PROJECT DESIGN AND IMPLEMENTATION OF ROAD CONSTRUCTION PROJECTS IN NAIROBI CITY COUNTY, KENYA.

[1] Majak Simon Kur, [2] Dr. Rotich Emmy

[1] Masters of Science in Project Management of Jomo Kenyatta University of Agriculture and Technology

[2] Lecturer at Jomo Kenyatta University of Agriculture and Technology

ABSTRACT

The successful implementation of large-scale road construction projects is vital for economic growth, infrastructure development, and socio-economic advancement, particularly in developing countries. Empirical literature highlights the critical role of project design in achieving project success but reveals gaps such as the need for adaptive project planning, flexible scope management, effective stakeholder engagement strategies, and efficient resource mobilization and allocation to address the challenges of complex infrastructure projects. This study is guided by two objectives: to assess the relationship between project planning and successful implementation and evaluate the influence of resource mobilization and allocation on the successful implementation of road construction projects. The theoretical framework incorporates Complexity Theory, and Resource-Based View (RBV) Theory to provide a multi-faceted understanding of the study variables. The study employed descriptive research design, with primary data collected using self-administered questionnaires targeting employees from the Kenya National Highways Authority (KENHA) who were directly involved in the Thika Superhighway project. The target population of 519 KENHA employees includes top management, middle-level management, and lower management staff. The sample size of 226 was determined using the Yamane Formula, ensuring representativeness and statistical reliability. Stratified random sampling was used for selecting study sample. The pilot test involved a sample of 23 respondents, which represents 10% of the total sample size. The results from the pilot test were not used in the main study, and the respondents who participate in the pilot test were excluded from the final research. Data analysis involved both descriptive and inferential statistics, using SPSS software. The analysis included measures such as mean, standard deviation, and percentages, while inferential analysis was conducted through Pearson correlation and multiple regression to test the strength and nature of relationships between the variables. The findings revealed that all four project design factors significantly influenced project implementation. Resource mobilization was the most significant predictor (B = 0.297, p = 0.000), followed by project planning (B = 0.278, p = 0.000), Project planning (r = 0.671), resource mobilization (r = 0.643), had strong positive correlations with project success. The study concludes that effective resource mobilization, detailed planning, clear scope management, and stakeholder engagement are critical for successful road construction projects. It recommends enhancing contingency planning, improving scope flexibility, strengthening stakeholder dispute resolution, and prioritizing resource mobilization to improve future project outcomes. Further research is suggested to explore external factors such as political influence and technology adoption on project success.

Key Words: Project Design, Project Planning, Successful Implementation, Resource Mobilization and Allocation, Road Construction Projects

Background of the Study

The design and effective execution of road construction projects are crucial for economic growth, connectivity enhancement, and socio-economic development. With the global population projected to reach between 9.5 and 12.9 billion by 2100 (United Nations, 2020), the demand for sustainable infrastructure has become increasingly vital. This demand emphasizes the need for strategic, future-ready infrastructure projects that support economic activities and improve quality of life (Marijana et al., 2019).

A well-crafted project design is a cornerstone for project success, encompassing strategic planning, risk assessments, and coordination strategies essential for guiding the implementation process. The Project Management Institute (PMI, 2021) underscores that robust project planning defines project scope, refines objectives, and creates actionable strategies to meet project goals. Without such planning, road construction projects risk delays, cost overruns, compromised quality, and failure (Antvik & Sjoholm, 2017).

The complexity of these projects is heightened by the involvement of various stakeholders such as contractors, consultants, government bodies, and local communities. Coordination issues, funding gaps, and management inefficiencies often arise, influencing project timelines and outcomes (Navon, 2015). Hwang et al. (2019) highlighted that factor like poor site management, ineffective stakeholder communication, and insufficient project management skills contribute significantly to project delays and failures.

In developing regions, infrastructure deficits can severely limit access to services, constrain market connectivity, and stifle economic growth. The African Development Bank (AfDB, 2019) reports that inadequate infrastructure is a key barrier to realizing economic potential in Sub-Saharan Africa, perpetuating poverty and slowing development. Improved road networks can bolster trade, increase access to resources, and catalyze regional economic integration.

Kenya's road construction sector illustrates these challenges and opportunities. Road construction projects in Nairobi City County aim at reducing congestion and improving connectivity within Nairobi City County and its environs, demonstrating the potential and significance of strategic infrastructure projects. However, despite the benefits in economic stimulation and travel efficiency, road projects face challenges such as funding delays, project scope adjustments, and stakeholder coordination issues (Ngunjiri, 2018). These issues are representative of broader trends in public infrastructure projects. The National Construction Authority (NCA, 2018) reported that a significant number of construction projects in Kenya fail to achieve their objectives, with 66% facing post-completion issues and 34% collapsing during construction. Inadequate planning, insufficient feasibility studies, and political influence contribute to these outcomes. Deloitte's Africa Construction Trends Report (2017) further highlights that 87% of public sector projects in Kenya experience delays, and 48% face cost overruns, reinforcing the necessity for more effective project management.

