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Effect of Project Cost Planning Practices on the Performance of Road Construction Projects in Meru County, Kenya

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Abstract

Road construction plays a critical role in economic growth, accessibility, and regional integration. However, despite its importance, road construction projects globally continue to face persistent challenges including cost overruns, project delays, and compromised quality standards. A key contributing factor to these challenges is ineffective project cost planning. In Kenya, road construction projects at the county level have particularly struggled with inconsistent budgeting, inaccurate cost estimation, and weak monitoring frameworks, resulting in stalled projects, public dissatisfaction, and wasted public resources. Meru County exemplifies these challenges, with a significant proportion of road construction projects experiencing cost escalations, delays, and substandard delivery outcomes that undermine rural transformation and economic development goals. The study examined the effect of project cost planning practices on the performance of road construction projects in Meru County, Kenya, with a focus on cost estimating, cost budgeting techniques, contingency cost planning, and cost monitoring. Project performance was assessed in terms of cost efficiency, timeliness, and client satisfaction. The study was grounded in four theoretical frameworks: the Theory of Constraints, Resource-Based View Theory, Transaction Cost Economics, and Systems Theory. A descriptive research design combining quantitative and qualitative methods was adopted. The target population comprised 572 stakeholders involved in ongoing and completed road construction projects in Meru County, from which a sample of 236 respondents was drawn using Yamane's formula and proportionate stratified sampling. Data were collected using semi-structured questionnaires and analyzed using IBM SPSS Statistics Version 28 through descriptive statistics, Pearson correlation, and multiple regression analysis. Qualitative data from open-ended questions were analyzed thematically to contextualize quantitative findings. The study established that all four cost planning practices positively and significantly influence road construction project performance, collectively explaining a substantial proportion of variance in performance outcomes. Contingency cost planning emerged as the strongest individual predictor, followed by cost estimating, cost budgeting techniques, and cost monitoring respectively. The study concludes that effective project cost planning significantly enhances road construction project performance by improving cost efficiency, ensuring timely completion, and increasing client satisfaction. It recommends institutionalizing evidence-based cost estimation, adopting structured budgeting systems, allocating adequate risk-based contingency provisions, strengthening integrated cost monitoring mechanisms, investing in stakeholder capacity building, and improving coordination among project governance structures in Meru County.

Keywords: *Project cost planning practices, performance, road construction projects, Meru County, Kenya*

1.0 Background of the Study

Projects are bounded by time and must be completed within planned periods, covering predetermined scope, budget, and quality specifications (Abdilahi et al., 2020). Road construction is a critical component of infrastructure development that facilitates economic growth, accessibility, and regional integration. However, road construction projects globally face persistent performance challenges including cost overruns, delays, and quality shortfalls. A key factor influencing these outcomes is project cost planning, which entails the systematic process of estimating, budgeting, and controlling costs throughout the project lifecycle (Yap, Chow & Shavarebi, 2019). Effective cost planning ensures optimal allocation of resources, promotes accountability, and supports timely project delivery (Turner & Müller, 2019). In Kenya, road infrastructure accounts for over 80% of total passenger and freight movement, underscoring the critical importance of ensuring that road construction projects are delivered efficiently, on time, and within approved budgets (Kenya Roads Board, 2021).

Cost planning practices are integral to project management as they help stakeholders anticipate financial requirements, allocate resources effectively, and avoid cost overruns that can derail project objectives (Mbae, 2020). Globally, poor cost planning has been cited as a leading cause of delays, abandonment, and budget overruns in infrastructure projects (World Bank, 2022). In developing countries like Kenya, the challenge is further complicated by limited technical capacity, weak regulatory oversight, and corruption (Ndiritu & Wanyoike, 2019). Project planning is critical to road construction success because it aims to reduce costs by ensuring allocated services are used to their full potential, eliminating duplication of effort and inspiring innovative management. Despite substantial investments under Kenya's Vision 2030 and devolved governance, many road projects in Meru County have suffered from inconsistent budgeting, cost underestimation, and frequent revisions to cost baselines, leading to delays and public dissatisfaction (Office of the Auditor-General, 2022).

Globally, project cost planning is recognized as a critical determinant of infrastructure project success. In developed countries such as the United States, United Kingdom, and Germany, cost planning is integrated into the project management lifecycle through tools including Building Information Modeling, Earned Value Management, and advanced cost estimation software (Flyvbjerg, 2021). The UK's Highways England agency has institutionalized rigorous cost planning systems and risk management protocols, resulting in improved delivery timelines and reduced lifecycle costs. Germany's Autobahn network similarly exemplifies comprehensive planning, risk management, and digital innovation converging to minimize cost overruns. However, developing economies face significant challenges including inadequate technical expertise, poor project scoping, and political interference. In India, road construction projects are frequently delayed due to unrealistic budget allocations and mid-implementation scope changes, while Latin America experiences widespread cost underestimation due to insufficient feasibility studies and weak procurement systems (Choudhury & Phatak, 2021; World Bank, 2022).

Across Sub-Saharan Africa, road infrastructure remains a strategic economic development pillar, yet systemic cost planning inefficiencies persist. The African Development Bank reports that over 60% of road construction projects in the region experience cost overruns, primarily due to poor upfront planning, corruption, and disjointed coordination between cost estimation and implementation (AfDB, 2020). In West Africa, Nigeria has experienced persistent flagship highway project delays due to inconsistent financial planning and politically motivated scope changes (Okonkwo et al., 2021). Ethiopia's cost estimation models rarely incorporate inflationary trends or currency fluctuation risks, resulting in budget shortfalls. In Tanzania,

numerous TANROADS projects experienced cost escalations of up to 35% due to poor estimation frameworks and insufficient procurement regulation enforcement (CAG, 2022). Uganda's National Roads Authority has similarly relied on outdated bills of quantities, generating frequent contract amendments and ballooning costs (Tumwebaze & Ayesiga, 2020).

Rwanda presents a notable regional exception demonstrating how structured cost planning improves road construction project performance. The Rwanda Transport Development Agency has institutionalized digital project appraisal tools and structured planning templates, leading to more accurate cost forecasts and stronger alignment with national development priorities (RTDA, 2021). Projects undergo rigorous feasibility assessments, and real-time cost tracking has significantly reduced financial leakage, resulting in more consistent and timely project delivery compared to regional peers. Rwanda has improved delivery efficiency further by adopting standardized cost planning protocols, enhancing contractor selection criteria, and investing in staff capacity building (African Development Bank, 2023). These experiences underscore that targeted institutional reforms, investment in digital planning tools, and strengthened procurement governance can substantially improve road construction project performance outcomes even within resource-constrained Sub-Saharan African environments.

In Kenya, road infrastructure plays a vital role in promoting socioeconomic development by enhancing accessibility, facilitating trade, and connecting rural areas to markets, education, and healthcare. Under the devolved governance system introduced by the 2010 Constitution, county governments are mandated to develop and maintain local road networks. However, despite increased funding allocations, performance of road construction initiatives has been mixed due to inefficiencies in project cost planning and financial management (Council of Governors, 2021). Cost overruns, incomplete works, and prolonged delays are common occurrences at the county level, where poor cost planning leads to stalled projects, inflated bills of quantities, and disputes between contractors and local authorities (Mwenda & Gikunda, 2020). Lessons from global best practices point to the importance of early stakeholder engagement, technology-enabled cost estimation, risk-adjusted budgeting, and ongoing cost monitoring as pathways to improved project outcomes (Flyvbjerg et al., 2023).

