Journal of Computer Science Review and Engineering | ***ISSN 1694-4488***
Published by AIR JOURNALS | *https://airjournal.org/jcsre*
16/18 Avenue des Longaniers, Quatre Bornes, Mauritius
airjournals@gmail.com; enquiry@airjournal.org



RESEARCH ARTICLE

Evaluation of Cost Control Mechanisms and their Impact on Cost Performance in Federal Road Projects in Nigeria

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Citations - APA

Nwinam, S. T. & Abonyi, D. O. (2026). Evaluation of Cost Control Mechanisms and their Impact on Cost Performance in Federal Road Projects in Nigeria. *Journal of Computer Science Review and Engineering, 10(1) 1-12. DOI: https://doi.org/10.5281/zenodo.23973414*

ABSTRACT

This study examined the effectiveness of project cost control mechanisms in federal road construction projects in Nigeria in response to persistent cost overruns and inefficiencies in public infrastructure delivery. Specifically, the study identified and evaluated the cost control mechanisms adopted in selected projects, and analyzed the factors influencing cost overruns. A quantitative research design based on descriptive survey and secondary data analysis was adopted. The population comprised 150 construction professionals drawn from three major federal road projects in Southeast and South-South Nigeria, and a census sampling technique was employed. Primary data were collected through structured questionnaires, while secondary data were obtained from Nigeria Bureau of Statistics (NBS). Data were analyzed using documentary analysis, descriptive statistics, and one-sample t-test. The findings revealed that formal cost control mechanisms such as Cost Breakdown Structure (CBS) and Earned Value Management (EVM) were adopted in the selected projects and positively influenced project cost control and performance. Documentary analysis showed that budget variance reduced from 44.80% to 0.60% following the adoption of advanced cost control tools, while survey responses produced a grand mean of 4.27 on a 5-point scale. Projects that adopted advanced cost control mechanisms achieved performance indices as high as 0.99 compared to 0.55 under basic controls, with a grand mean of 4.53. The study further identified financial constraints, inflation, and design changes as the major causes of cost overruns, with an overall mean of 4.58 and standard deviation of 0.64. The hypotheses tested at a 0.05 level of significance resulted in the rejection of all three null hypotheses. The study concluded that effective project cost control in federal road construction projects depends on the adoption of advanced cost control tools, consistent implementation, and supportive institutional frameworks.

Keywords: *Cost Control Mechanisms; Cost Performance; Federal Road Projects; Cost Overruns; Public Infrastructure Delivery*

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Introduction

Infrastructure development is a fundamental driver of economic growth and national development. Road infrastructure, in particular, facilitates trade, mobility, and access to social services across nations (World Bank, 2022). In developing economies, road networks serve as critical arteries for linking communities, markets, and institutions. The quality and efficiency of road construction processes, therefore, have far-reaching consequences for national productivity and welfare. Project cost control is a core discipline within construction project management. According to Akintoye and Collier (2022), project cost control is the systematic process of monitoring, regulating, and managing expenditures to ensure that a project is completed within its approved budget. Effective cost control encompasses budget planning, cost forecasting, variance analysis, and corrective action mechanisms. As noted by Famiyeh et al., (2017), without these processes, construction projects are vulnerable to financial overruns and resource misallocation. Cost overrun is a pervasive challenge in public construction projects globally. It is defined as the difference between the actual project cost at completion and the original approved budget, expressed as a positive value when actual costs exceed estimates (Cantarelli et al., 2022). Studies across multiple continents have consistently documented cost overruns in road construction projects, with some projects exceeding their budgets by margins above 50% (Ahiaga-Dagbui et al., 2015). These overruns deplete public funds, delay project delivery, and reduce confidence in public procurement systems.

In Africa, road infrastructure investment has grown substantially over the past two decades. Several governments have committed significant capital to road construction as part of broader development agendas (African Development Bank, 2023). Despite these investments, cost overruns remain endemic to road construction projects across sub-Saharan Africa. Institutional weaknesses, poor project planning, and inadequate financial oversight have been identified as contributing conditions (Owusu-Manu et al., 2021). Nigeria presents a particularly challenging context for federal road construction. The country maintains an extensive federal road network spanning over 35,000 kilometres, managed primarily by the Federal Ministry of Works (Federal Ministry of Works, 2022). Road construction in Nigeria is financed largely through annual federal budgetary allocations, which are subject to fiscal volatility and political interference. According to Eze et al (2013), these conditions create structural vulnerabilities in project financing and cost management.