The purpose of this study was to explore the role of project design in the successful execution of road construction projects. By analysing the factors contributing to project success and failure, this research aims to propose best practices for future infrastructure projects, aiding policymakers, engineers, and project managers in adopting strategies that minimize risks, optimize resources, and ensure timely and cost-effective project completion.

Statement of the Problem

The high failure rate of road construction projects continues to undermine the delivery of critical infrastructure and socio-economic development in Kenya. According to the National Construction Authority (NCA, 2018), 66% of construction projects in Kenya face post-completion challenges, while 34% collapse during the construction phase. These alarming statistics are attributed to weak project planning, insufficient feasibility studies, and political

interference. Delays and cost overruns are common, with Deloitte's Africa Construction Trends Report (2017) revealing that 87% of Kenya's public infrastructure projects experience time overruns and 48% suffer from budget escalations. Such inefficiencies point to flaws in project design and management frameworks, especially in complex and capital-intensive road construction projects.

A significant contributor to these failures is the lack of proper stakeholder coordination and engagement. Poor communication and collaboration among contractors, consultants, government agencies, and local communities often result in project delays and increased complexity (Navon, 2019). Hwang et al. (2019) further noted that limited project management capacity and weak site management exacerbate these challenges. Additionally, the absence of thorough feasibility studies during the early stages of project design limits the ability to foresee potential risks and complications, leading to implementation hurdles. These issues are compounded by political interference, where projects are initiated for political mileage rather than based on robust planning and resource mobilization and allocation (Ngunjiri, 2018), thereby jeopardizing project quality and sustainability.

The economic implications of these shortcomings are immense, particularly in developing economies like Kenya, where infrastructure development is critical to spurring growth and improving livelihoods. The African Development Bank (AfDB, 2019) identifies inadequate infrastructure as a major constraint to economic progress, limiting market connectivity and access to essential services. Despite the global emphasis on best practices—such as China's Belt and Road Initiative and Morocco's Rabat-Casablanca Expressway—Kenya still grapples with persistent project delays and cost overruns linked to design, governance, and management challenges.

This study identified three critical research gaps that necessitate investigation. First, there exists a knowledge gap because most existing studies have broadly examined project success factors without specifically focusing on the combined influence of project planning, scope management, stakeholder involvement, and resource mobilization and allocation on road construction project implementation in Kenya's public sector (Kerzner, 2022; Nguyen & Hadikusumo, 2020). Secondly, a methodological gap was evident, as few studies have employed robust quantitative methods, such as regression models or pilot-tested instruments, to statistically measure the strength of these relationships within the context of large-scale road infrastructure projects (Patil & Pataskar, 2019; Jensen, 2021). Lastly, there was a contextual gap since most research is conducted in developed countries or generalized across sectors, failing to account for the unique challenges faced in Nairobi City County, such as political interference, urban complexity, and diverse stakeholder interests that influence project outcomes (Ngunjiri, 2018; Deloitte, 2017; Ranganathan & Foster, 2020). Addressing these gaps, this study sought to generate context-specific evidence on how project design elements affect the successful implementation of road construction projects in Nairobi City County, offering practical recommendations for future infrastructure development.

General Objective

The general objective of this study was to establish the role of project design on implementation of road construction projects in Nairobi City County, Kenya.

Specific Objectives

The study was guided by the following specific objectives;

i. To establish the relationship between project planning and implementation of road construction projects in Nairobi City County, Kenya.
ii. To determine the relationship between resource mobilization and allocation and implementation of road construction projects in Nairobi City County, Kenya.

LITERATURE REVIEW

Theoretical Framework

Complexity Theory

Complexity theory was developed at the Santa Fe Institute in New Mexico, with Stuart Kauffman as a leading proponent. The theory posits that projects and systems are inherently complex, composed of interacting components that self-organize and create emergent structures (Lucas, 2019). Unlike linear models, complexity theory views projects as non-linear and dynamic, emphasizing the interdependencies and adaptive behaviours within project environments.

Complexity theory has been supported by various scholars who argue that modern projects are systems of interacting parts that cannot be fully understood by examining individual elements in isolation (Curlee & Gordon, 2017). The theory has been applied in project management to explain how complex projects require adaptive and flexible planning to address unexpected challenges effectively. It has been used to support the idea that projects, particularly large-scale ones like road construction, involve numerous stakeholders, technical components, and resources that interact in dynamic ways.

