

PROJECT COST MANAGEMENT PRACTICES AND PERFORMANCE OF ROAD CONSTRUCTION PROJECTS IN MOMBASA COUNTY, KENYA

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ABSTRACT

Road construction projects in Kenya continue to experience persistent cost overruns, schedule delays, and inefficient resource utilization, despite substantial public investment in transport infrastructure. In Mombasa County, unique environmental and logistical conditions, including saline soils, port congestion, and high urban density, further complicate project delivery and increase the risk of cost escalation. Although project cost management has received increasing scholarly attention, limited empirical evidence exists on the influence of cost estimation and cost planning on the performance of road construction projects in this context. This study examined the influence of cost estimation and cost planning practices on the performance of road construction projects in Mombasa County, Kenya. The study was anchored on Resource Dependency Theory and the Theory of Constraints and adopted a descriptive survey research design. The unit of analysis comprised 18 road construction projects implemented between 2020 and 2024, while the unit of observation consisted of 180 project staff. Data were collected using semi-structured questionnaires containing both Likert-scale and open-ended questions. Instrument validity and reliability were established through a pilot study involving 18 respondents. Quantitative data were analysed using descriptive statistics, Pearson's correlation, and multiple regression analysis, while qualitative responses were analysed using thematic content analysis. The findings revealed that cost estimation had a strong positive and statistically significant relationship with project performance ($r = 0.816$, $p < 0.001$), while cost planning also exhibited a positive and significant relationship with project performance ($r = 0.527$, $p < 0.001$). The study concludes that strengthening cost estimation and cost planning practices significantly enhances the performance of road construction projects. It recommends improving the accuracy of project cost estimates through comprehensive cost analysis and realistic forecasting, while strengthening cost planning through effective cost baseline development, cash flow planning, and cost forecasting to improve project delivery.

Keywords: Cost estimation, cost planning, project cost management, project performance, road construction projects, Mombasa County, Kenya.

INTRODUCTION

Infrastructure, particularly roads, is widely recognized as a key driver of economic development, trade, and social mobility (Obuo, 2024). Efficient road networks reduce transportation costs, enhance market access, and facilitate regional integration, thereby promoting long-term growth (World Bank, 2020). However, road construction projects across the world, and especially in developing countries, continue to struggle with cost overruns, schedule delays, and compromised quality (Gitonga, Muchelule, & Nyang'au, 2022). Flyvbjerg et al. (2021) further emphasize that infrastructure megaprojects globally are plagued by chronic underperformance, with cost overruns averaging between 30–45%, primarily due to weak cost estimation and ineffective cost control systems.

Kenya's road sector reflects these global challenges. Despite heavy government investment, many public road projects fail to meet time, cost, and quality benchmarks. Gitonga et al. (2022), in their study on urban road projects in Kenya, found that cost management practices such as estimation, budgeting, resource allocation, and control significantly influenced project performance. Similarly, Mwangi and K'Obonyo (2021) established that public road construction projects often experience budget overruns and delays, undermining service delivery and eroding public confidence. Musyoka and Muturi (2020) also highlighted that weak cost estimation and budgeting practices were critical contributors to stalled or incomplete infrastructure projects in Nairobi County. These findings suggest that the central challenge in Kenya's road projects is not insufficient funding, but inefficiencies in how financial resources are planned, scheduled, and controlled.

Empirical research has underscored that robust cost management processes are critical to project success. Obuo (2024) demonstrated that Cost Planning, estimation, and control strongly influence infrastructure project performance in Kenya, while Piyon (2025), studying road projects in Narok County, noted that poor cost forecasting and monitoring were major causes of deviations from budgets and timelines. Internationally, project cost management practices, including estimation, budgeting, scheduling, and control, are recognized as foundational pillars of project performance (Project Management Institute [PMI], 2021). In the Kenyan context, Nyaribo, Ombati, and Otieno (2022) reported that effective cost planning and scheduling significantly reduced time and cost overruns in county infrastructure projects. Likewise, Kiptum and Omwenga (2023) observed that systematic cost monitoring and variance analysis enhanced financial accountability and improved performance outcomes in devolved road projects.

Although research on cost management and infrastructure performance is growing, most existing studies emphasize national trends or focus on projects in Nairobi and other high-profile regions. Yet counties on the coast such as Mombasa face port congestion and logistical constraints, such as long vessel berth delays and yard capacity bottlenecks (Maersk, 2025; CSM, 2024). Environmental pressures like saline soil intrusion are documented in coastal areas (Ogara et al., 2025), and rapid urbanization exerts additional strain on infrastructure and planning dynamics (Ogara et al., 2025). These localized factors may complicate cost estimation, scheduling, and control in road projects. These factors complicate cost estimation, scheduling, and control, raising the question of whether existing cost management practices are sufficient to sustain performance in such environments. This study therefore seeks to investigate the effect of cost estimation, and Cost Planning on the performance of road construction projects in Mombasa County.

Statement of the Problem

Road infrastructure is a cornerstone of Kenya's socio-economic development, enabling mobility, facilitating trade, and strengthening regional integration. Over the past decade, the country has significantly increased public investment in the sector through national agencies such as the Kenya Urban Roads Authority (KURA), Kenya National Highways Authority

(KeNHA), and Kenya Rural Roads Authority (KeRRA). Despite these efforts, the performance of road projects remains consistently undermined by cost overruns, schedule delays, and inefficient resource utilization (Gitonga, Muchelule, & Nyang'au, 2022; Mwangi & K'Obonyo, 2021).

