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Influence of Project Planning Practices on Cost Overruns in The Construction of Trunk Roads in Kenya

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Abstract

In ideal situation, road infrastructure projects should be completed within the planned budget, schedule, and scope to ensure efficient utilization of public resources and timely delivery of transport services that support economic growth and social development. Currently, cost overruns are a persistent challenge in Kenya's road construction sector, particularly in national trunk road projects, where final expenditures frequently exceed planned budgets. These overruns undermine timely project delivery, strain public finances, and reduce value for money, hindering the achievement of Vision 2030. This study examined the influence of project planning practices that is scope definition, design planning, and funding allocation on cost overruns in national trunk road construction. The study was guided by the Systems Theory, Design Structure Theory, and Contingency Theory, the study adopted a retrospective design using secondary data from 46 KENHA projects implemented between 2005 and 2023. Data were extracted from KENHA and Kenya Roads Board. Document reviews were done on parliamentary reports, audit reports, and financiers including the World Bank and African Development Bank. Descriptive and inferential statistics were applied, with multiple linear regression determining relationships between planning practices and cost overruns. Results showed that scope

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definition, design planning changes, and funding allocation were significant drivers of cost overrun. The study concludes that strengthening feasibility studies, integrating modern design technologies, enhancing stakeholder engagement, and ensuring predictable funding flows are critical to minimizing budget deviations. The findings would offer actionable insights for policymakers, project managers, development partners, and scholars to improve planning frameworks, emphasizing efficiency, accountability, and sustainable infrastructure development. This underscores the need for well-structured project planning practices that minimize cost overruns and enhance the long-term performance of Kenya's road infrastructure sector.

Keywords: Project planning; cost overruns; construction projects; road infrastructure; funding allocation; project management; budget control.

1. Introduction

Effective project planning and implementation are vital for successful project management, translating strategies into actionable steps to meet objectives within time, cost, and quality constraints (Kerzner, 2025). According to Morad (2023), cost overruns frequently disrupt projects, exceeding budgets due to unforeseen challenges, leading to financial losses, delays, and damaged stakeholder trust. These overruns can result in project abandonment, reduced quality, and diminished competitiveness. According to Bello (2025), a proactive measures and best practices in project management are essential to mitigate risks, enhance execution efficiency, and ensure projects stay on track.

Infrastructure, particularly road construction, drives economic growth and social transformation by improving connectivity, trade, and access to markets (Ajakaiye & Ncube, 2010). Globally, road projects significantly contribute to GDP, as seen in China (7%) and Japan (5%) (Yang et al., 2020; Meijer et al., 2018). Yet, cost overruns are pervasive, affecting up to 90% of megaprojects, with average overruns of 30–50% in countries like Norway, the US, UK, and China (Kleivbo, 2017; Ondari & Gekara, 2013; Pitsis, A. et al., 2018). In Africa, weak institutions and external financing exacerbate these issues, with overruns of 30–100% in countries like Tanzania and Nigeria (Rwakarehe & Mfinanga, 2014; Mahmud et al., 2021; Mohamed et al., 2026).

In Kenya, roads are central to the Vision 2030 agenda, but over 60% of road projects from 2010–2020 exceeded budgets, driven by inflation (Construction Cost Index up 1.8% in 2023), poor planning, weak contractor performance, and governance gaps (KeNHA Annual Report 2022/2023; Gituro & Mwawasi, 2016). These overruns led to a 2.4% GDP decline and a 2% contraction in the construction sector in 2024 (KNBS, 2024). This study examines how project planning practices that is scope definition, design quality, and funding mechanisms influence cost overruns in Kenyan trunk road construction, aiming to enhance discipline in project management for improved resource use and alignment with Vision 2030 goals.