While complexity theory has been useful in framing project management, it has been critiqued for its limited practical applicability due to its abstract nature (Williams, 2017). Some argue that the theory lacks concrete tools or guidelines for managing complex projects, making it difficult for practitioners to apply in real-world scenarios. Furthermore, it may lead to overcomplicated approaches that are not necessary for projects with more predictable environments.

Despite these critiques, complexity theory is suitable for this study as it emphasizes the need for comprehensive project planning to manage the interconnected parts of road construction projects. Road construction projects involve multiple stakeholders and evolving conditions, align with the theory's emphasis on adaptive and integrated project planning. The theory underlines that effective project planning is essential for managing the complex interactions and uncertainties in road construction projects. By applying complexity theory, this study explored how detailed planning helps coordinate the numerous interdependent components involved in road construction projects in Nairobi City County.

**Resource Based View Theory**

The Resource-Based View (RBV) theory, developed by Barney (1991), posits that an organization's internal resources and capabilities are fundamental to achieving a sustainable competitive advantage. According to RBV, resources must meet the VRIN criteria—they should be Valuable, Rare, Inimitable, and Non-substitutable—to significantly contribute to organizational success (Barney, 1991). RBV has been widely supported in strategic management and project management literature. Scholars argue that organizations that effectively mobilize and leverage their unique resource bases—such as financial capital, skilled labor, materials, and technological assets—are better positioned to achieve superior performance and project success (Wernerfelt, 1984). In the context of project management, RBV is applied to assess how resource availability, timely mobilization, and efficient allocation directly impact project implementation, cost control, and sustainability (Almarri, 2014).

However, the RBV has faced criticism for its predominant internal focus, often overlooking external environmental factors such as market volatility, political dynamics, and competition (Priem & Butler, 2001). Critics further argue that RBV tends to emphasize resource possession without adequately addressing the strategic processes and managerial capabilities required to deploy these resources effectively (Kraaijenbrink, Spender, & Groen, 2010). Despite these

limitations, the RBV theory is appropriate for this study as it provides a strong foundation for analyzing how resource mobilization and allocation influence the successful implementation of road construction projects. Road projects, particularly in developing contexts like Nairobi City County, depend heavily on securing and managing financial, human, material, and equipment resources throughout the project lifecycle. Applying RBV allows this study to explore how the strategic management of these resources enhances project outcomes, minimizes delays, and ensures infrastructure development goals are achieved.

Conceptual Framework

A conceptual framework is defined as an element of the scientific research process in which a specific concept is defined as a measurable occurrence or in measurable terms that basically gives a clear meaning of the concept (Tamene, 2016). Conceptual framework is a diagrammatic representation of the relationship between dependent and independent variables.

Independent Variables   **Dependent Variable**
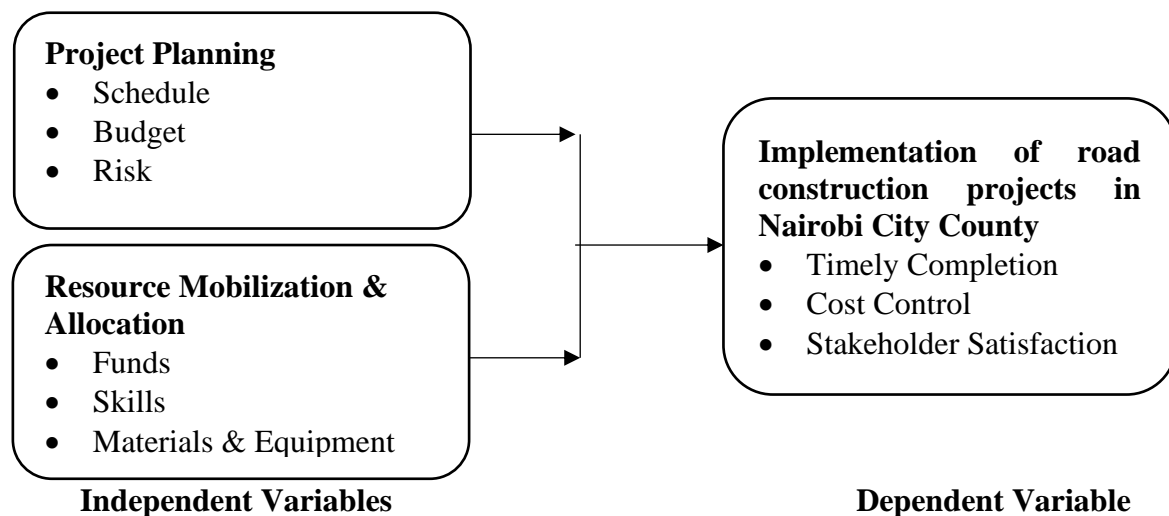
Figure 2. 1: Conceptual Framework

Project Planning and Implementation of road construction projects

Project planning is defined as the process of establishing the scope, objectives, and procedures to achieve project goals within a specific timeframe (Project Management Institute [PMI], 2021). It encompasses the creation of schedules, budgets, and risk management strategies that guide the project from inception to completion (Antvik & Sjöholm, 2021). According to Turner (2020), effective project planning lays the foundation for project execution, ensuring that resources are allocated efficiently and risks are anticipated.