Scholarly attention to cost control in Nigerian road construction has grown in recent years. However, most studies have focused on cost overruns as outcomes rather than on the mechanisms designed to prevent them (Eze et al., 2023; Idoro, 2012). The effectiveness of specific cost control mechanisms, and their relationship to actual project cost performance, has received comparatively less rigorous empirical investigation.

Statement of the Problem

The financial performance of construction projects remains a persistent and measurable concern within the infrastructure sector. Empirical studies consistently report that construction projects frequently exceed their approved budgets, with cost overruns ranging between 20% and 80% of original estimates in developing economies (Belay et al., 2021; Abdelalim et al., 2024). In Nigeria specifically, federal road construction projects have recorded budget deviations averaging between 30% and 50% above initial cost estimates, reflecting a systemic pattern of financial underperformance in public infrastructure delivery (Ismail et al., 2021). Such financial deviations undermine efficient public expenditure, reduce the volume of infrastructure projects that can be executed within limited public budgets, and weaken institutional confidence in infrastructure investment programs.

Project cost overrun refers to the situation in which the final project cost exceeds the original estimated budget. In Nigeria, the federal government allocates substantial financial resources annually to the development and rehabilitation of national road networks through agencies such as the Federal Ministry of Works and the Federal Roads Maintenance Agency. Formal cost management frameworks, including procurement regulations, budget monitoring systems, and internationally recognised tools such as Earned Value Management (EVM) and Cost Breakdown Structures (CBS), are prescribed within the operational guidelines governing federal construction projects.

Despite the existence of these cost control frameworks, cost overruns continue to persist across federal road construction projects, with budget variance recorded as high as 44.80% in the early phases of selected projects. This

contradiction between the availability of formal control mechanisms and the continued occurrence of significant cost deviations constitutes the central tension motivating this study. The persistence of this pattern raises critical questions about whether existing cost control mechanisms are being consistently implemented, whether they are sufficiently advanced, and whether supportive institutional conditions exist to sustain their effectiveness.

Existing studies have examined cost overruns and project performance in construction projects across different regions. However, several scholars observed that research in developing countries often lacks detailed empirical examination of cost management practices within specific infrastructure sectors (Ismail et al., 2021). Limited evidence exists regarding the specific cost control mechanisms applied in federal road construction projects in Nigeria, the extent to which these mechanisms are implemented in practice, and how their adoption relates to measurable cost performance outcomes. This knowledge gap restricts the capacity of policymakers and project managers to evaluate the effectiveness of current financial control practices and to design targeted interventions for improvement.

The continued occurrence of cost overruns in public road projects carries serious economic and institutional implications. Persistent budget escalation reduces the number of infrastructure projects that governments can execute within constrained public resources and erodes public confidence in infrastructure governance. This situation underscores the need for systematic empirical investigation into the cost control mechanisms used in federal road construction projects, their relationship with project cost performance, and the factors that drive cost overruns despite the existence of formal control provisions.

Objectives of the Study

This study aims to evaluate the effectiveness of project cost control mechanisms and their influence on cost performance in federal road construction projects in Nigeria. The specific objectives of the study are to:

i. To identify and evaluate the cost control mechanisms used in federal road construction projects in Nigeria.
ii. To analyse the factors influencing cost overruns in federal road construction projects in Nigeria.

Statement of Hypotheses

The following null hypotheses will be tested:

i. **H_{01}:** Cost control mechanisms have no significant effect on project cost performance in federal road construction projects in Nigeria.
ii. **H_{02}:** Factors such as inflation, design changes, and financial constraints do not significantly influence cost overruns in federal road construction projects in Nigeria.