National audits and reviews highlight the scale of the challenge. The Office of the Auditor General (2024) reported that 58% of road projects assessed in the 2022/2023 financial year experienced cost overruns of 37.4%. Similarly, the Public Procurement Regulatory Authority (PPRA, 2024) indicated that road construction contracts had the highest rate of variations among all sectors averaging 28-52% above the original contract sum. The Kenya Roads Board (2023) further estimated that inefficiencies in road projects resulted in a cumulative loss of about KES 46 billion loss between 2020 and 2022 due to cost escalations, variations, and abandoned projects. The Kenya National Bureau of Statistics (2024) reported a national Cost Performance Index (CPI) of 0.76 for road projects indicating that for every shilling planned, only 72 cents worth of work was actually achieved. While national frameworks such as the Public Investment Management Guidelines (National Treasury, 2023) exist, their implementation remains weak, especially at the county and agency level. Although several studies have examined cost management in road projects at the national level and in Nairobi, there is limited empirical research focusing on Mombasa County, despite its strategic economic importance as Kenya's second-largest city and key gateway port.

Road project performance in Mombasa County is particularly concerning. According to the Mombasa County Assembly Transport Committee Report (2024), more than 62% of the KURA-funded road projects initiated in 2021-2024 either stalled, were delayed, or experienced budget overruns. Notable examples include the Jomvu-Miritini Road and the Makupa Causeway rehabilitation projects which recorded costs overruns of 42% and 31% respectively and time delays of between 8-14 months (KURA Implementation Review, 2023). Ogara, Mutungi and Kenga (2025) reported that coastal-specific challenges such as saline conditions, high water table, and port-related congestion increase project costs by more than 20% in comparison to inland projects. However, these risks are not adequately considered during initial cost estimates. Even though there exist national frameworks such as the Public Investment Management Guidelines, their implementation is still weak especially at the County and agency level. Existing literature has primarily focused on national trends or major urban centers such as Nairobi. In addition, the studies rely on outdated Bills of Materials (BoMs), static budgets, and reactive rather than proactive cost control mechanisms (Gitonga et al., 2022; Obuo, 2024; Musyoka & Muturi, 2020). There is limited empirical research addressing cost management practices in counties such as Mombasa, despite their strategic significance and unique challenges. This study hence sought to fill the research gaps by examining the influence of project cost management practices on the performance of road construction projects in Mombasa County, Kenya.

Objectives of the Study

The general objective of this study was to examine the influence of project cost management practices on the performance of road construction projects in Mombasa County, Kenya.

The specific objectives guiding the study were:

- i. To assess the influence of cost estimation practices on the performance of road construction projects in Mombasa County, Kenya.
- ii. To examine the influence of Cost Planning practices on the performance of road construction projects in Mombasa County, Kenya.

LITERATURE REVIEW

Theoretical Review

Resource- Dependency Theory

The Resource Dependency Theory (RDT) was first developed by Pfeffer and Salancik (1978), not Wernerfelt. It posits that organizations depend on external resources for survival, and that the ability to acquire and control these resources determines organizational power, strategic choices, and performance outcomes. These resources, ranging from financial capital and technical expertise to regulatory support, are often controlled by other actors within the environment, creating interdependencies that organizations must navigate. The theory suggests that no organization is entirely self-sufficient; rather, it must actively manage its external relationships to ensure access to critical inputs (Pfeffer & Salancik, 1978).

Over the years, Resource Dependency Theory has evolved to include not just the acquisition of resources, but also how organizations manage uncertainty and reduce dependency by forming strategic alliances, diversifying suppliers, or integrating vertically. Scholars such as Hillman, Withers, and Collins (2009) expanded the theory to examine the role of corporate governance, particularly the role of board members in providing access to external resources. The inclusion of diverse, well-connected stakeholders is seen as a mechanism to reduce vulnerability and increase environmental adaptability. The theory has also been applied in public sector contexts, particularly in infrastructure and development planning, where agencies often rely on government allocations, donor funding, and regulatory permissions to execute projects effectively (Hillman et al., 2009).

Despite its widespread application, Resource Dependency Theory has been critiqued for underestimating the internal capabilities of organizations and for offering limited predictive power in rapidly changing environments. Critics argue that the theory assumes rational decision-making and stable resource networks, which may not hold in volatile contexts such as developing economies or politically unstable regions. Moreover, the theory may overemphasize external factors at the expense of internal innovation, resilience, and leadership (Casciaro & Piskorski, 2005). Nonetheless, its core insight, that organizations must actively manage their relationships with the external environment to secure necessary resources, remains highly relevant, especially for publicly funded infrastructure projects.

In the context of this study, Resource Dependency Theory provides a useful framework for understanding the importance of cost estimation as a mechanism through which public agencies such as the Kenya Urban Roads Authority (KURA) secure and manage financial resources. Accurate cost estimates are essential for obtaining budgetary approvals, attracting donor funding, and aligning stakeholder expectations. In resource-constrained settings such as Mombasa County, where road projects face high environmental and logistical uncertainties, effective cost estimation is not merely a technical requirement but a strategic tool for reducing funding gaps, preventing delays, and ensuring project continuity. Therefore, this theory underpins the study's first objective, which is to assess the influence of cost estimation practices on the performance of KURA's road construction projects.

Theory of Constraints

The Theory of Constraints (TOC) was introduced by Eliyahu M. Goldratt in his seminal work *The Goal* (1984), and later expanded through his Critical Chain Project Management (CCPM) framework. TOC is built on the premise that every system, including project management systems, has at least one constraint that limits its overall performance. In projects, these constraints often manifest as time delays, resource bottlenecks, or scheduling inefficiencies that, if left unaddressed, lead to cost overruns, missed deadlines, and compromised outcomes (Goldratt, 1997).