Meru County, with its diverse topography and strong agricultural base, has prioritized road construction to open remote areas, strengthen farm-to-market linkages, and facilitate service delivery. The County Government, in collaboration with KeRRA and KURA, has initiated several construction and rehabilitation projects including the Mikinduri–Maua, Nkubu–Chogoria, and Kianjai–Laare roads. In its CIDP 2018–2022, Meru County committed to upgrading over 1,000 kilometers of roads. However, according to the CIDP 2023–2027, nearly 60% of road construction projects undertaken in the past five years experienced cost overruns, delays, or delivery of substandard works, hindering access to markets, health services, and educational institutions particularly in Igembe, Tigania, and Buuri sub-counties (Meru CIDP, 2023). Flagship projects including Meru–Mikinduri–Maua and Nkubu–Chogoria have faced delays ranging from 8 to 24 months with cost escalations of up to 45%.

A key barrier to successful road project delivery in Meru County is ineffective project cost planning. Most projects are initiated without robust feasibility studies, realistic budgets, or comprehensive risk assessments, resulting in unrealistic budget projections and scope creep (KeRRA, 2022; Auditor General, 2023). Local studies confirm that road projects in Meru frequently experience cost overruns of up to 30%, primarily due to inaccurate bills of quantities, politically motivated project initiation, and absence of contingency planning (Muthuri & Kithinji, 2021). Monitoring and evaluation frameworks are weak or non-existent in several wards, leading to poor tracking of cost performance indicators. The disconnect

between cost planning and actual implementation, combined with limited use of cost control mechanisms and poor stakeholder coordination, underscores the urgent need for this study, which examined the effect of cost estimating, cost budgeting techniques, contingency cost planning, and cost monitoring on road construction project performance in Meru County.

1.1 Statement of the Problem

Despite substantial capital allocations under Kenya's devolved governance system, road construction projects in Meru County experience severe performance bottlenecks. Statistics from the Office of the Auditor-General (2023) indicate that between 2019 and 2023, approximately 40% of planned road infrastructure projects remained incomplete, stalled, or faced significant budget escalations. Specifically, flagship projects such as the Mikinduri–Maua and Kiirua–Ruiri roads report timeline delays ranging from 8 to 24 months and financial overruns extending up to 45% of the original contractual sums. Empirical evidence attributes up to 30% of these financial expansions directly to inaccurate initial bills of quantities and a complete omission of risk-based contingency frameworks during upfront planning. While previous research focuses heavily on national procurement procedures, there is a distinct lack of empirical baseline metrics establishing how specific localized cost planning practices—such as estimation accuracy, structured budgeting techniques, risk-mitigating contingency planning, and real-time monitoring—quantifiably determine county-level infrastructure performance. This study addresses this gap by measuring the explicit operational effects of these four cost planning elements on the cost efficiency, timeliness, and stakeholder satisfaction metrics of road projects in Meru County.

1.2 Objectives of the Study

i. To examine the effect of Cost Estimating on the performance of road construction projects in Meru County.
ii. To assess the effect of Cost budgeting techniques on the performance of road construction projects in Meru County
iii. To establish the effect of contingency cost planning on the performance of road construction projects in Meru County
iv. To determine the effect of cost Monitoring on the performance of road construction projects in Meru County.

2.0 Literature Review

This chapter presents a literature review that encompasses both theoretical and empirical aspects relevant to project cost planning practices in road construction and their impact on project performance. It outlines the conceptual framework that establishes the relationship between study variables and critiques existing literature, highlighting knowledge gaps. Focused on key themes such as cost estimating, budgeting techniques, contingency planning, and cost monitoring, the review is organized into three sections: theoretical, empirical, and the conceptual framework. Despite significant global research on road construction, there has been limited focus on cost planning specifically within the Kenyan context, particularly in Meru County. This study aims to address that gap by evaluating how effective cost planning can effect timelines, budgets, and quality in road infrastructure delivery.

2.1 Theoretical Review

This section explores the theoretical foundations that underpin project cost planning practices in road construction and their impact on project performance. This study was guided by four theories namely: theory of Constraints, Resource Dependency Theory, Transaction Cost

Economics (TCE) Theory and systems theory each of which offers insights into managing diverse interests and enhancing project performance.

Theory of Constraints

The Theory of Constraints was introduced by Eliyahu Goldratt in 1984 and posits that a set of constraints prohibits any management system from achieving more of its objectives. The three most frequent project constraints are scope, time, and budget, and meeting all project aims while adhering to these limits constitutes the primary duty of project management. Goldratt (1990) argued that every manageable structure is constrained, and that optimizing the allocation and integration of inputs required to achieve predetermined objectives is the core challenge of management. Road construction projects experience constraints including cost, time, and scope, all of which affect the capacity to deliver high-quality outcomes. After identifying a limiting constraint, the next step is addressing it to improve project performance. This theory informed the study's examination of how cost planning practices address budget and time constraints in road construction projects in Meru County.

Resource-Based View (RBV) Theory

The Resource-Based View Theory was developed by Jay Barney in 1991 and describes firms as collections of resources that generate value and competitive advantage. The theory prescribes that organizations should position themselves strategically based on their internal resources and capabilities rather than products and services alone. Resources must meet the VRIN criteria of being valuable, rare, inimitable, and non-substitutable to generate sustainable advantage. Barney and Mackey (2016) emphasize that RBV is essential for project managers because it enables them to define resource value, allocate resources according to policy, and identify skills required for organizational success. In the context of road construction, robust cost estimation, contingency planning, and budget management ensure that scarce public resources deliver maximum developmental value. This theory informed the study's assessment of how cost planning practices optimize resource allocation to improve road construction project performance in Meru County.

Transaction Cost Economics (TCE) Theory

Transaction Cost Economics was developed by Oliver Williamson in 1985 and offers a critical framework for analyzing the cost implications of various governance structures in managing project transactions. TCE postulates that transactions incur costs related to negotiation, contracting, monitoring, and enforcement, and that organizations must choose governance mechanisms that minimize these costs. In road construction, TCE guides project managers in selecting efficient procurement and contracting strategies by determining whether to manage components through market-based outsourcing or internal hierarchical structures. Williamson (1985) argues that weak contract monitoring mechanisms increase risks of delays and inflated costs due to opportunistic contractor behavior. However, TCE's primary limitation is its insufficient consideration of relational factors such as trust, culture, and collaboration that also significantly affect project outcomes. This theory informed the study's assessment of how cost planning practices align with governance mechanisms that reduce transaction-related inefficiencies in public road construction projects.

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Systems Theory

Systems Theory originates from the foundational work of Ludwig von Bertalanffy (1969), who emphasized the notion of interdependence between systems and subsystems, arguing that systems rarely exist in isolation. In the context of project management, Systems Theory frames road construction projects as complex, interconnected systems where various components continuously influence each other. Cost planning processes including estimating, budgeting, contingency planning, and monitoring are viewed not as isolated activities but as interdependent subsystems within the larger project system, whose performance is shaped by dynamic interactions among technical, financial, human, and environmental elements. A key strength of Systems Theory is its holistic perspective, enabling project managers to identify how inefficiencies in one component such as inaccurate cost estimates can cascade across the entire project lifecycle. It promotes proactive planning, feedback loop integration, and adaptive decision-making essential for managing road construction complexity (Kerzner, 2022), directly informing this study's integrated examination of all four cost planning practices.