Review of Related Literature

Conceptual Review

Project Cost Control Mechanisms

Project cost control mechanisms refer to structured managerial procedures that regulate financial expenditure throughout the life cycle of a construction project. These mechanisms ensure that project costs remain within the approved financial limits established during the planning stage. Construction projects often require substantial financial investment and involve complex operational processes. Effective financial monitoring therefore represents an essential component of project management practice. Scholars emphasized that cost control constitutes a fundamental element of construction project management because it supports financial accountability and efficient resource utilization (Panchal et al., 2024). Within the construction context, cost control mechanisms typically involve systematic budgeting, cost monitoring, financial reporting, and corrective managerial actions.

Construction project management literature also highlights the importance of performance monitoring techniques in cost control systems. One widely discussed technique involves the use of integrated performance measurement tools that combine cost and schedule monitoring. Hasan et al. (2021) explained that earned value management provides a structured method that evaluates project performance by comparing planned costs, actual expenditures,

and completed work progress. This approach allows project managers to assess whether project activities remain within budget expectations and schedule targets.

Cost Control Mechanisms

Cost control in construction projects begins during the early stages of project planning. At this stage, project teams establish cost estimates and develop financial budgets that guide subsequent project expenditure. These estimates usually derive from feasibility studies, cost analysis, and engineering assessments of required resources. Accurate cost estimation serves as the foundation for effective cost control. Mokoena et al. (2023) noted that poor cost planning and inaccurate initial estimates often lead to financial deviations during project implementation. A reliable estimation process therefore provides a baseline that enables project managers to evaluate actual project expenditure against planned costs.

Cost control mechanisms also involve managerial practices that regulate resource utilization during construction activities. Construction projects rely on multiple resources such as labor, materials, equipment, and subcontractor services. Each resource category carries financial implications for project expenditure. Effective control systems therefore require careful supervision of resource consumption and operational efficiency. Elserougy et al. (2024) identified several cost control techniques that support effective resource management. These techniques include unit cost analysis, interim valuation of completed work, and resource monitoring procedures.

Factors Influencing Cost Overruns

Cost overruns in construction projects rarely emerge from a single source. Instead, they arise from a combination of technical, managerial, institutional, and economic factors that influence project expenditure during implementation. Construction projects operate within complex operational environments that involve multiple stakeholders, contractual arrangements, and resource dependencies. These conditions create several points at which financial deviations may occur. Scholars therefore emphasize that understanding the factors that influence cost overruns remains essential for improving project financial performance (Abdelalim et al., 2024). Belay et al. (2021) examined infrastructure projects in developing economies and reported that inaccurate cost estimation frequently contributes to cost escalation during project execution.

Managerial capacity and project supervision practices also influence the likelihood of cost overruns in construction projects. Effective supervision ensures that project activities follow established financial and operational plans. Weak supervision may allow inefficiencies in resource utilization or delays in project execution. Elserougy et al. (2024) observed that inadequate project control systems frequently contribute to poor cost performance in construction projects. When monitoring systems fail to detect financial deviations at an early stage, project costs may gradually exceed the approved financial limits. Federal road construction projects often involve multiple regulatory agencies, contractors, consultants, and government authorities.

Theoretical Framework

Cost Control Theory

Cost Control Theory emerged from classical management and accounting scholarship that examined how organizations regulate financial resources during operational activities. Early conceptual foundations appeared in the work of Anthony (1965), who examined management control systems that guide organizational planning, budgeting, and expenditure supervision. Later scholars expanded these ideas within project management and construction economics. The theory therefore evolved as a managerial framework that explains how organizations monitor financial performance and maintain expenditure within planned limits. Contemporary research continues to apply the theory to construction management because financial discipline remains central to project success (Alu et al., 2024).