1.1 Problem Statement

Ideally, road infrastructure projects should be completed within the planned budget, schedule, and scope to ensure efficient utilization of public resources and timely delivery of transport services that support economic growth and social development. Effective project planning practices, including clear scope definition, sound project design planning, and adequate funding allocation, are expected to guide project implementation and minimize deviations from planned costs. When these practices are properly undertaken, road projects are more likely to achieve cost efficiency and deliver their intended benefits to society. However, in practice many road construction projects experience significant cost overruns. Project budgets are frequently exceeded during implementation due to weaknesses in defining scope, changes in design planning, and delays or inadequacy in project financing. As a result, projects require additional financial resources beyond the approved budgets, leading to delays in completion and inefficient utilization of public funds. Cost overruns therefore remain a persistent challenge affecting the successful delivery of road infrastructure projects. Globally, cost overruns in road construction projects have been widely reported. Studies show that more than 85% of road projects exceed their initial budgets, with overruns averaging between 20% and 45% (Flyvbjerg et al., 2002). Similar challenges are evident in developing regions. According to the Infrastructure Consortium for Africa (2022), approximately 70% of major infrastructure projects in Sub-Saharan Africa experience cost overruns ranging between 25% and 50% of the estimated budgets. Kenya reflects this regional trend, particularly in national trunk road projects which play a critical role in facilitating trade, economic growth, and national integration. Reports from the Kenya National Highways Authority indicate that about 60% of road projects exceed their planned budgets (KeNHA Annual Report 2022/2023). Such cost overruns increase the financial burden on government, delay infrastructure delivery, and undermine national development goals. If this challenge remains unaddressed, the consequences will continue to affect several stakeholders. The government will face increased fiscal pressure as additional funds are required to complete projects, taxpayers will bear the burden of rising public expenditure, and communities will experience delays in accessing transport infrastructure necessary for economic and social development. Although previous studies have examined factors contributing to cost overruns in infrastructure and construction projects, many focus on international contexts or the general construction sector (Asiedu & Adaku, 2020). Limited empirical research has specifically examined how project planning practices particularly scope definition, project design planning, and project funding allocation collectively influence cost overruns in Kenya's national trunk road projects**.** This study therefore sought to address this gap by examining how these planning practices influence cost overruns in trunk road projects implemented in Kenya between 2005 and 2023, with the aim of generating insights that can improve project planning and enhance cost-efficient delivery of road infrastructure.

1.2 Objective of the Study

To address the existing knowledge gap regarding the influence of project planning practices on cost overruns in Kenya's trunk road construction projects, this study sought to determine the influence of scope definition, design planning, and funding allocation on cost overruns in the construction of trunk roads in Kenya.

2. Literature Review

2.1 Systems Theory

Systems Theory**,** originally developed by Ludwig von Bertalanffy (1972)**,** provides a conceptual framework for understanding projects as complex systems composed of interrelated components that must work together to achieve the overall objectives. In project management, this theory emphasizes that every element of a project such as scope definition, project design planning, resources allocation, and scheduling cannot be treated in isolation because changes or weaknesses in one component can affect the entire system, including project costs, timelines, and overall quality. Applying Systems Theory to road construction projects highlights the critical role of scope definition**.** Poorly defined or inadequately managed scope often leads to scope creep, frequent design modifications, and contract variations**,** all of which escalate project costs and compromise timelines (Ajmal et al., 2020). Viewing project scope as an integral subsystem within the larger project system allows project managers to ensure that project output align with stakeholder requirements, available resources, and contractual obligations, thereby improving efficiency, cost predictability, and risk management. The theory further emphasizes integration and coordination among project stakeholders, processes, and resources. In complex projects such as national trunk road construction, integrating scope definition into the overall project system facilitates better communication, stakeholder engagement, and adaptive decision-making. By accurately defining project boundaries, outputs, and requirements, road construction projects can minimize scope deviations, optimize resource allocation, and reduce the risk of cost overruns. While Systems Theory is broad and adaptable rather than prescriptive, it offers a robust theoretical foundation for examining how structured scope management and other planning practices influence project performance. It underscores the necessity of seeing projects as integrated systems**,** where effective scope definition contributes directly to overall project success, cost control, and timely delivery.