2.2 Conceptual Framework

A conceptual framework according to Creswell (2005) is the presentation in a study that shows the relationship between variables thus giving the study a dimension to focus on. Kim and Kross (2015) state that a conceptual framework in a study depicts how variables in the study flow and the metrics to be utilised to gauge the impacts of the study's variables. The conceptual framework illustrates the relationship between Project Cost Planning Practices (independent variables) and Performance of Road Construction Projects in Meru County, Kenya(dependent variable).

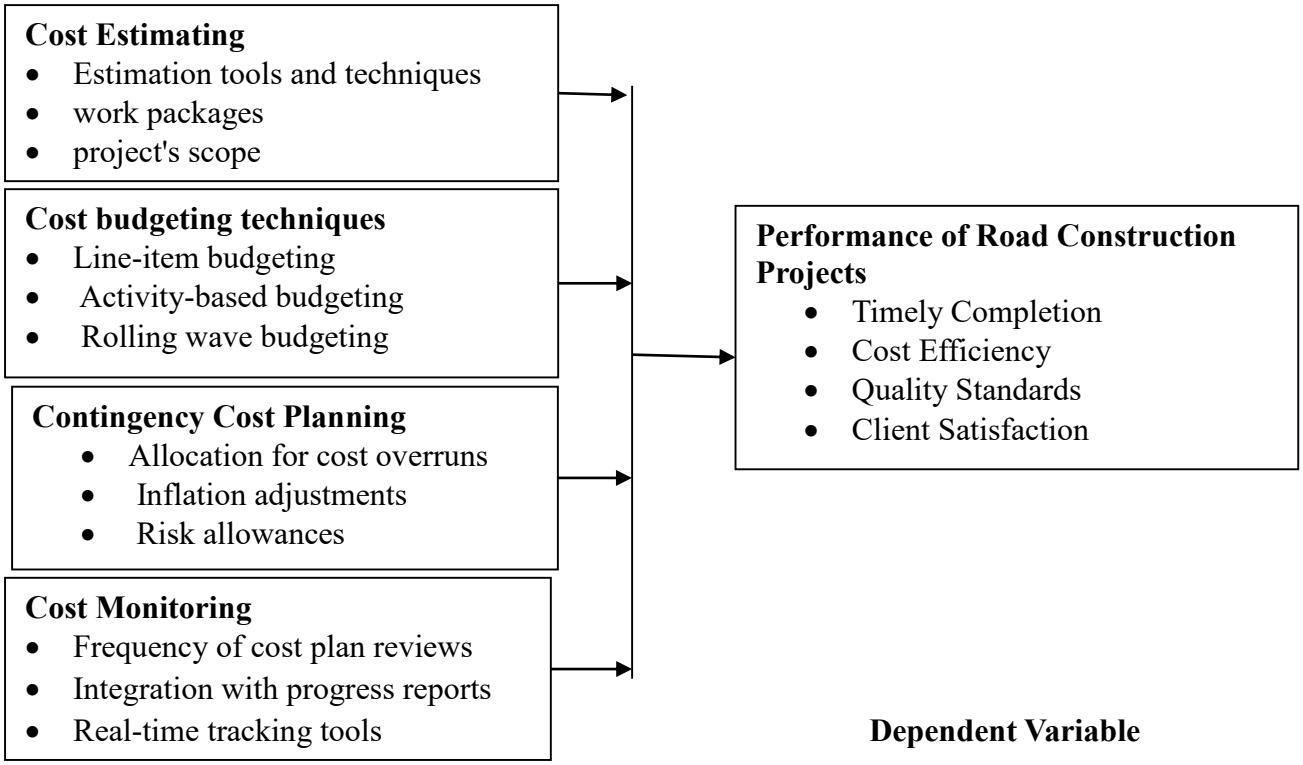

Figure 1: Conceptual Framework

2.3 Empirical Review

Mahamid, Bruland, and Dmaidi (2020) surveyed 34 contractors and 30 consultants on road construction delays in Palestine and identified payment delays, lowest bid price awards, and equipment shortages as the most severe delay triggers, with cost estimation weaknesses among the underlying causes. Egboga et al. (2022) found in Nigeria that accurate cost estimation using bottom-up and parametric methods significantly enhanced timely completion, budget adherence, and quality outcomes in construction firms. Omar (2022) established in Saudi Arabia that poor documentation, limited historical data, and frequent design changes negatively affected cost estimation accuracy and project performance. Abdel-Monem et al. (2022) found across the Middle East that scope changes, inflation, and unclear specifications were major sources of estimation errors. Fazil et al. (2021) concluded through systematic review that digital tools and historical cost databases substantially improve cost estimation performance and project delivery outcomes.

Mwangi and Kwasira (2019) found in Nakuru County, Kenya that effective cost budgeting including activity-based costing and use of budget baselines significantly improved timeline adherence and cost efficiency in public road projects. Yusuf and Alhassan (2021) established a strong positive correlation between work breakdown structure-based budgeting and project performance indicators including time, cost, and scope control in highway construction in northern Nigeria. Ngugi et al. (2020) found in Kenya that participatory budgeting, budget reviews, and contingency allocations positively influenced road infrastructure project delivery and sustainability among county governments. Ali and Issa (2022) found in Sudan that projects using zero-based and rolling budgets demonstrated better cost deviation control compared to traditional annual budgets. Ouma and Wanjiru (2023) established in Nairobi County that rigorous budgeting processes including regular variance analysis and cost forecasting improved budget compliance and timely project completion.

Mulei and Kimutai (2019) found in Machakos County, Kenya that road construction projects with well-defined contingency budgets were significantly more likely to remain within budget and schedule, concluding that contingency cost planning mitigates unexpected risks and enhances project success. Wambua and Otieno (2021) established in Nairobi County that contingency allowances contributed to better management of inflation, design changes, and unforeseen events, ensuring project continuity and stakeholder satisfaction. Abdullahi et al. (2020) found in Kaduna State, Nigeria that contingency cost planning was a significant predictor of highway project performance, particularly in controlling delays and managing financial risks through proactive risk assessment. Omondi and Barasa (2022) found under Kenya Urban Roads Authority that risk-based contingency plans improved cost performance and reduced contract litigation.

Kiprotich and Omwenga (2020) found in Kericho County, Kenya that continuous cost monitoring significantly enhanced budget compliance and reduced cost overruns in road construction projects, concluding that effective cost tracking mechanisms lead to better project cost control and performance. Abiola and Ogundele (2019) established in Lagos State, Nigeria that real-time cost monitoring through digital tools and frequent audits positively influenced timely completion and cost efficiency in highway construction projects. Nyabuto and Muturi (2021) found a strong positive correlation between effective cost monitoring and project performance in Nairobi County, concluding that routine financial tracking and variance analysis improve transparency and ensure project success. Aliyu and Musa (2022) found in Northern Nigeria that effective cost monitoring reduced fraud and mismanagement in federal road projects. Wanjiru and Chege (2023) established in Meru County that projects with regular

cost reporting and corrective actions were significantly more likely to achieve planned Performance Metrics.