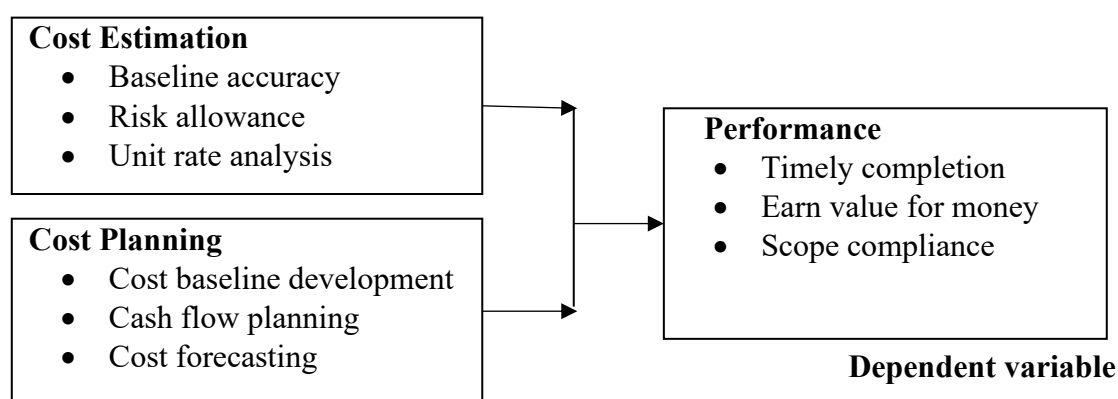
Within the TOC framework, project scheduling is approached not just as a sequencing activity, but as a strategic effort to identify and manage constraints that threaten on-time and on-budget delivery. TOC proposes the use of buffer management rather than rigid timelines to accommodate uncertainties. Buffers are placed strategically, at the end of critical chains or key resource paths, to absorb delays without derailing the project. This approach contrasts traditional methods that rely heavily on task-by-task float and often underestimate systemic delays (Leach, 1999). By focusing on the constraint, project managers can direct resources, attention, and corrective actions where they are most needed.

The theory has been widely adopted in both manufacturing and project-based environments and is especially relevant in complex, multi-stakeholder projects where time and resource coordination are critical. However, TOC has also been critiqued for being too linear and deterministic, especially in dynamic project environments such as public infrastructure. Critics argue that its emphasis on a single constraint may oversimplify the reality of interdependent project risks and multiple external variables (Herroelen & Leus, 2005). Moreover, while buffer management is effective for internal delays, it may be less adaptable in public-sector projects constrained by bureaucratic approvals and fluctuating political priorities.

Nonetheless, the relevance of TOC to Cost Planning in this study is clear. Road projects managed by the Kenya Urban Roads Authority (KURA) in Mombasa County face diverse constraints, ranging from limited rights-of-way and urban congestion to delayed procurement and contractor inefficiencies. These constraints often disrupt planned schedules, leading to extended timelines and inflated costs. Applying the Theory of Constraints allows project managers to proactively identify these bottlenecks, allocate time and cost buffers, and revise schedules dynamically to protect overall project performance. As such, TOC directly supports the study's third objective: to examine the influence of Cost Planning practices on the performance of KURA's road projects.

Conceptual Framework

In the arguments of Orodho (2024), conceptual framework can be construed as the main features of a study and their hypothesized relationship. The conceptual framework in Figure 2.1 demonstrates the linkage between independent variables and dependent variables. The independent variables are; cost estimation, and Cost Planning. The dependent variable is the performance of road construction projects by Kenya Urban Roads Authority. These variables and relationships are presented in Figure 2.1.



Independent variables

Figure 2. 1: Conceptual Framework

Cost Estimation

Cost estimation is a critical component of project cost management, involving the systematic prediction of financial resources required to complete a project's scope of work. It encompasses direct and indirect costs, including labor, materials, equipment, services, and contingency

provisions for identified risks (Rajapakse, 2024). Effective estimation serves as the foundation for budget formulation, bid evaluation, financing decisions, and project approval. Within the context of public road infrastructure, the accuracy of initial cost estimates determines the feasibility and credibility of a project and influences stakeholder confidence.

Cost estimation is inherently iterative. Estimates evolve as more information becomes available, typically progressing from rough order-of-magnitude estimates to more detailed assessments at later project stages (Forbatok, 2024). At the early planning phase, unit rate analysis plays a vital role by benchmarking historical costs or market rates to forecast activity-level expenditure. According to Hatamleh et al. (2020), failure to establish accurate baseline estimates often results in a mismatch between available funding and actual costs, contributing to cost overruns and project delays. Cost estimation also includes consideration of risk allowances, an explicit quantification of uncertainty, through techniques such as Monte Carlo simulation or reference class forecasting.

Recent studies emphasize that poor estimation practices remain a leading cause of cost overruns in public infrastructure projects, particularly in developing countries. Edwards and Kaeding (2025) assert that cost estimates are vulnerable to inaccuracies due to fluctuating material prices, design changes, and inconsistent estimation methodologies. Additionally, institutional constraints, such as inadequate data, fragmented responsibility, and lack of peer review, reduce the reliability of estimates at both national and county levels.

To ensure baseline accuracy, Valtanen (2020) highlights the importance of clearly defined project scopes, comprehensive bill of quantities (BoQs), and updated unit price databases. These elements provide the basis for sound estimation and reduce room for manipulation or optimism bias. Furthermore, Hatamleh et al. (2020) argue that estimation tools must incorporate realistic assumptions, especially when projects are implemented in volatile environments where political, environmental, and market risks are prevalent. The involvement of experienced professionals, coupled with independent verification of estimates, improves cost reliability and facilitates transparent financial planning.

Cost Planning

Costs schedule is a process of analyzing and forecasting the project's total costs to determine how to allocate the project's budget (Darwish, 2024). Cost Planning determines the resources needed, and reality of the delivery of the project. Project managers with vast experience are able to accurately dictate the tasks, effort and money required to complete a project. Cost Planning is a critical sub-domain of project cost management that deals with the strategic allocation of financial resources over time in relation to project activities. It entails the integration of cost elements with the project schedule to forecast when and how much funding will be required at specific project stages. Effective Cost Planning ensures that the project's financial flows are synchronized with activity execution, minimizing the risks of idle resources, cash flow constraints, and schedule slippage (Darwish, 2024). In the context of road infrastructure projects, where externalities such as weather, site conditions, and procurement delays frequently alter timelines, the ability to dynamically align financial expenditures with evolving activity schedules is a key determinant of project performance (Obegi & Kimutai, 2024).