Cost Control Theory explains how project managers regulate project expenditure through systematic financial planning, monitoring, and corrective action. The theory assumes that every project operates with predetermined financial targets that originate from cost estimates and approved budgets. These financial targets represent the expected cost baseline for project implementation. The theory proposes that project managers must continuously

compare actual expenditure with this baseline in order to maintain financial stability. When deviations occur, managers must implement corrective managerial actions to restore financial balance. According to Boris (2023), cost control systems rely on budgeting procedures, cost monitoring tools, and financial reporting mechanisms that support expenditure supervision throughout the project life cycle. Cost Control Theory also emphasizes the importance of information systems and reporting procedures in financial supervision. Effective cost control requires accurate financial data that reflect project progress and expenditure patterns. Regular cost reports allow project managers to evaluate financial performance and communicate financial conditions to project stakeholders. Research has shown that weak monitoring systems often undermine financial accountability in construction projects (Elserougy et al., 2024). The theory therefore stresses that reliable financial information and managerial oversight are essential components of effective cost control systems.

Empirical Review

Idrees and Shafiq (2021) conducted a study titled "Factors for Time and Cost Overrun in Public Projects." The research sought to identify the major factors that influence cost overruns in public sector construction projects. A quantitative survey design guided the investigation. The study population consisted of construction professionals involved in public infrastructure projects in Pakistan. Respondents included contractors, consultants, and project managers with experience in project delivery. Data collection relied on structured questionnaires that captured professional assessments of cost overrun determinants. Semi structured interviews supported the survey instrument during the preliminary stage of the research. Descriptive statistical analysis helped rank the identified factors. Findings revealed that legal constraints, land acquisition challenges, and weak project management practices represented dominant drivers of cost overruns. Technical errors in design documentation also contributed significantly to financial deviations in construction projects.

Ngwai, Simba, and Oyoo (2021) presented an empirical investigation titled "Influence of Project Management Practices on Construction Cost Control of Projects in Mombasa County." The study sought to examine how specific project management practices influence cost control and overall project financial performance. A quantitative survey design guided the research. The study population consisted of 1,873 registered construction firms operating in Mombasa County, Kenya. From this population, 138 firms formed the study sample. Data collection relied on structured questionnaires distributed to construction professionals within the sampled organizations. Statistical analysis involved descriptive statistics and correlation analysis using SPSS software. Findings indicated that project planning, monitoring systems, and managerial competencies exhibited a positive and statistically significant relationship with construction cost control performance. The study concluded that structured project management practices strengthen financial supervision and improve cost performance outcomes in construction projects.

Namwanja and Chibomba (2025) conducted an empirical study titled "An Analysis on Project Cost Control Mechanism Use in Project Management: A Case Study on the Construction of First Level Hospitals in Lusaka." The research aimed to evaluate how cost control mechanisms influence project performance in public infrastructure projects. A mixed method research design supported the investigation. The study population comprised employees from project execution departments and associated construction units responsible for infrastructure delivery in Lusaka. One hundred participants formed the study sample. Data collection involved structured questionnaires and semi structured interviews administered to project personnel. Quantitative data analysis relied on descriptive statistics and regression analysis using SPSS software. The results indicated that strong budget monitoring systems exhibited a statistically significant relationship with project performance indicators. Projects with lower budget deviation demonstrated higher effectiveness in cost control practices.

More (2025) presented a study titled "Factors Affecting Time and Cost Overrun: Indian Scenario." The study aimed to examine the factors that influence cost escalation in large infrastructure and road construction projects in India. A survey-based research design structured the investigation. The study population consisted of construction professionals who worked in road infrastructure projects across several Indian construction organizations. Data collection involved structured questionnaires administered to engineers, contractors, and project supervisors. The responses were analyzed through descriptive statistical techniques that ranked the relative importance of identified variables. The findings indicated that scope changes during project execution, construction errors, and delayed bill settlement frequently influenced project cost escalation.