3.0 Research Methodology

This study employed a descriptive research design combining qualitative and quantitative methods to investigate the effect of project cost planning practices on the performance of road construction projects in Meru County. The target population comprised 572 stakeholders involved in planning and execution of road construction projects, including sub-county and ward administrators, road directors and chief officers, contractors in construction firms, Community Road Empowerment project managers, and community representatives. Using Yamane's (1967) formula with a 5% error tolerance, a sample of 236 respondents was drawn through proportionate stratified sampling to ensure adequate representation of all stakeholder categories. The sample included 21 sub-county administrators, 2 directors, 83 contractors, 30 community road empowerment project managers, and 100 community representatives. A pilot test was conducted on 24 respondents from Embu County, representing 10% of the sample, to assess instrument reliability and validity before the main study.

Primary data were collected using semi-structured questionnaires comprising five-point Likert scale statements coded from 1 (Strongly Disagree) to 5 (Strongly Agree), along with open-ended questions for qualitative insights. Face and content validity were established through expert review by university supervisors, leading to questionnaire refinement through rewording, addition, and removal of items. Construct validity was assessed using Confirmatory Factor Analysis, with factor loadings above 0.50 accepted as the minimum threshold. Reliability was assessed using Cronbach's Alpha, with a coefficient of 0.7 and above considered acceptable (Mugenda & Mugenda, 2018). Quantitative data were analyzed using IBM SPSS Statistics Version 28, generating descriptive statistics including means, frequencies, and standard deviations, and inferential statistics encompassing Pearson correlation and multiple regression analysis. Qualitative data from open-ended responses were analyzed thematically. The regression model specified was $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon$, where Y represented project performance and X_1 to X_4 represented the four cost planning practices.

4.0 Research Findings and Discussion

This chapter presents the findings from the data collected in the field and includes an interpretation and discussion of these findings. The presentation is organized thematically according to the study's objectives. Data collection was conducted using questionnaires, and both descriptive and inferential statistics were employed for data analysis.

4.1 Response Rate

In analyzing the results, it was important to understand the response rate of the research. Response rate is one of the most important indicators of survey quality because it shows the demographic representativeness within the range examined. The researcher administered 231 questionnaires. The findings of response rate presented in Table 1.

Table 1: Response Rate

Questionnaire	Numbers	Percentage
Correctly filled	213	90.3
Not returned	23	9.7
Total	236	100

The results indicate that 213 questionnaires were completely filled and returned, , which is 90.3% response rate. This response rate is considered excellent for survey-based research and is sufficient to support reliable statistical analysis and generalization of findings. According to Mugenda and Mugenda (2003), a response rate of 70% and above is considered very good, while a response rate exceeding 80% is regarded as excellent. Similarly, Creswell and Creswell (2023) emphasize that high response rates enhance the representativeness of a sample and reduce the likelihood of non-response bias. Recent studies by Saunders, Lewis, and Thornhill (2023) further argue that response rates above 80% improve the credibility and validity of survey findings by ensuring adequate participation from the target population. Therefore, the achieved response rate of 90.3% was considered adequate for drawing valid conclusions and making reliable inferences regarding the study objectives.

4.2 Demographic Characteristics of Respondents

Table 2 presents the demographic characteristics of the 213 respondents who participated in the study. The analysis focused on gender, age, level of education, organizational position, and years of experience. Understanding these characteristics is important because they provide insights into the respondents' capacity to provide reliable information regarding project cost planning practices and the performance of road construction projects in Meru County

Table 2: Demographic Characteristics of Respondents

Demographic Characteristic	Frequency (n=213)	Percentage (%)
Gender		
Male	133	62.4
Female	80	37.6
Age		
Below 30 years	30	14.1
30-39 years	89	41.8
40-49 years	67	31.5
Over 50 years	27	12.6
Education Level		
Diploma	24	11.3
Higher Diploma	32	15.0
Bachelor's Degree	92	43.2
Master's Degree	65	30.5
Position		
Senior Managers	32	32.7
Middle Level Managers	38	38.8
Supervisors	28	28.5
Years of Experience		
Less than 1 years	50	23.5
1–3 years	32	15
4–6 years	66	31
Above 6 years	65	30.5

The findings in Table 2 indicate that the majority of respondents were male, accounting for 62.4% of the participants, while females comprised 37.6%. This distribution reflects the traditionally male-dominated nature of the construction and infrastructure sector, although the

participation of women demonstrates increasing gender diversity in project management and construction-related activities. Regarding age, most respondents were between 30 and 39 years, representing 89 (41.8%) of the sample, followed by those aged 40–49 years at 31.5%. Respondents below 30 years accounted for 14.1%, while those above 50 years constituted 12.6%. The predominance of respondents aged between 30 and 49 years suggests that the study captured views from individuals who are actively involved in project planning, implementation, and management and who possess substantial practical experience in road construction projects.

In terms of educational qualifications, the largest proportion of respondents held Bachelor's degrees, accounting for 43.2%, followed by Master's degree holders at 30.5%. Respondents with Higher Diplomas and Diplomas represented 15.0% and 11.3%, respectively. These findings indicate that the respondents possessed adequate academic and professional qualifications to understand project cost planning practices such as cost estimation, budgeting, contingency planning, and cost monitoring. According to Saunders, Lewis, and Thornhill (2023), respondents with relevant educational backgrounds are more likely to provide informed and reliable responses in management and project-related studies. Concerning organizational position, 38.8% of the respondents were middle-level managers, 32.7% were senior managers, and 28.5% were supervisors. This distribution is beneficial to the study because it incorporates perspectives from different managerial levels involved in planning, controlling, and monitoring project costs. The inclusion of managers and supervisors enhances the quality of information obtained regarding the influence of cost planning practices on project performance.

With respect to work experience, 31.0% respondents had between 4 and 6 years of experience, while 30.5% had more than 6 years of experience. Respondents with less than one year of experience accounted for 23.5%, while those with 1–3 years represented 15.0%. The findings suggest that a substantial proportion of respondents had considerable experience in road construction projects. Experience is an important factor in understanding project cost planning processes because individuals with longer industry exposure are likely to have encountered diverse project budgeting, cost control, and performance challenges. As noted by Kerzner (2022), experienced project personnel are better positioned to evaluate the effectiveness of project management practices and their contribution to project outcomes.

4.3 Reliability and Validity Test Results

A pilot study was conducted on 24 respondents from Embu County to assess the reliability and validity of the research instrument before the main data collection exercise. Reliability was assessed using Cronbach's Alpha internal consistency method, with a threshold of 0.7 and above considered acceptable (Mugenda & Mugenda, 2018). All five study variables exceeded this threshold, confirming strong internal consistency across the instrument. Project Performance recorded the highest reliability coefficient of 0.830, indicating that items measuring this construct were highly consistent. Cost Monitoring followed at 0.821, Cost Budgeting Techniques at 0.819, Contingency Cost Planning at 0.815, and Cost Estimating at 0.808. Since all coefficients exceeded the recommended threshold, the research instrument was confirmed as reliable and suitable for generating credible data across all study variables for the main data collection exercise.