2.2 Design Structure Theory

Design Structure Theory (DST)**,** developed by Eppinger and Browning, (2012)**,** provides a framework in project management and engineering that explains how the organization of design tasks and the interdependencies among project components influence overall project performance, including cost, schedule, and quality outcomes. The theory views a project as a system of interrelated design elements, where decisions in one component can impact other components, highlighting the importance of structured and coordinated design planning. Effective project design planning is critical to controlling costs and preventing delays in the construction of road projects. Poorly planned or uncoordinated designs often result in rework, design changes, and contract variations, which are major contributors to cost overruns (Ajmal et al., 2020). DST emphasizes task modularity and integration, allowing complex projects to be broken into manageable design components while ensuring that dependencies among these components are properly managed. This structured approach helps project managers anticipate design bottlenecks, minimize errors, and optimize the use of resources. Through organizing design tasks and understanding their interdependencies, project managers can make informed decisions that reduce the likelihood of scope changes, schedule delays, and additional costs. This enables better coordination among contractors, engineers, and procurement teams, thereby reducing the risk of rework and associated cost escalations. The theory also emphasizes interdisciplinary coordination and proactive planning, which are essential in complex infrastructure projects. By integrating DST principles into road project design, the study can examine how structured and well-coordinated design planning influences project cost performance. DST therefore provides appropriate and robust theoretical foundation for assessing the influence of project design planning on cost overruns in road construction projects.

2.3 Contingency Theory

Contingency Theory, proposed by Fred Fiedler, (1964), posits that there is no one-size-fits-all approach to organizational or project management. The optimal management practice depends on contextual factors, including project size, complexity, environment, and available resources. The theory suggests that financial planning must be tailored to the specific conditions of each project. Road construction projects often face delays and cost overruns when funding is inadequate, delayed, or poorly scheduled (Flyvbjerg et al., 2002). By applying contingency principles, project managers can design funding strategies that consider project complexity, risk, and cash flow requirements, ensuring that financial resources are available when needed and used efficiently. The theory also emphasizes flexibility and adaptability. In large infrastructure projects, unexpected events such as inflation, material shortages, or policy changes may affect funding requirements. Adaptive funding approaches allow managers to adjust allocations without compromising project scope or quality, reducing the risk of cost overruns. Overally, Contingency Theory provides a solid theoretical foundation for examining the relationship between project funding allocation and cost performance. It highlights that proper planning and adaptable financial management are essential for achieving budget adherence, timely completion, and overall project success in road infrastructure development.

2.4 Conceptual Framework

A conceptual framework outlines the hypothesized relationships between study variables, illustrating how independent variables affect the dependent variable. Variables are measurable attributes that differ across the study population (Ametepey et al., 2022). In this study, the independent variables are project planning practices; scope definition, design planning, and funding allocation while the dependent variable is cost overruns in road construction projects. Cost overruns, the dependent variable, represent the difference between planned budgets and actual costs incurred, driven by inefficiencies, unforeseen events, or inadequate planning. Key indicators include cost variance and time variance, stemming from scope changes, design modifications, or funding delays. The independent variables project planning practices comprise scope definition (measured by scope definition and scope cost), design planning (measured by design variations and design change costs), and funding allocation (measured by funding source and late disbursement costs). These practices are critical determinants of efficiency and financial performance in road construction, frequently linked to cost overruns (Murugi et al., 2023). By focusing on scope definition, design planning, and funding allocation, the study targets planning, technical, and financial aspects, emphasizing their role as the foundation for cost control.