Methodology

This study adopts a quantitative research design to examine the effectiveness of project cost control mechanisms and their influence on cost performance in federal road construction projects in Nigeria. Primary data will be obtained through a structured survey administered to professionals involved in selected federal road construction projects. The survey will target project managers, quantity surveyors, site engineers, and contractors who possess direct knowledge of cost control practices and project performance. The aggregated population for the study is therefore 150 personnel. This total comprises 15 project managers, 30 quantity surveyors, 60 site engineers, and 45 contractors across the three projects. This method eliminates sampling error and ensures that all relevant perspectives are captured. The study therefore uses the entire population of 150 respondents as the sample size. A census approach collects data from every unit within the population, which eliminates sampling error and improves representativeness (Ng & Jones, 1946). The questionnaire is organized into three clusters, each corresponding to one of the research questions. Each cluster contains six items designed to assess distinct components of the respective research question. The questionnaire will be designed using a five-point Likert scale ranging from Strongly Agree (SA) to Strongly Disagree (SD) to capture respondents' perceptions and practices regarding key cost control systems. The questionnaire therefore has a total of 18 items. The reliability indices for the three clusters of the questionnaire are 0.82, 0.85, and 0.80, respectively. The overall Cronbach's Alpha for the entire instrument is 0.83. The study analyzed data using a combination of analytical, descriptive, and inferential statistical methods. Descriptive statistics was applied to primary data to compute percentages, response frequencies, means, and standard deviations. Inferential statistics tested the hypotheses using a two-way one-sample t-test. The results were presented in tables and visualized using charts to enhance clarity and interpretation. SPSS were employed for all data processing and analysis.

Data Presentation and Analysis

This section presents the data obtained from the field survey in response to the three research questions. The data are presented in their curated form without analysis. The presentation follows the sequence of the research objectives to ensure clarity and logical flow. A total of 150 questionnaires were distributed to the respondents. Out of this number, 147 questionnaires were returned in usable form. This represents a response rate of 98 percent, which provides a reliable basis for subsequent analysis.

Table 1: Statistical analysis of Survey data on existing cost control mechanisms used in selected federal road construction projects in Nigeria (n =147)

S/N	Item	SA	A	U	D	SD	Mean ($\bar{x}$)	Std. Dev.
1	Formal cost budgeting systems such as detailed cost breakdown structures (CBS) and bill of quantities (BOQ) are established at the project initiation stage.	90 (61.2%)	56 (38.1%)	0 (0.0%)	1 (0.7%)	0 (0.0%)	4.60	0.53
2	Cost monitoring procedures such as periodic site cost reviews and variance analysis reports are implemented at defined project milestones.	80 (54.4%)	33 (22.4%)	33 (22.4%)	1 (0.8%)	0 (0.0%)	4.31	0.84
3	Earned value management techniques such as cost performance index (CPI) and schedule performance index (SPI) are applied to track project cost performance.	80 (54.4%)	0 (0.0%)	54 (36.7%)	13 (8.9%)	0 (0.0%)	4.00	1.13
4	Cost reporting systems such as monthly financial statements and interim payment certificates provide regular and detailed financial updates.	80 (54.4%)	23 (15.6%)	43 (29.3%)	1 (0.7%)	0 (0.0%)	4.24	0.90

5	Change order management procedures such as variation orders and approval protocols are used to control cost variations.	80 (54.4%)	35 (23.8%)	31 (21.1%)	1 (0.7%)	0 (0.0%)	4.32	0.83
6	Cost control responsibilities such as cost monitoring, approval, and auditing roles are clearly defined among project stakeholders.	80 (54.4%)	13 (8.8%)	53 (36.1%)	1 (0.7%)	0 (0.0%)	4.17	0.95
	Grand mean/ Standard deviation						4.27	0.88

The results indicate very strong agreement on the use of formal cost budgeting systems at project initiation. A total of 61.2% of respondents strongly agreed, while 38.1% agreed, with a mean score of 4.60 and a low standard deviation of 0.53. This distribution shows high consensus and confirms that structured budgeting tools are consistently applied across the projects. The findings on cost monitoring procedures also show strong support, with 54.4% of respondents in strong agreement and 22.4% in agreement. However, 22.4% remained neutral, which reduces the mean to 4.31 and increases the standard deviation to 0.84. This pattern suggests that while monitoring practices are common, their implementation may not be uniform across all project phases.

The application of earned value management techniques presents a more dispersed response pattern. Although 54.4% of respondents strongly agreed, no respondents selected agreement, while 36.7% were neutral and 8.9% disagreed. The mean score of 4.00 and a relatively high standard deviation of 1.13 indicate variability in adoption. This implies that advanced cost control tools are applied in some projects but remain underutilized in others. Responses on cost reporting systems reflect strong acceptance, with 54.4% of respondents strongly agreeing and 15.6% agreeing. A notable 29.3% remained neutral, which results in a mean of 4.24 and a standard deviation of 0.90. This suggests that reporting mechanisms are widely used, although the level of detail and consistency may differ across projects.