A fundamental element of Cost Planning is timeline planning, which involves identifying the sequence and duration of project activities and linking them with corresponding budgetary allocations. This includes the use of scheduling tools such as Gantt charts, Critical Path Method (CPM), and Program Evaluation and Review Technique (PERT), which help in establishing logical sequencing, estimating activity durations, and identifying dependencies among tasks (Kerzner, 2024). For example, the use of earned value techniques within timeline planning allows managers to compare planned expenditures with actual progress, thereby generating early warning signals for cost or time deviations (Pheng, 2022; PMBOK, 2024).

Activity sequencing forms another essential pillar of Cost Planning. It entails the identification of the logical order in which tasks should be executed to ensure efficient resource utilization and cost-effectiveness. The sequencing must consider technical dependencies, resource constraints, and external factors such as regulatory approvals or environmental conditions (Williams, 2020). Inaccurate sequencing or failure to account for interdependencies can lead to idle equipment, cost escalations due to rushed procurement, and rework, especially in road construction where sequencing errors may involve site preparation, drainage works, or asphalt laying (Ronoh & Cheruiyot, 2020). Empirical findings by Obuo (2024) indicate that a lack of synchronized activity planning and financial disbursement scheduling was a major contributor to delays and cost overruns in public infrastructure projects in Kenya, including those in coastal counties.

An increasingly important consideration in Cost Planning is the buffering strategy, which involves the deliberate insertion of time and cost buffers into project schedules to absorb potential delays or disruptions. The Theory of Constraints (TOC), particularly through the Critical Chain Project Management (CCPM) approach, advocates for strategic buffering as a risk management tool (Leach, 1999). These buffers are not arbitrarily assigned but are based on identified uncertainties such as procurement risks, contractor performance, and weather variability. In practice, this can mean reserving additional days or financial allocations for high-risk activities, thereby enhancing project resilience (Temesgen, 2024). Research by Alao and Godwin (2024) emphasized that poor cash flow planning, linked directly to ineffective buffering strategies, often leads to contractor insolvency or stalled projects, which subsequently affect project outcomes. In Mombasa, where urban congestion, saline soils, and high water tables are common, the incorporation of context-specific buffers is critical to mitigating the effects of environmental and logistical shocks (Ogara, Mutungi, & Kenga, 2025).

Furthermore, Cost Planning serves not only as a planning tool but also as a dynamic control mechanism. As project execution unfolds, actual performance data is collected and compared against the schedule to detect variances in real time. This enables managers to reallocate resources, adjust timelines, and reprioritize activities to maintain alignment with project objectives. Studies such as those by Cudjoe (2019) and Piyon (2025) affirm that dynamic scheduling, anchored in accurate forecasting and continuous monitoring, significantly improves the likelihood of timely and cost-effective project delivery.

Notably, the integration between scheduling and budgeting enhances project financial health by ensuring that expenditures are both timely and justified. In public road projects managed by agencies such as the Kenya Urban Roads Authority (KURA), the lack of integrated cost and schedule tracking mechanisms often results in discrepancies between physical progress and financial disbursement (Kiptum & Omwenga, 2023). Without such integration, managers may either overspend prematurely or under-disburse, leading to implementation lags. This challenge is particularly pronounced in counties like Mombasa, where high-risk environments necessitate agile scheduling frameworks supported by real-time data and scenario analysis (Obuo, 2024; Ogara et al., 2025).

Performance of Road Construction Projects

Performance of road construction projects is a multidimensional construct that reflects the extent to which projects achieve intended outcomes in terms of cost efficiency, timeliness, and conformity to design specifications. It is commonly assessed through three interrelated dimensions: cost adherence, timely completion, and scope compliance (Piyon, 2025; PMBOK, 2024). In public infrastructure contexts, these performance indicators are critical for ensuring that taxpayer resources are utilized effectively and that infrastructure assets deliver intended socio-economic benefits (Obuo, 2024; Gitonga, Muchelule, & Nyang'au, 2022).

Cost adherence refers to the project's ability to remain within the approved budget throughout its lifecycle. It is one of the most visible and politically sensitive indicators of performance,

particularly in public works projects where budget overruns often result in scrutiny from oversight agencies, funders, and the public. According to Edwards and Kaeding (2025), cost deviations are frequently attributed to poor early-stage estimation, inflation, scope creep, and weak cost control mechanisms. In Kenya, the Auditor General (2022) reported that over 40% of road construction projects exceeded their original cost estimates, with cumulative financial losses amounting to billions of Kenyan shillings between 2020 and 2022. In Mombasa County specifically, high-cost deviations have been recorded in projects such as the Kizingo–Serena dual carriageway, largely due to unforeseen environmental conditions and inadequate cost planning (Ogara, Mutungi, & Kenga, 2025).

Timely completion, another core performance indicator, refers to whether a project is completed within the originally scheduled timeframe. Delays in infrastructure projects can cause cascading effects, including increased costs due to inflation and contractual claims, disruption of public services, and reputational damage to implementing agencies. In a recent study by Nyaribo, Ombati, and Otieno (2022), project schedule performance was found to be heavily influenced by procurement delays, contractor inefficiencies, and poor integration of scheduling and financial planning. Internationally, the Project Management Institute (2021) emphasizes the integration of time-cost performance metrics, such as Schedule Performance Index (SPI), to dynamically assess progress and detect slippage. In the context of Mombasa, urban congestion, high groundwater levels, and delayed disbursements have contributed significantly to the failure of projects to meet their timelines (Mombasa County Assembly, 2023; Obuo, 2024).