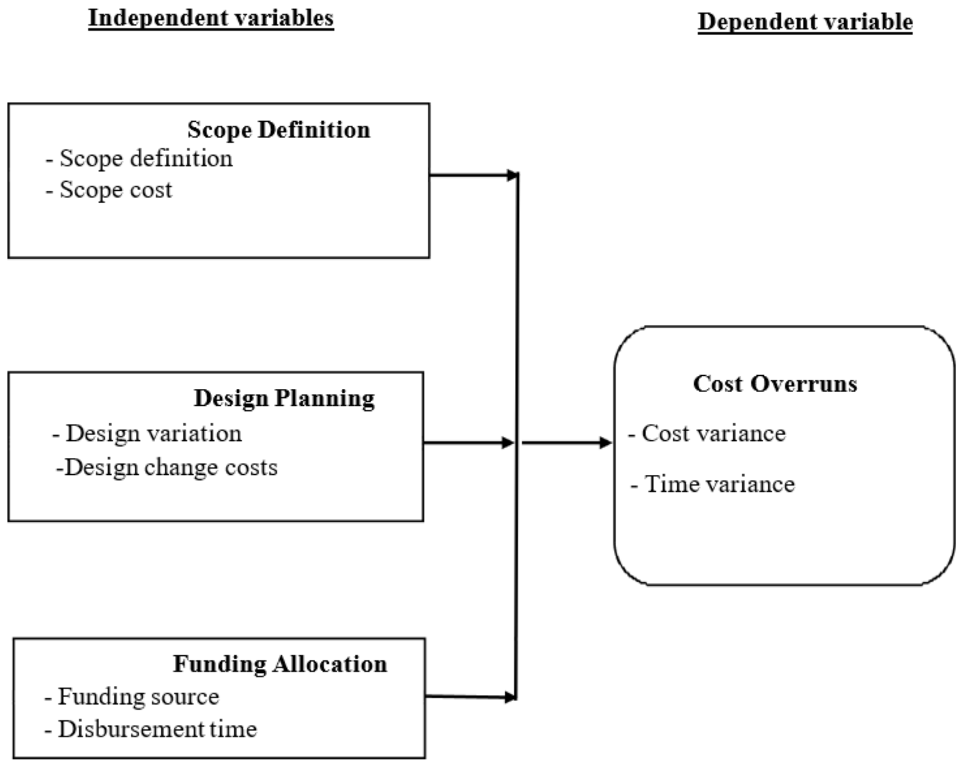

Fig. 1. Conceptual framework

3. Methodology

3.1 Research Design and Data Collection

Research design, as defined by Asenahabi (2019), is the conceptual framework guiding data collection, measurement, and analysis, outlining logical steps from problem formulation to interpreting findings. This study employed a retrospective research design with a quantitative approach, utilizing historical data to analyze patterns, relationships, and outcomes over time. The retrospective design was chosen for its cost-effectiveness, time efficiency, and suitability for large datasets, enabling analysis of existing records (Taber et al., 2020). It facilitates the identification of long-term trends and relationships not easily observed in short-term studies. By leveraging quantitative data, the study applied objective statistical techniques, yielding generalizable, evidence-based findings that provide a foundation for future research. The study spanned 2005-2023, a period selected to capture short-term fluctuations and long-term trends in road construction, encompassing vital infrastructural phases, policy reforms, and economic cycles. This broad timeframe ensures data variability, enhancing the robustness and reliability of findings on how project planning practices influence cost overruns. Data were systematically extracted using a data extraction sheet for consistency and analyzed using descriptive and inferential statistics, with results presented in tables to clearly illustrate key relationships.

3.2 Target Population

The study focused on national trunk road projects in Kenya managed by the Kenya National Highways Authority (KeNHA, 2023). These roads constitute critical infrastructure, linking major urban centers, facilitating trade, and supporting socioeconomic development across the country. The research examined completed trunk road projects implemented between 2005 and 2023 across various regions of Kenya. This broad coverage captures diverse geographical, economic, and logistical conditions, thereby enabling a more representative analysis of the factors contributing to cost overruns.

The target population refers to the entire group of elements individuals, objects, or events that share common characteristics and from which the researcher seeks to draw conclusions (Willie, M. M., 2024). In this study, the target population comprised all completed national trunk road projects constructed and maintained by KeNHA between 2005 and 2023. According to KeNHA Annual Report (KeNHA, 2022/2023), a total of 46 such projects were recorded in the agency's database. These projects were selected because they fall within the period during which significant cost overruns in national trunk road construction were reported by both KeNHA Annual Report (KeNHA, 2022/2023) and the Kenya National Bureau of Statistics (KNBS, 2024).