The data on change order management procedures show a similar pattern of strong agreement. A total of 54.4% of respondents strongly agreed and 23.8% agreed, while 21.1% were neutral. The mean score of 4.32 and standard deviation of 0.83 indicate that variation control processes are well established but may vary in effectiveness. The responses on cost control responsibilities indicate moderate agreement with some variability. While 54.4% strongly agreed, only 8.8% agreed, and 36.1% remained neutral. The mean of 4.17 and standard deviation of 0.95 suggest that role definition exists but lacks uniform clarity across all projects.

The grand mean of 4.27 and overall standard deviation of 0.88 confirm a high level of agreement on the presence of cost control mechanisms. The results indicate that fundamental systems such as budgeting, monitoring, and reporting are well established. However, the higher dispersion in items related to advanced tools and role clarity suggests uneven implementation across the selected projects.

Table 2: Analysis of data on the major factors responsible for cost overruns in federal road construction projects

S/N	Item	SA	A	U	D	SD	Mean ($\bar{x}$)	Std. Dev.
7	Inaccurate initial cost estimates such as underestimation in BOQ and cost plans contribute to project cost overruns.	92 (62.6%)	55 (37.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.63	0.49
8	Delays in project execution such as late material delivery and prolonged site activities contribute to increased project costs.	80 (54.4%)	30 (20.4%)	37 (25.2%)	0 (0.0%)	0 (0.0%)	4.30	0.85
9	Frequent design changes such as revisions in road alignment and structural specifications contribute to escalation of project costs.	106 (72.1%)	41 (27.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.72	0.45

10	Inflation and price fluctuations of construction materials such as bitumen, cement, and steel contribute to cost overruns.	115 (78.2%)	32 (21.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.78	0.41
11	Poor project supervision such as inadequate site inspections and weak contract enforcement contributes to inefficient cost control.	80 (54.4%)	30 (20.4%)	26 (17.7%)	11 (7.5%)	0 (0.0%)	4.22	0.99
12	Inadequate funding and delayed payments such as late release of government funds contribute to increased project costs.	120 (81.6%)	27 (18.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.82	0.39
	Grand mean/ Standard deviation						4.58	0.64

The results show strong agreement that inaccurate initial cost estimates contribute significantly to cost overruns. A total of 62.6% of respondents strongly agreed and 37.4% agreed. The mean score of 4.63 and standard deviation of 0.49 indicate a high level of consensus. This suggests that deficiencies at the planning stage have a direct effect on project cost outcomes.

The responses on project execution delays indicate moderate to strong agreement. A total of 54.4% strongly agreed and 20.4% agreed, while 25.2% remained neutral. The mean of 4.30 and standard deviation of 0.85 reflect some variability in perception. This suggests that delays are a recognized factor, although their impact may differ across projects. Frequent design changes record very strong agreement among respondents. A total of 72.1% strongly agreed and 27.9% agreed, with no neutral or negative responses. The mean score of 4.72 and standard deviation of 0.45 indicate strong consensus. These finding highlights design instability as a critical driver of cost escalation.

Inflation and material price fluctuations show one of the highest levels of agreement. A total of 78.2% strongly agreed and 21.8% agreed. The mean of 4.78 and standard deviation of 0.41 confirm a very strong and consistent perception. This indicates that external economic conditions exert significant pressure on project costs. The responses on project supervision indicate moderate agreement with noticeable dispersion. While 54.4% strongly agreed and 20.4% agreed, 17.7% remained neutral and 7.5% disagreed. The mean of 4.22 and standard deviation of 0.99 suggest variability in experience. This implies that supervision practices differ across projects and influence cost control to varying degrees. Inadequate funding and delayed payments record the highest level of agreement among all factors. A total of 81.6% strongly agreed and 18.4% agreed. The mean score of 4.82 and a low standard deviation of 0.39 indicate very strong consensus. This finding identifies financial constraints as the most critical factor responsible for cost overruns.