The critical role of project planning in successful project execution is emphasized by Williams and Samset (2021), who argue that projects planned meticulously are more likely to be delivered on time, within budget, and meet stakeholder expectations. Recent research by Osei-Kyei and Chan (2020) shows that comprehensive project planning minimizes uncertainties and improves project control, enhancing the likelihood of project success. Planning also ensures alignment with strategic goals, making it easier to navigate challenges as they arise (Kerzner, 2022).

Despite its recognized importance, project planning has been critiqued for being overly rigid in some contexts. According to Leach (2019), excessively detailed plans can limit a project's flexibility to adapt to unforeseen circumstances. The dynamic nature of construction projects often demands real-time adjustments that traditional planning models may not accommodate. Furthermore, poorly executed planning, even if thorough, can lead to scope creep and ineffective resource allocation (Müller, 2021).

Project planning is suitable for this study as it directly influences the ability to manage complex road construction projects like the Thika Superhighway. By analyzing project planning practices, this study seeks to determine their impact on project timelines, budgets, and overall success. This study will investigate how project planning elements such as scheduling, budgeting, and risk management contribute to successful implementation of road construction projects in Nairobi City County.

Resource Mobilization and Allocation

Resource mobilization and allocation refer to the systematic process of identifying, securing, and efficiently distributing the necessary resources—financial, human, material, and equipment—required for the successful execution of a project. In road construction projects, this involves planning how resources will be acquired, scheduled, and utilized to ensure smooth project implementation (PMI, 2021). Effective resource mobilization is a critical aspect of project design, as it directly influences a project's capacity to meet timelines, control costs, maintain quality, and achieve intended outcomes.

Research highlights that poor resource planning and allocation are major causes of project delays and cost overruns, particularly in infrastructure projects in developing countries (Turner, 2020). Successful projects demonstrate that timely availability of skilled labor, construction materials, machinery, and financing are key to maintaining project momentum and avoiding disruptions (Kerzner, 2022). Studies such as that of Almarri (2024) emphasize that resource mobilization is not limited to funding but also includes managing the logistics of moving equipment and materials to project sites, which is often challenging in urban environments like Nairobi.

However, resource mobilization and allocation face challenges such as budget constraints, supply chain disruptions, skills shortages, and political interference in public projects (Ranganathan & Foster, 2020). These issues can result in stalled projects, quality compromises, and stakeholder dissatisfaction. Additionally, ineffective resource allocation can lead to wastage or underutilization, further escalating costs and delaying project completion (Osei-Kyei & Chan, 2020).

Resource mobilization and allocation are highly relevant to this study as they determine the operational capacity of road construction projects like the Thika Superhighway. A well-designed resource mobilization plan ensures that all critical inputs are available when needed, minimizing project risks. This study will examine how effective resource mobilization and allocation influence the successful implementation of road construction projects in Nairobi City County, with a focus on how financial resources, skilled labor, equipment, and materials are planned, acquired, and deployed to achieve project objectives within time and cost constraints.

Implementation of Road Construction Projects

The successful implementation of road construction projects refers to the achievement of project objectives within the predefined constraints of time, cost, and quality, ultimately leading to customer satisfaction and sustainable benefits (PMI, 2021). It encompasses delivering a project on schedule, within budget, and meeting or exceeding stakeholder expectations. According to Kerzner (2022), project success is evaluated based on the alignment of outcomes with the planned project scope and the satisfaction of stakeholders.

Completing a project within the stipulated timeframe is a critical indicator of success. A project's timely delivery ensures that it can meet the needs it was intended to address and prevent potential cost escalations due to delays (Osei-Kyei & Chan, 2020). Time management practices, such as setting realistic schedules and adhering to them through proper monitoring and control, are crucial for project success (Larson & Gray, 2020).

Cost control is a fundamental measure of project success. The ability to complete a project within its allocated budget reflects effective financial planning and resource management (Jensen, 2021). Cost overruns can have significant negative implications, leading to funding issues and delays (Patil & Pataskar, 2019). Effective budgeting, cost tracking, and financial oversight contribute to a project's successful completion. Delivering a project that meets predefined quality standards is essential for the project's functionality and longevity. According to Turner (2020), quality assurance involves ensuring that all project outputs align with the specifications and expectations set during the planning phase. High-quality outcomes improve stakeholder trust and project sustainability.