The third dimension, scope compliance, pertains to the degree to which the delivered infrastructure matches the planned specifications in terms of length, quality, materials, and functionality. It reflects the technical integrity and value-for-money of a project. Projects that meet budget and schedule targets but deliver substandard or incomplete outputs still represent underperformance. According to Musyoka and Muturi (2020), changes in design during implementation, often caused by weak initial planning or stakeholder disagreements, are a leading factor in scope drift and compromised output quality. The World Bank (2020) highlights that in developing countries, scope compliance is often threatened by informal changes, poor supervision, and inadequate risk assessment during project inception. In coastal areas like Mombasa, where soil salinity and spatial constraints affect foundational integrity and road layout, projects must be rigorously scoped and monitored to avoid technical non-compliance (Ogara et al., 2025).

The interplay between these three dimensions is critical. A project that adheres to cost but exceeds time or compromises on quality does not achieve holistic performance. For this reason, performance evaluation must adopt a systems-based view, recognizing that trade-offs among cost, time, and scope are often necessary but must be managed strategically (Kerzner, 2024; Sterman, 2000). Tools such as Earned Value Management (EVM) provide integrated performance indicators to monitor and adjust these trade-offs in real-time, enabling more adaptive and evidence-based project delivery (Pheng, 2022; Cho et al., 2020).

In the Kenyan public sector context, especially under the devolved system, road project performance is also influenced by institutional coordination, capacity constraints, and fiscal predictability. Kiptum and Omwenga (2023) argue that many county governments, including Mombasa, lack integrated project performance tracking systems, resulting in delayed corrective actions and weakened accountability. Moreover, the lack of ex-post evaluations limits learning and perpetuates systemic inefficiencies. Piyon (2025) further notes that performance measurement frameworks must go beyond financial and temporal targets to include stakeholder satisfaction and long-term functionality, factors that are often neglected in routine project assessments.

The performance of road construction projects is therefore best evaluated as a function of cost adherence, timely completion, and scope compliance, each of which is shaped by planning rigor, institutional capacity, and operational environment. For agencies such as the Kenya Urban Roads Authority (KURA), particularly in complex jurisdictions like Mombasa County, performance cannot be isolated from the robustness of project cost management practices. Ensuring financial discipline, timely implementation, and design conformity requires the systematic integration of estimation, budgeting, scheduling, and control across all project stages (PMBOK, 2024; Obuo, 2024; Gitonga et al., 2022).

Empirical Review

Cost Estimation and Project Performance

Valtanen (2020) investigated methods used to reduce project cost variance in industrial project-based firms. The objective was achieved by observing the sales organization and the cost estimation procedure in the case company. This analysis revealed the need to update the cost estimation tools for specific elements in the company's product portfolio. Adoption of alternative cost estimation techniques helps to balance resource utilization as well as making the process clearer. Nakhleh (2019) examined the relationship between cost estimation and project performance. The study adopted a correlation study design. Purposive sampling was used to sample 67 project sponsors, managers, and coordinators in Qatar. Questionnaires were used to collect data. Findings showed a significant linear relationship between cost estimation and project performance.

Omar and Omar (2022) sought to determine the most critical factors affecting the accuracy of Saudi Arabian public project construction cost estimates. A questionnaire was used to collect data from 100 participants. Results showed that cost estimates for Saudi public building projects are affected by financial concerns, the bidding situation and project features, as well as the estimation technique. The results found that the main factors affecting project cost estimates are financial status of client market, the unstable economic situation, cost estimation accuracy, financial resource availability, punctuality of cost flow as well as the availability of high-quality financial plans and accurate estimation.

Pournima, and Leon (2024) sought to identify the level of importance given to different complexity dimensions in cost estimation and to recognize best practices to improve cost estimation accuracy. The data was collected using questionnaires that were administered online. In-depth interviews were conducted among experts and practitioners. Results showed that risk, project and product size, and time frame are the high-impact complexity dimensions on cost estimation, which need more attention in reducing unforeseen cost implications. Appropriate staffing, network enhancement, risk management, and circumspect estimation are some of the suggestions to improve cost estimation of complex projects.

Egboga, Cross, and Abubakar (2022) investigated effect of cost estimation on project performance in construction firms in Abuja. The study adopted a descriptive survey design. The results showed that both bottom-up estimation and parametric cost estimating are both positively and significantly influenced by scope/specifications, time/schedule and cost. The study concluded that project managers need to be cognizant of the relationship between estimating project costs and focus on developing estimates and schedules using modern project management tools that would project accurate costs and schedules. Temesgen (2024) assessed factors affecting the accuracy of cost estimation and analyzes their effect on project success. The data was collected using questionnaires. The findings indicated that most of the estimated cost of the projects is either under-utilized or over utilized which shows there is undeniable inaccuracies in the project's cost estimation.

Cost Planning and Project Performance

Williams (2020) examined the relationship between project Cost Planning and project success. The study adopted a correlational study design. Data was collected from 110 construction companies in Liberia. Questionnaires were used to collect data. Results showed that there is a significant relationship between Cost Planning and project success. The researcher recommended that project managers should exploit relevant project management training and other capacity development efforts to effectively manage project costs and schedules for success. Cudjoe (2019) investigated cost planning as a tool in monitoring construction projects in the government sector in the Ghana Armed Forces. The study adopted a descriptive research design. A structured questionnaire was used to collect data from 66 respondents. The results of the study showed that cost planning must correspond with the funds availability for the projects. Cost planning was highly ranked as an effective modern cost planning techniques that enhances project delivery.

