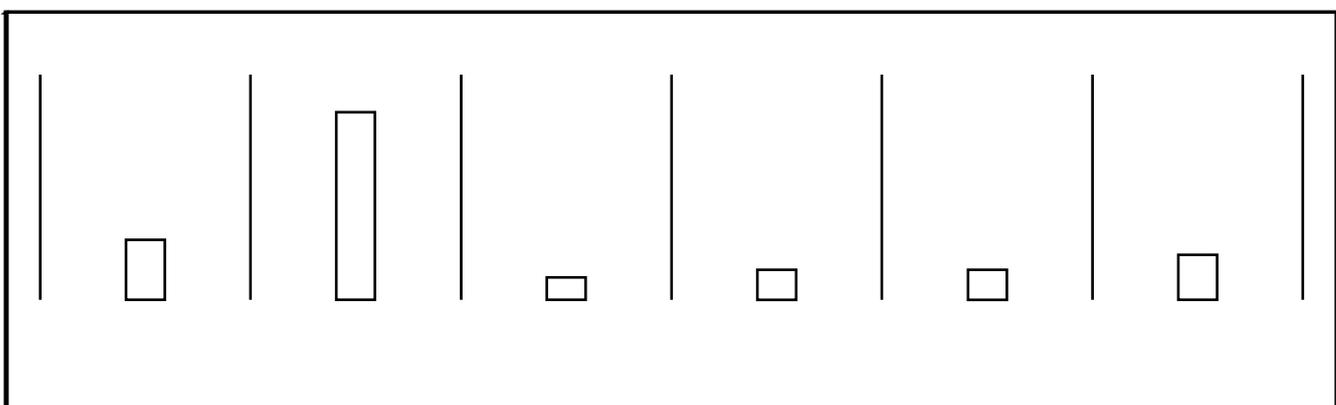
GOVERMENT BUREAUCRACY	NIL	EXCESS ADDITIONAL	ALWAYS	UNDUE INTERVENTION	MANAGEMENTCHALLENGES IN
WORKS				ON PROFESSIONAL	HELPING TO IMPLEMENT
				ETHICS	COST CONTROL
				DELIVERY	

This Chart above shows the survey on the other challenges, and it revealed that 8 respondents representing 16% suggested government bureaucracy, 25 respondents representing 36% suggested nil, 3 respondents representing 6% suggested Excess Additional works , 4 respondents representing 8% suggested always, 4 respondents representing 8% suggested Undue intervention on professional ethics delivery while 6 respondents representing 12% selected Management challenges in helping to implement cost control.

Earned value analysis originated in the US, and employed mainly for large construction projects. It has become an established method for the evaluation and financial analysis of projects throughout their life cycle. It deals with the control of both the cost and schedule of projects, through the use of trends analysis. The cost-to-schedule variance thus generated by this approach is the popular „S" curve. Earned value analysis requires the calculation of three important values for each activity in the work breakdown structure (Garvin, 2000). In this research both the EVA and S"Curve techniques shows very low awareness and implementation, it can then be deduced that this techniques is not applicable in Nigeria and reason for it low ranking out of the 22 techniques identified. It was instructive that „Use of S- curve for cost monitoring" was considered the least known and second to the least technique applied. This might be in line with assertions of writers such as Otim et al. (2018) that lack of technical knowledge is a major problem of project cost control. Dindi et al. (2018) acknowledge the importance of experience when they recommended mentoring of younger professionals by their more experienced older counterparts; this study's finding agrees with this position. In ranking the application of cost control techniques, it was observed that more experienced respondents differed sharply from those that had fewer years of work experience. This might mean that studies of cost control techniques need to target construction professionals on the basis of work experience in order to develop workable strategies.

The use of software and cost recording are not techniques used widespread in the construction industry for civil engineering projects as it was only ranked 19th and 20th out of 22 cost control techniques. Researchers have been examining how to carry out cost control through the use of software created for project management (Costin et al. (2012).For example, from the study by Liberatore et al. (2001) Primavera Project Planner and Microsoft Project are the most common software employed for project management; the use of software was found to be universal amongst most researchers contrary to this research that ranked awareness of software as 19th out of 22 techniques.

Results also shows that projects where stakeholders use cost control techniques were executed within the estimated cost while some even recorded reduced cost of construction. It was also observed that project were carried out within the proposed duration and some earlier than proposed when cost control techniques were applied. The above comply with the research findings that most well recognized means of achieving cost is maintained is through effective control of cost of project, using a variety of proven tools and techniques. This benefits both the client (who gets the project he wanted at the planned cost) and the contractor (who is able to make a profit on the effective delivery of the project to the client) (Kumar et al., 2015).

The findings of this study are in agreement with Adejei et al. (2017) who identified a number of problems facing the implementation of cost control techniques/practices. Some of the challenges identified were (i) Instability in prices construction materials which records the highest percentage of 54% (ii) Delayed/ No payments for works done records 40% (iii) Unstable Government Policies/ Economic Conditions records 40% (iv) Variation recorded 40%. The problem that was considered least important was lack of technical know =how and choice of procurement method recording 28% and 22% respectively. Other challenges identified by respondents are; Government bureaucracy 16%, Excess additional works 6%, Undue intervention on professional ethics delivery 8% and Management of challenges in other to implement cost control techniques 12%.

The length of working experience, professional status and type of work and period spend on cost overrun all influence how people perceive the importance of the problems that confront the implementation of cost control techniques/practices. These findings add to the conclusions of writers such as Otim et al. (2018) and Adejei et al. (2017) with respect to the influence of experience, training and work type on problems of cost control.

CONCLUSION AND RECOMMENDATION

The study concluded that projects that cost control techniques were implemented kept the cost of construction down and in some cases were completed within the estimated contract sum while those that did not apply cost control techniques recorded cost overrun. Similar, project that cost control techniques were implemented were completed earlier than the projected duration and some within the duration. In contrast, it was established that the four major factor challenges influencing the implementation of these techniques are unstable instability in the price of materials, Delay/Non-payment of work done, Government policy, Variation, at 54%, 40%, 40% and 40% respectively.

Conclusions

Based on the strength of the findings of the study, the following conclusions were drawn:

- Cost Control Techniques ensures that projects are completed within the estimated budget and stipulated time.
- Top 5 Challenges facing the implementation of Cost Control techniques are; Instability of prices of materials, Variation, Government regulations and delay/non payment of work done.

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