The end-users' satisfaction plays a critical role in determining project success. This involves meeting or exceeding the expectations of all stakeholders, including government authorities, community members, and contractors (Eskerod & Jepsen, 2021). Successful projects often involve mechanisms for gathering feedback and implementing adjustments during the project to ensure satisfaction.

The successful implementation of road projects has been supported by various recent studies that highlight the importance of integrated management practices. For example, Nguyen and Hadikusumo (2020) stress that comprehensive planning and stakeholder involvement significantly impact the achievement of project goals. Research by Khan and Alam (2021) shows that projects that adhere to clear quality standards, maintain cost control, and follow a strict timeline tend to be more successful. Moreover, Yang and Shen (2019) point out that continuous stakeholder engagement and feedback loops improve project outcomes by addressing issues in real-time.

Measuring project success can be complex due to the varying definitions and metrics applied across projects (Williams & Samset, 2021). While some scholars argue that time, cost, and quality are sufficient indicators, others suggest that these metrics do not capture the full spectrum of project benefits, particularly those related to social and environmental impacts (Kumar & Mishra, 2020). Additionally, projects may be deemed successful during initial implementation but fail to deliver long-term benefits due to insufficient post-completion monitoring and sustainability measures (Nguyen et al., 2021).

Empirical Literature Review

Project Planning

Nguyen and Hadikusumo (2020) conducted a study on the impact of project planning on construction project success in Vietnam. The study was grounded in project management theory, emphasizing the importance of planning in mitigating risks and uncertainties. The researchers employed a quantitative design with a survey distributed to project managers and engineers from various construction firms. The population included construction professionals in Vietnam, with a sample size of 200 participants selected through stratified random sampling. Data were collected using structured questionnaires and analyzed using multiple regression analysis. The findings indicated that comprehensive project planning significantly influenced project success, with 72% of respondents agreeing that effective scheduling and budgeting were crucial for on-time project delivery. The study concluded that detailed project planning reduces risks and enhances project control and recommended that construction firms prioritize comprehensive planning phases to minimize delays and cost overruns.

Williams and Samset (2021) examined the role of project planning in public infrastructure projects across Europe. The study utilized complexity theory as its theoretical background, proposing that effective planning helps manage the intricacies of large-scale projects. This mixed-methods research included both qualitative interviews and a quantitative survey, targeting government project managers and contractors. The sample size consisted of 150 participants, selected through purposive sampling. Data collection involved interviews and an

online questionnaire, and thematic analysis was used for qualitative data, while quantitative data were analyzed using ANOVA. Results revealed that 68% of successful public infrastructure projects had comprehensive project planning mechanisms in place. The authors concluded that planning acts as a risk management tool, essential for project success, and recommended integrating risk assessment into the planning stage for future projects.

Patil and Pataskar (2019) focused on the effectiveness of time and cost planning in construction projects in India. The study was based on the Theory of Constraints, emphasizing how scope and time constraints affect project outcomes. A quantitative research design was adopted, with a sample of 180 project managers from major Indian construction companies, chosen through stratified random sampling. Data collection was conducted via a structured questionnaire, and regression analysis was performed to identify the relationship between planning and project outcomes. Findings showed that 75% of projects that adhered to rigorous time and cost planning were completed on time and within budget. The study concluded that detailed project planning significantly enhances project success and recommended the use of software tools for project scheduling and cost management.

Osei-Kyei and Chan (2020) studied public-private partnership (PPP) projects in Ghana, investigating the role of project planning in project success. The theoretical framework was based on project management best practices. This study used a cross-sectional survey design with a sample of 220 project stakeholders, including government officials and private contractors, selected through simple random sampling. Data were gathered using structured questionnaires and analyzed with structural equation modeling (SEM). Results revealed that project planning was a significant predictor of project success, contributing to 64% of the variance in successful project outcomes. The study concluded that PPP projects require extensive planning to mitigate risks and align expectations between public and private entities, recommending that governments establish detailed guidelines for project planning in PPPs.

Kerzner (2022) conducted a global review of project management practices, focusing on how project planning influences project success. Rooted in the principles of systems theory, the research used a meta-analysis of existing case studies and survey data from international project management practitioners. The study examined data from 50 case studies across various industries, with a focus on large infrastructure projects. The analysis showed that 80% of projects with comprehensive planning phases achieved their objectives within the set timeline and budget. The author concluded that project planning is a fundamental element of successful project management, stressing the importance of continuous monitoring and adaptive planning to address evolving project conditions. The study recommended integrating project planning with modern project management software for better real-time tracking and adjustment.