Ronoh and Cheruiyot (2020) investigated the influence of project resource scheduling on performance of residential construction projects in Nairobi City County, Kenya. A descriptive survey research design was used. The sample was 79 gated community residential construction projects. Data was collected using questionnaires. Findings showed there is a significant relationship between resource scheduling and project performance. The study concluded that the proper allocation of project equipment facilitates smooth operations and successful project completion.

Obegi and Kimutai's (2024) studied effects of resource scheduling on the performance of NGO projects in Nairobi City County. The target was 187 INGOs in Nairobi County. Questionnaires were used to collect data. The project performance was influenced by resource scheduling because it ensured that the project was operating within budget and the changes are made to adapt to the dynamic nature of the projects, and the staff had what was needed for the job.

RESEARCH METHODOLOGY

This study adopted a descriptive research design to examine the influence of project cost management practices on the performance of road construction projects in Mombasa County, Kenya. The design was appropriate because it enabled the collection and analysis of data on existing project cost management practices without manipulating the study variables.

The unit of analysis comprised 18 road construction projects implemented by the Kenya Urban Roads Authority (KURA) in Mombasa County between 2020 and 2024, while the unit of observation consisted of 180 project personnel directly involved in project implementation, including project managers, engineers, quantity surveyors, procurement officers, finance officers, monitoring and evaluation officers, and site supervisors. Given the relatively small and accessible population, the study adopted a census approach to ensure comprehensive coverage of all eligible respondents.

Primary data were collected using a semi-structured questionnaire comprising both closed-ended and open-ended questions. The closed-ended items were measured on a five-point Likert scale ranging from strongly disagree to strongly agree, while the open-ended questions provided respondents with an opportunity to elaborate on issues related to project cost management practices. Prior to the main survey, a pilot study involving 18 respondents was conducted to assess the validity and reliability of the instrument. Content and face validity were established through expert review, while construct validity was assessed using confirmatory factor analysis. Instrument reliability was evaluated using Cronbach's alpha coefficient, with a threshold of 0.70 considered acceptable.

Data were analysed using Statistical Package for the Social Sciences (SPSS) version 28. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were

used to summarize the data. Inferential analysis involved Pearson's correlation to determine the strength and direction of relationships among the study variables and multiple linear regression to assess the influence of project cost management practices on project performance. Qualitative responses from the open-ended questions were analysed thematically to complement the quantitative findings.

RESEARCH FINDINGS AND DISCUSSIONS

The sample size of study was 180 project staff respondents from 18 projects implemented by KURA in Mombasa County. The pilot test was carried out with 18 respondents who were not included in the actual study hence 162 questionnaires were administered out of which 133 were answered successfully. The response rate was adequate as recommended by Wu, Zhao, and Fils-Aime (2022) that a response rate which is more than 50% is considered adequate while excellent response rate is usually above 70%. This implies that the response rate in this research is good for making conclusions as well as recommendations. The high response rate was as a result of researchers' efforts to closely monitor the data collection process.

Descriptive Statistics

Cost Estimation Practices

The first objective was to assess the influence of cost estimation practices on the performance of road construction projects in Mombasa County, Kenya. Respondents were asked to indicate their agreement or disagreement with statements on cost estimation practices. Findings are presented in Table 1.

Table 1: Cost Estimation Practices

Statements	Mean	Standard Deviation
Our projects use detailed cost breakdowns during the estimation stage.	4.33	1.18
Historical cost data is regularly used to inform current cost estimates.	4.15	1.34
Risk and uncertainty are considered in the cost estimation process.	4.20	1.00
The organization uses standardized templates or tools for cost estimation.	4.50	1.00
Cost estimation is typically done by qualified personnel or consultants.	4.05	1.11
Project teams conduct multiple estimation iterations before approval.	4.26	1.06
Our cost estimation process integrates environmental and location factors.	4.39	1.10
Cost estimation outcomes are closely aligned with actual project costs.	2.39	1.10
Average	4.03	1.11

N=133

The results show that the respondents strongly agreed that; the organization uses standardized templates or tools for cost estimation (M=4.50, Std. =1.00), the cost estimation process integrates environmental and location factors (M=4.39, Std. =1.10), the projects use detailed cost breakdowns during the estimation stage (M=4.33, Std. =1.18), and the project teams conduct multiple estimation iterations before approval (M=4.26, Std. =1.06). The findings also show that the respondents agreed that; risk and uncertainty are considered in the cost estimation process (M=4.20, Std. =1.00), historical cost data is regularly used to inform current cost estimates (M=4.15, Std. =1.34), and cost estimation is typically done by qualified personnel or consultants (M=4.05, Std. =1.11). The respondents disagreed that cost estimation outcomes are closely aligned with actual project costs (M=2.39, Std. =1.10). The findings show that the project staff generally consider cost estimation practices at the KURA projects to be well established as reflected by the high overall mean score (M=4.03, Std.= 1.11). This shows that the Authority has established structure cost estimation processes that guide project planning and enhance informed financial decision-making before project implementation.

The results indicate that KURA uses several different types of cost estimation methods to estimate the cost of their project. KURA uses a combination of standard templates, cost breakdowns, historical data, risk assessment, multiple cost estimates, and various environmental and locational factors to develop the estimation of costs. In addition, all respondents agreed that the cost estimate must be developed by a qualified person or consultant that has been adequately trained. KURA's cost estimation methods demonstrate that they are developed and applied through a systematic and professional method, resulting in improved budgeting processes and successful project planning. However, the respondents had low agreement that the estimated project cost matched the actual project cost. This could be due to changes in the project scope, fluctuations in input costs, unforeseen site conditions, and other challenges associated with project implementation. Findings are in agreement with Omar and Omar (2022) that the main factors affecting project cost estimates are financial status of client market, the unstable economic situation, cost estimation accuracy, financial resource availability, punctuality of cost flow as well as the availability of high-quality financial plans and accurate estimation. Pournima, and Leon (2024) also found that that risk, project and product size, and time frame are the high-impact complexity dimensions on cost estimation, which need more attention in reducing unforeseen cost implications. Similarly, Temesgen (2024) reported that that most of the estimated cost of the projects is either under-utilized or over utilized which shows there is undeniable inaccuracies in the project's cost estimation.