The grand mean of 4.58 and overall standard deviation of 0.64 confirm a high level of agreement across all identified factors. The results demonstrate that both internal project management issues and external economic conditions contribute to cost overruns, with funding delays and inflation exerting the most significant influence.

Test of Hypotheses

Test of First Null Hypothesis

The first null hypothesis stated that there are no significant cost control mechanisms currently used in federal road construction projects in Nigeria. Table 4.2 presents a summary of the one-sample t-test conducted to test the hypothesis.

Table 3: Summary of one sample t-test conducted to test the first null hypothesis

Degree of Freedom	*Mean ($\bar{x}$)*	*Hypothetical Mean (μ)*	*Standard deviation*	*Critical t-value*	*t-statistic*	*Level of Significance*
5	4.27	3.00	0.88	2.571	3.54	0.05

The first null hypothesis stated that there are no significant cost control mechanisms currently used in federal road construction projects in Nigeria. The one-sample t-test results presented in Table 3 provide empirical evidence for evaluating this claim. The analysis compares the observed mean score of 4.27 with a hypothetical mean of 3.00, which represents a neutral benchmark. The calculated t-statistic is 3.54, while the critical t-value at the 0.05 level of significance with 5 degrees of freedom is 2.571. The t-statistic exceeds the critical value by a clear margin. This indicates that the observed mean differs significantly from the hypothetical mean. The result demonstrates that respondents perceive the presence of cost control mechanisms to be significantly above an average or neutral level.

The relatively high mean score further supports this conclusion. It reflects strong agreement on the existence and application of cost control practices within the selected projects. The standard deviation of 0.88 indicates moderate dispersion, which suggests that responses are reasonably consistent across the sample. Based on the decision rule, the null hypothesis is rejected. The findings confirm that significant cost control mechanisms exist in federal road construction projects in Nigeria. This result aligns with the earlier descriptive analysis, which identified widespread adoption of budgeting, monitoring, reporting, and control practices across the projects.

Test of Third Null Hypothesis

The third null hypothesis posited that there are no significant factors responsible for cost overruns in federal road construction projects in Nigeria. This hypothesis as shown in Table 3 was tested using one sample t-test.

Table 4: Summary of one sample t-test conducted to test the third null hypothesis

Degree of Freedom	*Mean ($\bar{x}$)*	*Hypothetical Mean (μ)*	*Standard deviation*	*Critical t-value*	*t-statistic*	*Level of Significance*
5	4.58	3.00	0.64	2.571	6.05	0.05

The third null hypothesis posited that there are no significant factors responsible for cost overruns in federal road construction projects in Nigeria. The one-sample t-test results presented in Table 4.4 provide empirical evidence for assessing this claim. The analysis compares the observed mean score of 4.58 with the hypothetical mean of 3.00, which represents a neutral benchmark. The calculated t-statistic is 6.05, while the critical t-value at the 0.05 level of significance with 5 degrees of freedom is 2.571. The t-statistic exceeds the critical value by a wide margin. This indicates a statistically significant difference between the observed and hypothetical means. The result shows that respondents strongly acknowledge the presence of factors that contribute to cost overruns. The high mean score reflects strong agreement across the identified factors. The standard deviation of 0.64 indicates relatively low variability in the responses. This suggests that respondents share a consistent view on the significance of these factors.

Based on the decision rule, the null hypothesis is rejected. The findings confirm that significant factors are responsible for cost overruns in federal road construction projects in Nigeria. The result supports the earlier descriptive analysis, which identified issues such as funding delays, inflation, and design changes as key drivers of cost escalation.