Data on the selected road projects were obtained from official databases of KeNHA and the Kenya Roads Board (KRB). Additional data were collected from KeNHA personnel, including engineers, project managers, and quality control managers, who were provided with structured Excel templates to supply the required information. To enhance data accuracy and reliability, the collected data were cross-validated using audit reports, financiers' reports, and project completion reports.

3.3 Data Processing and Analysis

Data processing began with cleaning and organizing extracted information using Excel for initial tabulation. Costs were normalized per kilometer to ensure comparability across projects of varying lengths. Project planning was operationalized as the difference between initial scope budgets and actual costs incurred due to changes, measured in Kenyan Shillings (Kshs) billions per kilometer. Analysis employed both descriptive and inferential statistics using R software. The study utilized a multiple Linear Regression (MLR) model as the primary analytical tool. MLR was selected because the research investigates the simultaneous effect of multiple independent variable on a dependent variable, cost overrun in road construction projects. The choice of MLR was also supported by the measurement scales of the variables: the dependent variable, cost overrun, is continuous, measured as the percentage deviation from the planned budget, while the independent variables are measured on continuous.

The general form of the multiple linear regression model is expressed as:

$$Yi = \beta 0 + \beta 1X1i + \beta 2X2i + \beta 3X3i + \cdots + \beta kXki + \epsilon i$$

Where:

Yi = the dependent variable (outcome) for observation i
$\beta 0$ = the intercept (constant term)
$\beta 1 + \beta 2 + \beta 3 + \cdots + \beta k$ = regression coefficients that measure the effect of planning process on Y $X1i + X2i + X3i + \cdots + Xki$ = independent (predictor) variable
ϵi = the error term representing unexplained variation

4. Result and Discussion

4.1 Regression Analysis on Cost Overruns

The occurrence of cost overruns in construction projects has raised significant concerns among policymakers and project stakeholders. Through the application of regression analysis, this study quantitatively evaluates how variations in project planning practices influence the magnitude of cost overruns.

Table 1. Model Summary for Project planning practices

Model	R	R2	Adj. R2	S. E
1	0.921	0.929	0.924	0.00666

Predictors: (Constant), Resource

The table presents the model summary statistics for project planning practices and their effect on cost overruns in the construction of national trunk roads in Kenya. It includes key indicators such as R, R^2, adjusted R^2, and the standard error of the estimate, which show the strength and explanatory power of the model.

The study intended to examine the influence of project planning on cost overruns. The model results had an adjusted R^2 of 0.924. This means that approximately 92.4% of the variation in cost overrun per kilometer is explained by the scope of modification in the model.

Table 2. Moderated regression coefficients of the planning practices

Variable	Estimate (β)	t-statistic	95% CI (Lower)	95% CI (Upper)	p-value	VIF
(Intercept)	-0.010	-1.391	-0.023	0.004	0.1714	
Design Change Cost per Km	2.355	5.189	1.439	3.270	<0.0001	2.836
Late Disbursement Cost per Km	1.358	10.759	1.103	1.612	<0.0001	2.126
Scope Modification Cost	0.022	3.301	0.008	0.035	0.0020	1.694
F-test (3, 42) = 184.57	P- value = 3.302e-24					
Durbin-Watson test =1.7752	P-value = 0.2096					
Studentized Breusch-Pagan test = 1.4939	P-value = 0.6837					
Shapiro-Wilk normality test = 0.9586	P-value = 0.05283					

The overall significance of the model was further confirmed by the F-test statistic $F(3,42) = 184.57$, $p < 0.001$), which demonstrates that the independent variables, taken together, have a statistically significant influence on cost overrun per kilometer. This implies that the predictors are not redundant and that they collectively improve the capacity of the model. The results of this model support the notion that cost overruns in road projects are not the result of a single factor but rather the combined effect of multiple interrelated drivers.

The model produced a constant (intercept) of - 0.010, with a p-value of 0.1714, which is greater than the 5% level of significance. Therefore, the study failed to reject the null hypothesis at the 5% significance level and concludes that the constant term is not statistically significant in explaining cost overruns per kilometer. This implies that when all independent variables; Design Change Cost per Km, Late Disbursement Cost per Km, and Scope Modification Cost per Km are equal to zero, the expected cost overruns per kilometer would be - 0.073 suggesting that cost overruns are minimally affected in the absence of the factors under study.