Item-level reliability analysis for Cost Estimating confirmed that all nine items exceeded the 0.7 threshold, with individual alpha values ranging from 0.717 for estimation techniques considering direct and indirect costs to 0.806 for reliable estimation tools and techniques. For Cost Budgeting Techniques, all nine items exceeded the threshold, with values ranging from

0.811 for line-item budget preparation to 0.842 for regular budget updates reflecting actual progress. For Contingency Cost Planning, all six items exceeded the threshold, ranging from 0.809 for adequate contingency fund allocation to 0.822 for project team awareness of contingency fund access procedures. For Cost Monitoring, all six items exceeded the threshold, ranging from 0.818 for frequent cost plan reviews to 0.826 for regular cost reviews preventing budget overruns. All items across all four independent variables were therefore retained for the main study without revision or exclusion.

Item-level reliability for Project Performance confirmed that all eight items exceeded the 0.7 threshold, with values ranging from 0.825 for timely project completion to 0.891 for stakeholder satisfaction with project outcomes. The relatively high alpha values across all project performance items, particularly the 0.891 recorded for stakeholder satisfaction, indicate strong internal consistency in how respondents interpreted and responded to performance-related questions. The consistently high reliability coefficients across all constructs demonstrate that the research instrument was robust, internally coherent, and capable of generating stable and accurate data for examining the relationship between project cost planning practices and the performance of road construction projects in Meru County, Kenya.

Validity of the research instrument was assessed through face validity, content validity, and construct validity. Face and content validity were established through expert review, whereby the questionnaire was developed based on study objectives, the conceptual framework, and relevant literature, and subsequently reviewed by university supervisors and research experts. Their recommendations led to refinement of the instrument through modification, addition, and removal of items to ensure adequate and representative coverage of all study constructs. Construct validity was assessed using factor analysis, with Average Variance Extracted values of 0.50 and above required as evidence of adequate convergent validity, following recommendations by Fornell and Larcker (1981) and factor loading thresholds of 0.50 and above as recommended by Hair et al. (2022).

Construct validity results confirmed that all five study variables recorded Average Variance Extracted values above the 0.50 threshold. Cost Estimating achieved an AVE of 0.511, Cost Budgeting Techniques 0.518, Contingency Cost Planning 0.521, Cost Monitoring 0.531, and Project Performance 0.519. Individual item factor loadings also exceeded the 0.50 threshold across all variables. Cost Estimating items ranged from 0.609 to 0.804, Cost Budgeting Techniques from 0.721 to 0.865, Contingency Cost Planning from 0.714 to 0.851, Cost Monitoring from 0.701 to 0.889, and Project Performance from 0.610 to 0.854. Since all items across all five variables exceeded the minimum thresholds for both reliability and construct validity, none were removed from analysis, confirming that the research instrument accurately and validly represented all study constructs and was suitable for rigorous inferential statistical analysis.

4.4 Descriptive Statistics

Descriptive statistics were used to summarize respondents' perceptions on the independent variables of cost estimating, cost budgeting techniques, contingency cost planning, and cost monitoring, as well as the dependent variable of project performance. A five-point Likert scale was utilized where 1 = Strongly Disagree and 5 = Strongly Agree. Higher mean scores indicated stronger agreement while lower standard deviations reflected greater respondent consensus.

Cost Estimating

The first objective examined the effect of cost estimating on road construction project performance in Meru County. The table below presents descriptive statistics on respondents' level of agreement with cost estimating practice statements.

Table 3: Descriptive Statistics for Cost Estimating

Statement	Mean	SD
The project uses reliable estimation tools and techniques for forecasting costs	4.6	0.5
Work packages are clearly defined and used as the basis for cost estimation	3.9	1.0
The project scope is well-defined and understood before estimating costs	4.3	0.8
Cost estimates are regularly reviewed and updated as project details become clearer	3.9	0.8
Estimation techniques consider all relevant direct and indirect costs	3.7	0.9
Historical data from previous projects is used to improve cost estimation accuracy	3.4	0.9
Estimation tools include software applications that support accuracy and efficiency	4.0	0.8
Work package-based estimation helps in tracking cost performance at a detailed level	4.1	0.7
Scope changes are promptly reflected in revised cost estimates	4.2	0.6
Average	**4.0**	**0.78**

Table 3 reveals an overall mean of 4.0 and standard deviation of 0.78, indicating general agreement that cost estimating practices are implemented in Meru County road construction projects. Use of reliable estimation tools recorded the highest mean of 4.6, with well-defined project scope and prompt reflection of scope changes in revised estimates also scoring strongly at 4.3 and 4.2 respectively. Work package-based estimation and software tools recorded means of 4.1 and 4.0, reflecting increasing adoption of structured and digital approaches. The lowest mean of 3.4 was recorded for use of historical data, with 46.0% of respondents neutral, suggesting this practice is not yet fully institutionalized. These findings align with Kerzner (2022) and PMI (2021), who emphasize that accurate cost estimation forms the foundation of effective project planning and significantly influences budget performance and resource allocation outcomes.

Table 4: Perceptions of the Effect of Cost Estimating on Project Performance

Effect of Cost Estimating on Performance	Frequency	Percent
Accurate estimates provide a reliable financial baseline	76	35.7%
Variations in technical capacity and data quality influence effectiveness	54	25.4%
Inaccurate estimates lead to funding shortfalls and project interruptions	83	38.9%
Total	**213**	**100%**

Table 4 shows that 38.9% of respondents identified inaccurate or overly optimistic estimates as having the most negative effect on road construction project performance, causing funding shortfalls, procurement delays, and project activity interruptions. A further 35.7% indicated

that accurate and well-developed estimates provide a reliable financial baseline supporting budgeting, procurement, and resource allocation. The remaining 25.4% attributed variations in estimation outcomes to differences in technical capacity, data quality, and estimation practices across projects. These findings confirm that cost estimating effectiveness is not uniform and that institutional capacity gaps, inconsistent data quality, and variation in professional expertise significantly influence whether estimation practices translate into improved project performance outcomes in Meru County.

Cost Budgeting Techniques

The second objective evaluated the effect of cost budgeting techniques on road construction project performance. The table below presents descriptive statistics on respondents' level of agreement with cost budgeting technique statements.

Table 5: Descriptive Statistics for Cost Budgeting Techniques

Statement	Mean	SD
The project budget is prepared by listing each expense as a separate line-item	4.7	0.6
Line-item budgeting facilitates easy identification of cost overruns	4.7	0.5
Changes to line-item budgets are formally approved before implementation	4.7	0.6
Budgets are prepared based on the cost of specific activities or tasks	3.9	0.8
Activity-based budgeting improves the accuracy of budget allocation	3.5	0.8
Cost-saving opportunities are identified through activity-based budgeting	3.1	0.9
Budgeting is done progressively with detailed near-term budgets and rough future estimates	3.9	0.8
Rolling wave budgeting allows flexibility to adjust the budget as the project progresses	3.1	1.0
The budget is regularly updated to reflect actual progress and changes	3.9	0.9
Average	**3.9**	**0.8**

Table 5 reveals an overall mean of 3.9, indicating general agreement that cost budgeting techniques are applied in Meru County road construction projects. Line-item budgeting recorded the strongest agreement across three items, each with a mean of 4.7, demonstrating strong emphasis on budget structure, accountability, and formal change approval. Activity-based budgeting showed moderate adoption with mixed perceptions of its effectiveness, particularly around cost-saving identification, which recorded the lowest mean of 3.1 and 61.6% neutral responses. Rolling wave budgeting similarly showed limited uptake with only 28.1% agreement. These findings align with PMI (2021) and Kerzner (2022), who emphasize that structured budgeting enhances cost visibility and accountability, while Atkinson (1999) and Love et al. (2015) caution that budgeting techniques alone cannot guarantee project success without addressing scope changes, behavioral biases, and rework.