Cost Planning Practices

The third objective was examine the influence of Cost Planning practices on the performance of road construction projects in Mombasa County, Kenya. Respondents were asked to indicate their agreement or disagreement with statements on Cost Planning practices. Findings are presented in Table 2.

Table 2: Cost Planning Practices

Statements	Mean	Standard Deviation
Project schedules are created based on cost resource planning.	4.19	1.04
Scheduling tools (e.g., Gantt charts, software) are used in our projects.	4.13	0.99
Cost implications of schedule delays are usually calculated.	4.47	0.93
Milestones and deliverables are clearly linked to scheduled budgets.	4.32	1.10
Time buffers are included in scheduling to manage uncertainties.	4.31	1.00
Regular reviews are conducted to align cost and time schedules.	4.17	1.03
Changes in scheduling are reflected in budget revisions.	4.38	0.95
Schedule adherence is a key performance indicator in our projects.	4.20	1.03
Average	4.27	1.00

N=133

Results show that the project staff strongly agreed that; cost implications of schedule delays are usually calculated ($M=4.47$, $Std. =0.93$), milestones and deliverables are clearly linked to scheduled budgets ($M=4.32$, $Std. =1.10$), changes in scheduling are reflected in budget revisions ($M=4.38$, $Std. =0.95$), and time buffers are included in scheduling to manage uncertainties ($M=4.31$, $Std. =1.00$). The staff also agreed that; schedule adherence is a key performance indicator in our projects ($M=4.20$, $Std. =1.03$), project schedules are created based on cost resource planning ($M=4.19$, $Std. =1.04$), scheduling tools (e.g., Gantt charts, software) are used in our projects ($M=4.13$, $Std. =0.99$), and regular reviews are conducted to align cost and time schedules ($M=4.17$, $Std. =1.03$). The results imply that the project staff generally considered Cost Planning practices at KURA projects in Mombasa County to be highly effective as reflected by the overall mean score ($M = 4.27$, $Std. = 1.00$).

The results suggest that project schedules are prepared based on cost resource planning, availability of scheduling tools used during project implementation, the cost effects of schedule

delays are assessed, and project deliverables are linked to project budgets. In addition, the time buffers are integrated to manage risks, frequent reviews are conducted to align cost and time schedules, schedule changes are replicated in the budget reviews, and schedule adherence is considered as an important performance metrics. These findings support that the KURA's effective implementation of combining cost and scheduling processes enable the authority to effectively monitor and implement projects. These findings also support that effective scheduling for both cost and project time will provide KURA with the ability to better coordinate between project timelines and costs which may enable the authority to proactively identify project delays, adjust budgets as necessary, and better monitor the progress of projects. Improved coordination between cost and project time will enhance the ability of the authority to complete projects on schedule and increase the desired outcomes for KURA projects. Findings are in support of; Cudjoe (2019) whose results showed high ranking for cost planning implying that it is an effective modern cost planning techniques that enhances project delivery. Obegi and Kimutai's (2024) found that project performance was influenced by resource scheduling because it ensured that the project was operating within budget and the changes are made to adapt to the dynamic nature of the projects, and the staff had what was needed for the job.

Project Performance

Respondents were asked to indicate their agreement or disagreement with statements on project performance. Findings are presented in Table 3.

Table 3: Project Performance

Statements	Mean	Standard Deviation
Our projects are generally completed within approved budgets.	2.13	1.10
We achieve project completion within scheduled timeframes.	2.16	1.12
Projects meet the expected quality and technical specifications.	3.90	1.10
Stakeholder satisfaction is regularly assessed in completed projects.	4.08	1.08
Project outputs (e.g., roads) are functional and usable upon handover.	4.41	1.13
Projects adhere to regulatory and environmental compliance standards.	4.20	0.98
Lessons learned are documented and used to improve future projects.	4.45	0.97
Projects result in improved mobility, safety, and economic activity.	4.35	0.88
Average	3.71	1.04

N=133

Results show that the project staff strongly agreed that; lessons learned are documented and used to improve future projects ($M=4.45$, $Std. =0.98$), project outputs (e.g., roads) are functional and usable upon handover ($M=4.41$, $Std. =1.13$), and projects result in improved mobility, safety, and economic activity ($M=4.35$, $Std. =0.88$). The staff also agreed that; projects adhere to regulatory and environmental compliance standards ($M=4.20$, $Std. =0.98$), stakeholder satisfaction is regularly assessed in completed projects ($M=4.08$, $Std. =1.08$), and projects meet the expected quality and technical specifications ($M=3.90$, $Std. =1.10$). The staff disagreed that they projects are completed within scheduled timeframes ($M=2.16$, $Std. =1.12$) and that the projects are generally completed within approved budgets ($M=2.13$, $Std. =1.10$). The results imply that the project staff generally consider the performance of KURA projects in Mombasa County to be moderately good as reflected by the mean score ($M=3.71$, $Std. =1.04$). This implies that even though the authority successfully delivers quality project outcomes and meeting stakeholder anticipations, there are challenges in achieving optimum project performance in all project performance metrics.