Resource Mobilization and Allocation

Almarri (2024) conducted a study examining how resource mobilization influences project success in large-scale construction projects in the Middle East. Grounded in the Resource-Based View (RBV) theory, the study used a quantitative survey design targeting 200 project managers and engineers. Data collected through structured questionnaires revealed that 82% of projects that effectively mobilized financial, material, and human resources met their time and cost objectives. The study concluded that resource mobilization is a critical determinant of project success and recommended integrating detailed resource planning into project design phases.

Osei-Kyei and Chan (2020) investigated resource allocation challenges in public-private partnership (PPP) infrastructure projects in Ghana. Using a mixed-methods approach, the study combined surveys and interviews with 180 project stakeholders, including government officials and private contractors. Findings indicated that projects with structured resource allocation plans experienced fewer delays and cost overruns. The study highlighted the need

for strong resource mobilization strategies, especially in developing countries where resource constraints often affect project execution.

Turner (2020) explored resource management practices in European road infrastructure projects. A sample of 120 project managers was surveyed, focusing on the impact of resource availability on project implementation. Results showed that timely mobilization of skilled labor, equipment, and materials significantly reduced project risks. The study concluded that projects with well-planned resource mobilization frameworks had better performance outcomes, particularly in meeting quality and schedule targets.

Ranganathan and Foster (2020) assessed resource mobilization in African road projects, emphasizing the importance of early resource planning. The study employed a quantitative design involving 150 project finance and operations experts. Data analysis revealed that 78% of successful projects prioritized resource allocation at the design stage, contributing to reduced delays and cost efficiency. The study recommended that road projects in Africa, including Kenya, incorporate comprehensive resource mobilization strategies from project inception.

Kerzner (2022) examined global best practices in resource mobilization within large infrastructure projects. Using a meta-analysis of case studies, the study found that poor resource planning was a leading cause of project failure. Conversely, projects that adequately assessed and secured resources—labor, materials, finances—during the design phase demonstrated higher implementation success rates. The study advocated for embedding resource mobilization planning within the broader project design framework to mitigate risks and enhance project outcomes.

RESEARCH METHODOLOGY

The study employed descriptive research design. Descriptive research describes data and characteristics of the population or phenomena being studied. For this study, the target population includes agencies and institutions responsible for road construction projects within Nairobi City County, Kenya. Specifically, data was collected from employees of the Kenya National Highways Authority (KENHA) who were involved in the construction of the Thika Superhighway. The total target population of 519 employees (KENHA, 2023) was chosen due to their direct involvement and extensive knowledge of the project, ensuring the data collected is relevant and comprehensive. In this study, the unit of analysis was the road construction project itself—specifically, the Thika Superhighway Project as an example of large-scale infrastructure implementation in Nairobi City County. Yamane Formula was chosen for its simplicity and ability to provide a scientifically sound sample size that represents the target population. Therefore, the sample size was 226 respondents.

Table 1: Sample Size

Category	Target Population	Sample
Top management employees	58	25
Middle level management employees	173	75
Lower management employees	288	126
Total	**519**	**226**

The 226 respondents were chosen with the help of stratified random sampling technique. Stratified random sampling technique was used since the population of interest is not homogeneous and could be sub-divided into groups or strata to obtain a representative sample. This sampling technique divides the population into groups or strata. The strata are reached upon on the basis of the shared traits (Singpurwalla, 2019).

For this study, the primary data collection tool was a questionnaire. A pilot was carried out to ascertain the consistency and accuracy of the data collection tool and study design in order to

enhance validity and reliability of the data instrument (Kalatya & Moronge, 2017). This was carried among 23 respondents in KENHA. Descriptive statistics such as frequency distribution, mean (measure of dispersion), standard deviation, and percentages were used. Correlation was used to test the strength and the direction of the relationship between the dependent and the independent variables. The relationship between the study variables was tested using multivariate regression models.

RESEARCH FINDINGS AND DISCUSSION

A total of 220 questionnaires were distributed to employees of the Kenya National Highways Authority (KENHA) who were directly involved in the Thika Superhighway road construction project. Out of these, 186 questionnaires were completed and returned, representing a response rate of 84.5%. According to Mugenda and Mugenda (2003), a response rate of 50% is adequate, 60% is good, and above 70% is very good for data analysis in survey research. Therefore, the achieved response rate of 84.5% in this study is considered excellent and sufficient for statistical analysis and generalization of the findings to the target population.