Table 6: Perceptions of the Effect of Cost Budgeting Techniques on Project Performance

Effect of Cost Budgeting Techniques on Performance	Frequency	Percent
Cost control improvement	30	14.1%
Budget variance reduction	89	41.8%
Resource allocation efficiency	67	31.5%
Identification of cost overruns	27	12.7%
Total	**213**	**100%**

Table 6 shows that budget variance reduction was the most frequently cited effect of cost budgeting techniques on project performance, reported by 41.8% of respondents, confirming that the primary contribution of budgeting is minimizing deviations between planned and actual expenditures. Resource allocation efficiency was reported by 31.5%, reflecting a moderate perception that budgeting improves resource distribution across project activities. Cost control improvement and identification of cost overruns were reported by 14.1% and 12.7% respectively, recording the lowest proportions. These findings suggest that cost budgeting in Meru County road construction projects primarily functions as a financial control mechanism, with its influence on broader cost management dimensions such as resource efficiency and early overrun detection remaining inconsistently realized across different projects and planning contexts.

Contingency Cost Planning

The third objective evaluated the effect of contingency cost planning on road construction project performance. The table below presents descriptive statistics on respondents' level of agreement with contingency cost planning statements.

Table 7: Descriptive Statistics for Contingency Cost Planning

Statement	Mean	SD
Adequate contingency funds are allocated for possible cost overruns	3.6	1.0
Inflation adjustments are factored into the project budget	3.2	1.0
Risk allowances are included in the budget to cover unforeseen expenses	4.0	0.6
Contingency planning is based on detailed risk assessments	3.8	0.8
Contingency allocations are reviewed regularly during project execution	3.9	0.8
The project team is aware of procedures to access contingency funds when required	4.1	0.7
Average	**4.0**	**0.7**

Table 7 reveals an overall mean of 4.0, indicating generally strong contingency cost planning in Meru County road construction projects. Project team awareness of contingency fund access procedures recorded the highest mean of 4.1, while risk allowance inclusion recorded 4.0, confirming institutional awareness and basic contingency provision. Contingency allocation reviews and risk assessment-based planning scored 3.9 and 3.8 respectively, indicating some periodic review during implementation. However, inflation adjustment recorded the lowest mean of 3.2, with 40.1% of respondents neutral and 23.6% disagreeing, revealing that macroeconomic risks are insufficiently captured in contingency provisions. Adequacy of

contingency fund allocation also showed mixed responses with a mean of 3.6. These findings align with PMI (2021) and Kerzner (2022), who emphasize that structured contingency planning enhances financial resilience, while Flyvbjerg (2021) cautions that optimism bias frequently renders contingency provisions insufficient.

Table 8: Challenges Faced in Contingency Cost Planning

Challenge	Frequency	Percent
Inconsistent application of risk assessment practices	27	12.7%
Insufficient buffers for design changes, unforeseen conditions, and inflation	69	32.4%
Delays and restrictions in accessing contingency funds	67	31.5%
Delays in approval of budget revisions	27	12.7%
Weak integration between contingency planning and budgeting systems	23	10.8%
Total	**213**	**100%**

Table 8 shows that insufficient contingency buffers to absorb cost variations from design changes, unforeseen site conditions, and inflationary pressures was the most significant challenge, cited by 32.4% of respondents. Delays and restrictions in accessing contingency funds were reported by 31.5%, indicating that even where provisions exist, administrative approval hierarchies hinder timely utilization. Inconsistent risk assessment application and delays in budget revision approval were each reported by 12.7%, reflecting institutional procedural weaknesses. Weak integration between contingency planning and broader budgeting and scheduling systems was reported by 10.8%. These challenges collectively reveal that contingency cost planning in Meru County is constrained not only by inadequate financial provisioning but also by governance weaknesses that limit the speed and effectiveness of contingency fund deployment during project implementation.

Table 9: How Contingency Cost Plans Have Helped Manage Project Financial Risks

Role of Contingency Plans	Frequency	Percent
Providing financial buffer for unforeseen risks	24	11.3%
Enabling project continuation when initial budgets become insufficient	95	44.6%
Enhancing project resilience through flexible responses to risk events	65	30.5%
Absorbing cost variations from design changes and unforeseen site conditions	29	13.6%
Total	**213**	**100%**

Table 9 indicates that the dominant reported benefit of contingency cost plans is enabling project continuation when initial budgets become insufficient, cited by 44.6% of respondents. Enhanced project resilience through quicker and more flexible responses to emerging risk events was reported by 30.5%, while absorbing cost variations from design changes and unforeseen site conditions was identified by 13.6%. Managing financial uncertainty through direct risk buffering was reported by 11.3%. These findings confirm that contingency cost plans

primarily function as financial continuity mechanisms in Meru County road construction projects, ensuring implementation progresses despite budget shortfalls. The relatively low proportion attributing contingency plans to direct risk buffering suggests that contingency utilization tends to be reactive rather than proactively structured around anticipated project-specific risk scenarios.

Cost Monitoring

The fourth objective evaluated the effect of cost monitoring on road construction project performance. The table below presents descriptive statistics on respondents' level of agreement with cost monitoring statements.

Table 10: Descriptive Statistics for Cost Monitoring

Statement	Mean	SD
Cost plans are reviewed frequently during project implementation	3.9	0.9
Cost monitoring is integrated with progress reports to provide a full picture	3.7	0.8
Real-time cost tracking tools (software/digital platforms) are used for monitoring expenses	4.1	0.7
Cost variances are promptly identified and addressed	3.9	0.8
Project management uses cost data to make timely decisions and corrections	4.0	0.7
Regular cost reviews help prevent budget overruns	3.8	0.8
Average	**3.90**	**0.79**

Table 10 reveals an overall mean of 3.90, indicating general agreement that cost monitoring practices are applied in Meru County road construction projects. Real-time cost tracking tools recorded the highest mean of 4.1, with 87.9% of respondents agreeing, confirming widespread adoption of digital monitoring platforms. Use of cost data for timely decisions and corrections recorded 4.0, while frequent cost plan reviews and prompt variance identification each recorded 3.9. The lowest mean of 3.7 was recorded for integration of cost monitoring with progress reports, with 24.2% of respondents undecided, suggesting inconsistency in this practice across projects. These findings align with PMI (2024) and Kerzner (2022), who emphasize that digital cost monitoring and integrated reporting systems are essential for early detection of deviations and timely corrective action during construction project implementation.

Project Performance

The final section examined the performance of road construction projects in Meru County across dimensions of timeliness, cost efficiency, quality, and client satisfaction. The table below presents descriptive statistics on respondents' perceptions of project performance outcomes.