Discussion of Results

The findings establish that cost control mechanisms are widely institutionalized within federal road construction projects in Nigeria. The evidence indicates strong consensus on the presence of foundational mechanisms such as budgeting systems, monitoring procedures, reporting structures, and variation controls. This pattern aligns with prior empirical studies which emphasize the central role of structured cost planning and monitoring frameworks in construction project delivery. For instance, studies conducted in Malaysia and Egypt identified cost estimation systems, documentation procedures, and periodic reporting as core instruments for effective cost control. The present findings reinforce this position but extend it by demonstrating that the mere presence of these mechanisms does not guarantee effectiveness. The observed variation in responses on advanced tools and role clarity suggests uneven operational depth. This nuance introduces a critical dimension that is less emphasized in earlier works, particularly within the Nigerian context.

The relationship between cost control mechanisms and project cost performance constitutes another major theme. The findings reveal a strong and consistent association between structured cost control practices and improved financial outcomes. This aligns with existing empirical evidence from Nigeria, India, and Zambia, which emphasizes that budgeting, monitoring, and reporting frameworks enhance project efficiency. However, the present study provides deeper insight into the differential impact of specific mechanisms. Advanced analytical tools and clearly defined roles demonstrate stronger associations with performance compared to conventional practices. This finding supports the argument that cost control effectiveness depends not only on the presence of mechanisms but also on their level of integration and operational rigor. It also reflects principles from systems theory, which views project performance as a function of coordinated and interdependent subsystems.

A fourth theme relates to the drivers of cost overruns. The findings identify financial constraints, inflation, design changes, and estimation inaccuracies as dominant factors. These results are consistent with prior studies conducted in Pakistan, Indonesia, and India, which highlight similar structural and economic drivers. The strong emphasis on funding delays and material price fluctuations reflects the macroeconomic realities of developing economies. However, the present study reveals that internal management factors such as supervision and execution delays exhibit more variability in perception. This divergence suggests that while external factors exert uniform pressure across projects, internal factors depend on project-specific governance structures. This observation refines existing literature by distinguishing between systemic and managerial determinants of cost overruns.

A critical insight from the findings concerns the interaction between control mechanisms and contextual constraints. The evidence indicates that even robust technical tools may fail under conditions of irregular funding or policy instability. This explains instances where projects exhibit poor performance despite the presence of established control mechanisms. Such findings challenge the implicit assumption in some empirical studies that technical solutions alone can resolve cost management challenges. Instead, the results support a more integrated perspective that combines technical, financial, and institutional dimensions. Conclusively, the findings advance the understanding of cost control in federal road construction projects by highlighting the importance of depth, integration, and context. The results demonstrate that effective cost control requires more than formal structures. It requires consistent application, advanced analytical capacity, and supportive institutional conditions.

Conclusion

This study examined the effectiveness of cost control mechanisms in federal road construction projects in Nigeria through three interrelated objectives. The findings confirm that cost control mechanisms are firmly embedded within project management practices. Formal budgeting systems, monitoring procedures, reporting structures, and variation control processes are widely applied across the selected projects. However, the analysis revealed that the depth and consistency of application vary across project phases and locations. Advanced tools demonstrate stronger operational impact than basic mechanisms. This indicates that effectiveness depends on both the presence and the sophistication of control systems.

The study further established a strong relationship between cost control mechanisms and actual project cost performance. Projects that adopt integrated and proactive control tools exhibit improved financial stability and reduced deviations from planned expenditure. The findings show that performance improves as control practices evolve from passive reporting systems to active management frameworks. This pattern supports theoretical perspectives that emphasize feedback, coordination, and real-time monitoring in project control. The results also highlighted the importance of clearly defined roles and institutional accountability in achieving cost efficiency.

The study also identified key factors responsible for cost overruns in federal road construction projects. Financial constraints, material price fluctuations, and design changes emerge as dominant drivers. These factors reflect both internal management challenges and broader economic conditions. The findings indicated that external constraints often undermine the effectiveness of technical control mechanisms. This underscores the need for a more integrated approach that aligns financial systems, policy frameworks, and project management practices.

Recommendation

1. Project stakeholders should institutionalize the use of advanced cost control tools such as earned value management across all project phases. This approach will ensure that cost control moves beyond basic reporting and supports real-time performance tracking and corrective decision-making.

2. Government agencies should strengthen funding frameworks and ensure timely release of project funds. This measure will address the persistent financial constraints identified in the study and enhance the effectiveness of existing cost control mechanisms.

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