The survey results indicate that respondents felt that all completed projects met the appropriate quality and technical specifications. That project outputs are functional and usable when handed over, regulatory and environmental standards are met, the satisfaction of stakeholders

is evaluated, lessons learned are documented as a reference for improving future projects, and that all KURA projects contribute to improved mobility, safety, and economic activity. This indicates that KURA projects have achieved their intended development goals and have provided value to KURA's customer base. Respondents, however, indicated that they strongly disagree with the statement that KURA projects are completed on time and on budget, indicating that, even though KURA delivers quality infrastructure and creates positive socio-economic impacts through its projects, KURA continues to experience cost overruns, and schedule delays, when delivering on these projects. The data indicates that further improvements can be made in the area of project cost and schedule management to improve the overall performance of road projects in Mombasa County. The findings are in support of The Office of the Auditor General (2024) and the Public Procurement Regulatory Authority (PPRA, 2024) reports that; 58% of road projects experienced cost overruns of 37.4% and road construction contracts had the highest rate of variations among all sectors averaging 28-52% above the original contract sum.

Correlation Analysis

Pearson's correlation analysis was conducted to examine the strength and direction of association between cost estimation, Cost Planning, and performance of road construction projects in Mombasa County, Kenya. A correlation is significant at ≤ 0.05 . A correlation value of 0-1. 0.-0.29 shows weak correlation, 0.3-0.49 moderate correlation while 0.5-0.79 shows strong correlation. Correlation results are presented in Table 4.

Table 4. 1: Coefficient of Correlation

Variables		Project Performance	Cost estimation	Cost Planning
Project Performance	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	113		
Cost estimation	Pearson Correlation	.816**	1	
	Sig. (2-tailed)	.000		
	N	113	113	
Cost Planning	Pearson Correlation	.527**	.003	1
	Sig. (2-tailed)	.009	.971	
	N	113	113	113

Results show a strong significant correlation between cost estimation and performance of KURA projects ($r=0.816$, $p=0.00$). This suggests that improvements in cost estimation practices are related with better project performance. The strong correlation implies that accurate and inclusive cost estimation is closely related to the successful delivery of KURA projects. Results concur with Nakhleh (2019) that there is a significant relationship between cost estimation and project performance.

Results show a strong significant correlation between Cost Planning and performance of KURA projects ($r=0.527$, $p=0.00$). This suggests that projects with effective Cost Planning practices are more likely to achieve better performance. The findings suggest that integrating project schedules with cost planning improves coordination, promotes efficient resource utilization, and supports timely project delivery. The results concur with Williams (2020) that there is a significant relationship between Cost Planning and project success.

Regression Analysis

Multiple linear regression analysis was conducted to examine the influence of project cost management practices on the performance of road construction projects in Mombasa County, Kenya. The regression model demonstrated a strong relationship between the study variables and project performance ($R = 0.886$), with an adjusted coefficient of determination (Adjusted R^2) of 0.779. The model explained 78.5% of the variation in project performance, indicating

that project cost management practices accounted for a substantial proportion of the observed differences in project performance. The model was statistically significant ($F = 117.101$, $p < 0.001$), confirming its suitability for predicting project performance.

Given the focus of this article, attention is placed on the two strongest predictors of project performance, namely cost estimation and cost planning. Both variables had positive and statistically significant effects on project performance ($p < 0.001$). Cost planning recorded the strongest standardized coefficient ($\beta = 0.660$), indicating that improvements in cost baseline development, cash flow planning, and cost forecasting produced the greatest improvement in project performance. Cost estimation was the second strongest predictor ($\beta = 0.617$), demonstrating that accurate estimation of project costs significantly enhances project performance. These findings suggest that strengthening cost planning and cost estimation practices is critical for improving the performance of road construction projects in Mombasa County.

Table 5: Multiple Regression Results

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Constant/Y Intercept	4.719	.346		13.639	.000
Cost estimation	.725	.051	.617	7.934	.000
Cost Planning	.770	.097	.660	14.090	.000

Model Summary: $R = 0.886$; $R^2 = 0.785$; Adjusted $R^2 = 0.779$; $F(4,128) = 117.101$; $p < 0.001$.

According to findings, the equation becomes

$$\text{Procurement Performance} = 4.719 + 0.725 (\text{Cost estimation}) + 0.770 (\text{Cost Planning})$$

Conclusions

The evaluation of cost estimation methods at Kenya Urban Roads Authority (KURA) projects in Mombasa County uncovers a significant contradiction. Although the authority has effectively established a strong and organized estimation system, these procedural initiatives are not presently resulting in financial precision. The results indicate that project teams employ strict, uniform methods such as iterative evaluations, comprehensive cost analyses, and specialist-led reviews, leading to a significant degree of institutional development. Nonetheless, the significant gap between these established practices and the actual project results indicates a crucial disconnection. Thus, even though KURA has succeeded in procedural standardization, it is crucial to enhance the connection between these technical methods and actual project implementation to guarantee that their advanced estimation initiatives successfully promote cost predictability.

The results of Cost Planning methods at Kenya Urban Roads Authority (KURA) projects in Mombasa County shows a highly skilled and effectively coordinated strategy for managing time and costs. The results show that project teams have effectively fostered a culture of accountability in which schedule delays are measured in advance and clearly connected to financial consequences. Through the use of standardized scheduling tools, integrating essential time buffers, and maintaining dynamic alignment of budget revisions with schedule changes, KURA has created a strong framework that prioritizes time adherence as a key component of project performance. This significant perception of effectiveness indicates that the organization recognizes the connection between time and cost and has effectively implemented this relationship to reduce uncertainty. Therefore, the effectiveness of these scheduling methods acts as a crucial foundation for the projects, offering the required clarity to uphold financial discipline while project schedules change.

Recommendations

KURA should improve the accuracy of its bid estimates by strengthening the use of up-to-date market prices, performing periodic reviews of project costs prior to project approval, and accounting for all potential risks (including inflation, price variations, and scope changes) in its estimating procedures. This will help to reduce variability between estimated and actual project expenditures.

KURA should continue combining budgeting and scheduling with the aim of improving the utilization of scheduling tools for following the progress of projects. Frequent assessment of project schedules and timely budget updates will help in achieving the project completion within deadlines and set costs.

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