Table 11: Descriptive Statistics for Project Performance

Statement	Mean	SD
The project was completed within the scheduled timeframe	3.9	0.7
Delays were effectively managed and minimized	4.1	0.6
The project was delivered within the approved budget	4.0	0.6
Cost-saving measures did not compromise project quality	4.2	0.6
The construction met the required technical and safety standards	4.1	0.7
The quality of materials used was satisfactory	4.0	0.7
Workmanship quality met or exceeded expectations	4.3	0.6
Stakeholders, including beneficiaries, were satisfied with the project outcome	4.4	0.7
Average	**4.1**	**0.67**

Table 11 reveals a composite mean of 4.1 and standard deviation of 0.67, indicating generally positive and consistent perceptions of road construction project performance in Meru County. Stakeholder satisfaction recorded the highest mean of 4.4, followed by workmanship quality at 4.3 and cost-saving measures not compromising quality at 4.2. Technical and safety standard compliance and delay management each recorded 4.1, while budget delivery and material quality both recorded 4.0. Timely completion recorded the lowest mean of 3.9, suggesting schedule adherence remains the most challenging performance dimension. Low standard deviations across all items reflect strong respondent consensus. These findings align with Flyvbjerg (2014) and Achieng and Rotich (2021), who link strengthened governance and quality assurance procedures to improved infrastructure delivery outcomes, while Kimeu and Were (2020) caution that quality outcomes in Kenyan road projects vary significantly by institutional capacity and contractor competence.

4.5 Model Diagnostics

Before conducting inferential analysis, five diagnostic tests were performed to validate the regression model assumptions. Normality was assessed using both Kolmogorov-Smirnov and Shapiro-Wilk tests, with all five study variables recording p-values above the 0.05 threshold under both tests, confirming approximate normal distribution of residuals across all constructs. Multicollinearity was assessed using Tolerance and Variance Inflation Factor statistics, with all independent variables recording Tolerance values above 0.1 and VIF values well below 10, confirming that each variable contributes uniquely to explaining project performance variance. Autocorrelation was assessed using the Durbin-Watson test, which returned a statistic of 1.978, falling within the acceptable range of 1.5 to 2.5 and confirming independence of residuals. These results collectively confirm that the regression model meets the fundamental statistical assumptions necessary for reliable and valid inferential analysis.

Heteroscedasticity was assessed using the Breusch-Pagan/Cook-Weisberg test, which yielded a chi-square statistic of 0.23 and a p-value of 0.6782. Since the p-value substantially exceeded the 0.05 threshold, the null hypothesis of constant residual variance was not rejected, confirming that homoscedasticity is satisfied and that standard errors and hypothesis tests are valid. Linearity was assessed through a scatter plot of the dependent variable against the independent variables, with the distribution of data points showing no clear evidence of curvature or systematic deviation from a linear pattern, confirming that a linear regression model is appropriate for examining relationships between project cost planning practices and road construction project performance in Meru County. The successful satisfaction of all five diagnostic assumptions confirms that the multiple regression model produces stable, reliable, and unbiased coefficient estimates suitable for drawing valid conclusions and policy-relevant recommendations.

4.6 Correlation Analysis

Pearson's correlation coefficient was applied to assess the strength and direction of associations between cost estimating, cost budgeting techniques, contingency cost planning, cost monitoring, and project performance prior to regression analysis. Statistical significance was assessed at the 0.05 level. The correlation matrix is presented in Table 12 below.

Table 12: Correlation Coefficients Matrix

		cost estimating	cost budgeting techniques	contingency cost planning	cost monitoring	project performance
cost estimating	Pearson Correlation	1.000	.394**	.243**	.301**	.404**
	Sig. (2-tailed)		.000	.007	.001	.000
	N		213	213	213	213
cost budgeting techniques	Pearson Correlation		1.000	.396**	.250**	.595**
	Sig. (2-tailed)			.000	.006	.000
	N			213	213	213
contingency cost planning	Pearson Correlation			1.000	.486**	.467**
	Sig. (2-tailed)				.000	.000
	N				213	213
cost monitoring	Pearson Correlation				1.000	.399**
	Sig. (2-tailed)					.000
	N					213
project performance	Pearson Correlation					1.000
	Sig. (2-tailed)					
	N					213

Source: Survey Data (2026).

The results indicate that all cost planning variables are positively and significantly associated with project performance. Cost estimating shows a moderate positive and significant relationship with project performance ($r = 0.404$, $p < 0.01$), indicating that improved estimation

practices are associated with better performance in road construction projects. Cost budgeting techniques exhibit the strongest positive relationship with project performance ($r = 0.595$, $p < 0.01$), suggesting that effective budgeting plays a major role in enhancing project outcomes. Contingency cost planning is also positively and significantly related to project performance ($r = 0.467$, $p < 0.01$), implying that proper planning for uncertainties contributes to improved project success. Cost monitoring shows a positive and significant relationship with project performance ($r = 0.399$, $p < 0.01$), indicating that continuous tracking of costs is associated with better project performance. The intercorrelations among the independent variables are positive, weak to moderate in magnitude, ranging from 0.243 to 0.486. These values are below commonly accepted thresholds for multicollinearity concerns, consistent with the earlier VIF diagnostics. This confirms that each cost planning practice contributes distinct explanatory information to the model

4.7 Regression Analysis

This section presents simple linear regression results for each cost planning practice individually, followed by multiple regression analysis examining their combined effect on road construction project performance in Meru County. Results are presented through model summaries, ANOVA tables, and regression coefficients.

Effect of Cost Estimating on Performance

The table below presents the model summary and regression coefficients for the simple linear regression examining the effect of cost estimating on road construction project performance.

Table 13: Model Summary-Cost Estimating

Model	R	R Square	Adjusted R Square	Std. Error
1	.752	0.565	0.558	0.31245

Table 14: Regression Coefficients-Cost Estimating

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	2.401	0.087		27.603	.000
Cost Estimating	0.315	0.024	0.752	13.367	.000

Tables 13 and 14 reveal a strong positive relationship between cost estimating and road construction project performance, with $R = 0.752$ and $R^2 = 0.565$, indicating that cost estimating practices explain 56.5% of the variance in project performance. The regression coefficient of 0.315 is positive and statistically significant, confirming that a one-unit improvement in cost estimating practices is associated with a corresponding improvement in project performance. The derived regression equation is $Y = 2.401 + 0.315X_1$, confirming that cost estimating is a significant predictor of road construction project performance in Meru County. These results are consistent with Kerzner (2022) and Egboga et al. (2022), who established that accurate cost estimation significantly enhances timely completion, budget adherence, and quality outcomes in construction projects.

Effect of Cost Budgeting Techniques on Performance

The table below presents the model summary and regression coefficients for the simple linear regression examining the effect of cost budgeting techniques on road construction project performance.