This study examined the influence of project planning practices scope, design, and funding on cost overruns in Kenyan trunk road construction, using regression analysis to confirm their impact. The findings highlight the critical role of effective planning in mitigating cost escalations, supported by relevant theories and literature.

4.2 Scope Definition and Cost Overruns

Regression analysis identified scope modification as a significant predictor of cost overruns ($\beta = 0.022$, $t = 3.301$, $p = 0.002$), rejecting the null hypothesis at the 5% significance level. A Kshs 1 billion increase in scope modification cost per kilometer leads to an average Kshs 0.022 billion increase in cost overruns per kilometer. Scope creep, driven by changes in deliverables or stakeholder demands, increases resource needs and extends timelines, inflating costs (Abotaleb et al., 2019; Abdelalim et al., 2025). Studies by Okafor & Odubade (2022), and Ajmal, M. et al., (2020) noted that scope changes, often due to political priorities or additional works, cause significant budget escalations.

Projects with robust stakeholder engagement and strict change control mechanisms experience fewer overruns (Ajmal et al., 2020). These results are also supported by the Systems Theory (ST) which provides a conceptual framework for understanding projects as complex systems composed of interrelated components that must work together to achieve the overall objectives (Ludwig Bertalanffy, 1968).

4.3 Design Planning and Cost Overruns

Design changes significantly influence cost overruns, with regression results showing a strong positive coefficient ($\beta = 2.355$, $t = 5.189$, $p < 0.0001$), rejecting the null hypothesis at the 5% significance level. A Kshs 1 billion increase in design change costs per kilometer results in an average Kshs 2.355 billion increase in cost overruns per kilometer. Design alterations, often triggered by geotechnical issues, regulatory shifts, or political interference, lead to rework and contract variations, escalating costs (Kumar & Kumari, 2025). Odeck, (2014), highlighted that poor feasibility studies exacerbate design-related overruns. The Iron Triangle framework underscores the interdependence of cost, time, and quality, with excessive design changes disproportionately increasing costs (Myers, 2022). These findings are in line with the Design Structure Theory (DST) which provides a framework in project management and engineering that explains how the organization of design tasks and the interdependencies among project components influence overall project performance, including cost, schedule, and quality outcomes. The theory emphasizes the integration of cost considerations during the design phase to optimize functionality, efficiency, and long-term value, thereby minimizing the likelihood of cost overruns.

4.4 Funding Allocation and Cost Overruns

Funding delays emerged as the strongest predictor of cost overruns ($\beta = 1.358$, $t = 10.759$, $p < 0.0001$), rejecting the null hypothesis at the 5% significance level. A Kshs 1 billion increase in late disbursement costs per kilometer leads to an average Kshs 1.358 billion increase in cost overruns per kilometer. Delays in fund disbursement stall progress, increase contractor claims, and expose projects to inflation, significantly escalating costs (Odeck, 2014). In Kenya, bureaucratic inefficiencies and donor-driven processes exacerbate funding delays, as noted in government audits (World Bank, 2023; OAG, 2023/2024; Gituro & Mwawasi, 2016). These findings align with Contingency Theory (CT), developed by Fred Fiedler in 1964, which suggests that financial planning must be tailored to the specific conditions of each project. The results are also backed by the study of Flyvbjerg et al (2002) which highlighted that road construction projects often face delays and cost overruns when funding is inadequate, delayed, or poorly scheduled. Streamlined disbursement mechanisms, ring-fenced financing, and improved cash-flow forecasting are essential to reduce funding-related cost escalations.

The study therefore, confirms that scope modifications, design changes, and funding delays significantly drive cost overruns in Kenyan trunk road construction. Supported by ST, DST, and CT, the findings underscore the need for rigorous scope control, stable design processes, and timely funding mechanisms. Implementing robust planning, comprehensive feasibility studies, stakeholder engagement, and streamlined financial systems can enhance cost predictability and project success, aligning with Kenya's Vision 2030 objectives. Diagnostic tests showed no autocorrelation ($DW = 1.78$, $p > 0.2096$), no heteroscedasticity ($BP = 1.494$, $p > 0.6837$), and normally distributed residuals ($SW = 0.9586$, $p > 0.053$), confirming model adequacy.