Descriptive Analysis

This section presents the descriptive analysis of the study variables based on the responses collected. The analysis was guided by the five-point Likert scale used in the questionnaire, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree. The interpretation of the mean scores is based on the following scale: 1.00 – 1.99 = *Strongly Disagree,* 2.00 – 2.99 = *Disagree,* 3.00 – 3.99 = *Neutral, and* 4.00 – 5.00 = *Agree.* Mean scores and standard deviations are presented to provide insight into respondents' perceptions of project design factors influencing the successful implementation of the Thika Superhighway project.

Project Planning

The study sought to establish the relationship between project planning and implementation of road construction projects in Nairobi City County, Kenya. This section presents the descriptive analysis of project planning practices in the Thika Superhighway project. Respondents rated key planning elements, including scheduling, budgeting, communication, and risk management. The results are summarized in Table 2.

Table 2: Descriptive Statistics for Project Planning

Statement	Mean	Standard Deviation
Schedule was thorough and detailed	4.231	0.534
Scheduling and timelines were realistic and adhered to	4.187	0.612
The project budget was communicated effectively to all team members	4.115	0.571
Regular updates and reviews of the project budget were conducted	4.054	0.648
Risk management was integrated into the planning process effectively	4.038	0.599
Contingency plans were developed for potential risks	3.923	0.683
Aggregate Score	**4.091**	**0.608**

The results indicate that project planning was perceived positively, with an aggregate mean score of 4.091 and a standard deviation of 0.608. The highest-rated aspect was the thoroughness and detail of the project schedule, which scored 4.231 (SD = 0.534). This reflects strong planning efforts in structuring the project schedule, enabling effective monitoring of progress and timelines. The second-highest rating was assigned to the realism and adherence to

scheduling and timelines, with a mean score of 4.187 (SD = 0.612), suggesting that the project maintained discipline in implementing its schedule.

Effective communication of the project budget to team members also scored highly at 4.115 (SD = 0.571), confirming that financial information was well-disseminated, supporting transparency and accountability. Regular updates and reviews of the project budget followed closely, scoring 4.054 (SD = 0.648), indicating that budget monitoring was consistently integrated into project management. However, the lowest mean score was recorded on the development of contingency plans for potential risks at 3.923 (SD = 0.683). Despite falling within the "agree" range, this finding suggests that risk mitigation planning received comparatively less emphasis, highlighting an area for improvement in future projects.

Overall, the low standard deviations across most items demonstrate general agreement among respondents, indicating consistent experiences regarding planning practices in the Thika Superhighway project.

The strong performance in scheduling, timeline adherence, and budget communication aligns with Nguyen and Hadikusumo (2020), who emphasized that detailed planning and realistic scheduling significantly contribute to the success of large-scale infrastructure projects. Similarly, Kerzner (2022) stressed that consistent budget monitoring and effective communication within project teams enhance project control and prevent budget overruns, which this study's results confirm. However, the relatively lower rating on contingency planning reflects challenges commonly reported in infrastructure projects across developing countries. Hwang et al. (2019) identified weak risk anticipation and mitigation as factors that frequently lead to cost escalations and project delays. This observation resonates with the findings of this study, indicating that while planning was generally strong, enhancing risk management frameworks could further strengthen project resilience and implementation success.

The results validate that effective project planning was a critical driver of success in the Thika Superhighway project but also suggest the need for a stronger focus on proactive risk management in future large-scale road construction initiatives.

Resource Mobilization and Allocation

The second objective was to determine the relationship between resource mobilization and allocation and implementation of road construction projects in Nairobi City County, Kenya. This section presents the descriptive analysis of resource mobilization and allocation in the Thika Superhighway project. Respondents assessed the identification, availability, deployment, and monitoring of resources—financial, human, material, and technical. The results are summarized in Table 2.

Table 3: Descriptive Statistics for Resource Mobilization and Allocation

Statement	Mean	Standard Deviation
Resource allocation was continuously monitored and adjusted	4.231	0.556
Skilled labor and technical expertise were available as required	4.198	0.573
Resource requirements were clearly identified during project design	4.154	0.601
Construction materials and equipment were mobilized on time	4.115	0.621
Resource mobilization plans were reviewed periodically	4.082	0.633
Adequate financial resources were secured before project commencement	4.027	0.647
Resource shortages did not significantly disrupt project activities	3.993	0.688
Aggregate Score	**4.114**	**0.617**

The results show that resource mobilization and allocation were well-managed in the Thika Superhighway project, with an aggregate mean score of 4.114 and a standard deviation of 0.617. The highest-rated aspect was continuous monitoring and adjustment of resource allocation (Mean = 4.231, SD = 0.556), indicating strong project management practices in tracking resource utilization and making necessary real-time adjustments. Availability of skilled labor and technical expertise also scored highly (Mean = 4.198, SD = 0.573), suggesting that the project had access to qualified personnel, which is vital for maintaining quality and efficiency. Resource requirement identification (Mean = 4.154) and timely mobilization of materials and equipment (Mean = 4.115) further reflect proactive planning and execution.