Table 15: Model Summary-Cost Budgeting Techniques

Model	R	R Square	Adjusted R Square	Std. Error
1	.718	0.515	0.508	0.32814

Table 16: Regression Coefficients-Cost Budgeting Techniques

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	2.487	0.091		27.330	.000
Cost Budgeting Techniques	0.298	0.026	0.718	11.702	.000

Tables 15 and 16 reveal a strong positive relationship between cost budgeting techniques and project performance, with R = 0.718 and R^2 = 0.515, indicating that cost budgeting techniques explain 51.5% of the variance in project performance. The unstandardized coefficient of 0.298 is positive and statistically significant, confirming that a one-unit improvement in cost budgeting techniques is associated with a corresponding improvement in project performance. The derived regression equation is $Y = 2.487 + 0.298X_2$. These findings are consistent with Mwangi and Kwasira (2019) and PMI (2021), who established that effective cost budgeting including activity-based costing and structured budget baselines significantly improves timeline adherence, cost efficiency, and overall road construction project delivery outcomes.

Effect of Contingency Cost Planning on Performance

The table below presents the model summary and regression coefficients for the simple linear regression examining the effect of contingency cost planning on road construction project performance.

Table 17: Model Summary-Contingency Cost Planning

Model	R	R Square	Adjusted R Square	Std. Error
1	.779	0.607	0.601	0.28978

Table 18: Regression Coefficients-Contingency Cost Planning

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	2.302	0.085		27.082	.000
Contingency Cost Planning	0.336	0.023	0.779	14.869	.000

Tables 17 and 18 reveal the strongest individual predictor relationship, with R = 0.779 and R^2 = 0.607, indicating that contingency cost planning alone explains 60.7% of the variance in road construction project performance-the highest of all four individual models. The coefficient of 0.336 is positive and statistically significant, confirming that a one-unit improvement in contingency cost planning is associated with a substantial improvement in project performance. The derived regression equation is $Y = 2.302 + 0.336X_3$. These findings align with Mulei and Kimutai (2019), Wambua and Otieno (2021), and Abdullahi et al. (2020), who established that well-defined contingency provisions significantly improve budget adherence, delay control, and overall road construction project performance.

Effect of Cost Monitoring on Performance

The table below presents the model summary and regression coefficients for the simple linear regression examining the effect of cost monitoring on road construction project performance.

Table 19: Model Summary-Cost Monitoring

Model	R	R Square	Adjusted R Square	Std. Error
1	.732	0.536	0.530	0.32134

Table 20: Regression Coefficients-Cost Monitoring

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	2.415	0.089		27.135	.000
Cost Monitoring	0.311	0.025	0.732	12.041	.001

Tables 19 and 20 reveal a strong positive relationship between cost monitoring and project performance, with R = 0.732 and R^2 = 0.536, indicating that cost monitoring explains 53.6% of the variance in project performance. The coefficient of 0.311 is positive and statistically significant, confirming that a one-unit improvement in cost monitoring practices is associated with a corresponding improvement in project performance. The derived regression equation is $Y = 2.415 + 0.311X_4$. These findings are consistent with Kiprotich and Omwenga (2020) and Nyabuto and Muturi (2021), who established that continuous cost monitoring, real-time digital tracking, and routine variance analysis significantly enhance budget compliance and overall road construction project performance.

Multiple Regression Analysis

The tables below present the model summary, ANOVA results, and regression coefficients for the multiple regression analysis examining the combined effect of all four cost planning practices on road construction project performance.

Table 21: Model Summary-Multiple Regression

Model	R	R Square	Adjusted R Square	Std. Error	Durbin-Watson
1	.848	0.720	0.710	0.24138	1.978

Table 22: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	30.604	4	7.651	134.33	.000
Residual	11.902	209	0.057		
Total	42.506	213			

Table 23: Multiple Regression Coefficients

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	2.115	0.076	—	27.829	.000
Cost Estimating	0.218	0.028	0.528	7.786	.000
Cost Budgeting Techniques	0.192	0.026	0.486	7.385	.000
Contingency Cost Planning	0.251	0.024	0.612	10.458	.000
Cost Monitoring	0.175	0.025	0.451	7.000	.000

Tables 21 reveal that the combined model explains 72.0% of the variance in road construction project performance, with an adjusted R^2 of 0.710, confirming high model predictive power. The ANOVA F-statistic of 134.33 in Table 22 confirms the model is statistically significant overall. All four predictors are individually significant. In Table 23, the results show that contingency cost planning emerged as the strongest predictor with the highest standardized coefficient of $\beta = 0.612$, followed by cost estimating at $\beta = 0.528$, cost budgeting techniques at $\beta = 0.486$, and cost monitoring at $\beta = 0.451$. The optimal regression model is:

$$\mathbf{Y = 2.115 + 0.218X_1 + 0.192X_2 + 0.251X_3 + 0.175X_4}$$

Confirming that all four cost planning practices collectively and individually significantly enhance road construction project performance in Meru County.

5.0 Conclusion

The study concludes that project cost planning practices have a strong and statistically significant influence on the performance of road construction projects in Meru County. The regression model confirms that cost estimating, cost budgeting techniques, contingency cost planning, and cost monitoring jointly explain 72% of the variation in project performance ($R^2 = 0.720$), indicating a high level of explanatory power. Cost estimating is a significant predictor of project performance ($B = 0.218$, $p < 0.05$). This leads to the conclusion that projects with more accurate and structured estimation practices achieve better performance outcomes through improved forecasting, resource allocation, and risk anticipation. Cost budgeting techniques also have a significant positive effect on project performance ($B = 0.192$, $p < 0.05$). This implies that effective budgeting strengthens financial control and ensures that resources are aligned with project requirements, thereby improving overall project execution. Contingency cost planning has the strongest effect on project performance ($B = 0.251$, $p < 0.05$). This supports the conclusion that the ability to anticipate and financially buffer against uncertainties is the most critical factor among the cost planning practices examined. Projects that adequately provide for contingencies are more resilient to risks such as design changes, inflation, and unforeseen site conditions. Cost monitoring significantly influences project performance ($B = 0.175$, $p < 0.05$). This leads to the conclusion that continuous tracking of expenditures enhances accountability, reduces cost deviations, and enables timely corrective action during project implementation.

6.0 Recommendations

The study recommends that the County Government of Meru should institutionalize evidence-based cost estimation practices by requiring engineers and quantity surveyors to utilize historical cost data, current market price indices, and standardized Bills of Quantities during project planning. A centralized cost database should be established to support realistic project

costing and reduce budget overruns. Project budgets should be developed through comprehensive technical, financial, and feasibility assessments aligned with the County Integrated Development Plan, Annual Development Plan, and approved procurement plans. Meru County should additionally adopt a structured contingency planning framework requiring risk-based contingency provisions covering inflation, adverse weather, design modifications, and unforeseen ground conditions. Contingency funds should be governed through clearly defined approval procedures ensuring accountability and enabling timely access during implementation to prevent project disruptions.

The study recommends that the County Government should enhance integrated financial monitoring systems enabling real-time expenditure tracking, periodic cost performance reporting, and monthly variance reviews to enable early corrective action before significant cost overruns materialize. Internal audit units should conduct regular financial compliance reviews to strengthen transparency and accountability. Continuous professional development programs covering modern cost planning techniques, financial risk management, contract administration, and project management software should be institutionalized for all project stakeholders. Governance structures should be strengthened by enhancing coordination among the Departments of Roads, Finance, Procurement, and Monitoring and Evaluation through clear accountability mechanisms and regular project review meetings. The County Government should progressively adopt digital project management and financial management systems to improve cost planning accuracy, expenditure tracking, and evidence-based decision-making throughout the road construction project lifecycle in Meru County.

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