5. Conclusions

The study demonstrates that scope modifications, design changes, and funding delays are critical drivers of cost overruns in Kenyan trunk road construction, with their compounded effects undermining project efficiency and national development goals. Poor scope definition leads to scope creep, inflating costs through additional deliverables and delays, the finding is supported by Systems Theory (ST) and synced with other studies which emphasizes rigorous scope baselines and stakeholder engagement (Ajmal et al., 2020; Okafor & Odubade, 2022; PMI, 2017). Design changes, identified as the most significant factor, trigger rework and contract variations due to inadequate front-end planning, aligning with Design Economics Structure (DST), which advocates robust design validation to optimize resources and reduce overruns (Odeck, 2014; Myers, 2022; Kumar & Kumari, 2025). Funding delays disrupt cash flows, stall progress, and expose projects to inflation and litigation, consistent with Contingency Theory (CT) and evidence highlighting timely disbursements as essential for cost control (Odeck, 2014; Gituro & Mwawasi, 2016). These findings are critical to Kenya's Vision 2030 and Big Four Agenda, where infrastructure drives economic transformation. A holistic approach integrating standardized scope management, comprehensive design reviews, and predictable funding mechanisms is essential to minimize overruns, enhance fiscal prudence, and accelerate infrastructure delivery for sustainable development.

6. Recommendations

6.1 To Strengthen Effective Cost Management

Improving project planning practices is essential for minimizing cost overruns in trunk road projects. First, scope management should be strengthened by ensuring that all key stakeholders are engaged early in the project planning stage so that project requirements are clearly defined from the outset. Strict approval procedures should also be established for any scope changes, allowing only those supported by clear cost–benefit justification. Similarly, continuous monitoring of project scope throughout the project lifecycle should be encouraged to minimize scope creep and ensure efficient use of resources. Second, design governance should be enhanced through comprehensive feasibility studies, geotechnical surveys, and peer-reviewed design validation before projects are tendered. The adoption of modern planning tools such as Building Information Modelling (BIM) and value engineering should also be promoted to detect design flaws and optimize project designs before construction begins. Mid-construction design changes should also be minimized and approved only when unavoidable and demonstrably beneficial. Finally, funding mechanisms should be improved by ensuring that project funds are disbursed on time and aligned with implementation milestones to avoid costly delays. Project budgets should be protected by ring-fencing funds to prevent diversion or misallocation.

Financial planning should also be strengthened through accurate cash-flow forecasting and the timely resolution of contractual disputes using alternative dispute resolution mechanisms rather than lengthy and costly litigation.

6.2 To Strengthen Institutional Coordination and Oversight

To enhance the effectiveness of these planning practices, policymakers should strengthen coordination among institutions responsible for road infrastructure development. In particular, the Kenya National Highways Authority (KeNHA) in collaboration with the Kenya Roads Board (KRB) should establish a formal multi-agency project planning committee at the project initiation phase. This committee should involve key stakeholders such as development partners, relevant government ministries, and technical agencies to review project scope, design plans, and funding arrangements before project approval. Such a mechanism would promote standardized planning frameworks, improve transparency in decision-making, and reduce the risk of planning inconsistencies that often lead to cost overruns.

6.3 To Strengthen Monitoring and Accountability Mechanisms

The study also recommends strengthening monitoring and accountability mechanisms throughout the project lifecycle. Implementing agencies should establish structured monitoring systems to track project progress against planned scope, design specifications, and financial allocations. Regular project audits and performance reviews should be conducted to detect early signs of cost escalation and enable timely corrective actions. Enhanced accountability and transparency in project management will contribute to better financial discipline and more efficient use of public resources in road infrastructure development.

Disclaimer (Artificial Intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

Competing Interests

Authors have declared that no competing interests exist.

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