However, the lowest score was recorded for minimizing disruptions caused by resource shortages (Mean = 3.993, SD = 0.688), indicating that while resources were generally well-managed, the project faced occasional constraints—likely related to fluctuating market prices, supply chain delays, or political influences, which are common in large infrastructure projects. The standard deviations indicate relative consistency in responses, though slightly higher variation is seen in areas linked to financial flows and resource shortages, signaling that these were pressure points during implementation.

These findings align closely with Almarri (2024) and Osei-Kyei and Chan (2020) who emphasized that timely and well-planned resource mobilization is a critical success factor in infrastructure projects, particularly in developing countries where resource constraints are prevalent. The high ratings in continuous monitoring and resource availability validate that KENHA effectively anticipated and addressed resource needs during the Thika Superhighway project. However, the noted challenges in preventing resource shortages confirm Ranganathan and Foster's (2020) argument that even with good planning, African infrastructure projects often face disruptions due to financing delays, procurement bottlenecks, or governance issues. The results also reflect Nguyen et al. (2021), who found that weak resource control often leads to project delays and cost overruns.

Overall, the study confirms that resource mobilization and allocation significantly contributed to the project's success. Nonetheless, the findings highlight the importance of strengthening resilience against external resource supply shocks in future large-scale projects to maintain continuity and efficiency.

Implementation of Road Construction Projects

This section presents the descriptive analysis of the overall implementation success of the Thika Superhighway project. Respondents rated project performance based on time, budget, quality, goal alignment, sustainability, and stakeholder satisfaction. The results are summarized in Table 4.

Table 4: Descriptive Statistics for Implementation of Road Construction Projects

Statement	Mean	Standard Deviation
The project quality met all specified standards	4.242	0.532
The project was completed within the scheduled time frame	4.215	0.564
The project outcomes aligned with the initial goals and objectives	4.187	0.581
The project demonstrated long-term sustainability and usability	4.165	0.602
The project received positive feedback from stakeholders	4.148	0.615
The project stayed within the allocated budget	4.082	0.643
The project minimized negative environmental impacts	3.915	0.690
Aggregate Score	**4.136**	**0.604**

The descriptive results show that project implementation was perceived as largely successful, with an aggregate mean score of 4.136 and a standard deviation of 0.604. The highest-rated aspect was the project meeting all specified quality standards (Mean = 4.242, SD = 0.532),

reflecting a strong emphasis on delivering a durable and functional infrastructure that met technical specifications. Timely completion also received a high score (Mean = 4.215, SD = 0.564), suggesting that the project adhered well to scheduled timelines—a significant achievement given the scale and complexity of the road construction. Alignment with initial goals (Mean = 4.187) and demonstration of long-term sustainability (Mean = 4.165) further indicate that the project not only delivered on immediate objectives but was also viewed as a durable asset contributing to future development.

The budget performance received a moderate score (Mean = 4.082, SD = 0.643), indicating that while the project managed finances reasonably well, there were likely some budgetary challenges. Notably, minimizing environmental impacts scored the lowest (Mean = 3.915, SD = 0.690), suggesting that environmental considerations were less prioritized or faced more challenges compared to other implementation aspects. The standard deviations across the items were generally low to moderate, indicating a shared perception of project success, with slightly more variation on environmental performance.

The high scores on quality, timeliness, and stakeholder satisfaction align with Deloitte (2017) and Nguyen et al. (2021), who emphasized that successful infrastructure projects in Africa are often measured by their ability to meet technical standards, maintain timelines, and satisfy stakeholder expectations. The moderate rating on budget control reflects challenges noted by Khan and Alam (2021), who highlighted that large-scale projects often face financial risks and budget overruns due to shifting resource costs and external pressures. This suggests that while KENHA managed costs effectively, there were likely typical financial strains that accompany large infrastructure works. The lower score on environmental impact management aligns with Nguyen et al. (2021) and Kumar and Mishra (2020), who criticized infrastructure projects in developing regions for often sidelining environmental and social impacts in favor of economic goals. The Thika Superhighway experience mirrors this trend, indicating a need for more integrated sustainability planning in future projects.

Correlation Analysis

Correlation analysis was conducted to determine the strength and direction of the relationships between project design factors (Project Planning and Resource Mobilization) and the Successful Implementation of the Thika Superhighway Project. The Pearson correlation coefficient (r) was used, where values closer to +1 indicate a strong positive relationship, values near -1 indicate a strong negative relationship, and values around 0 suggest no relationship. The results of the correlation analysis are summarized in Table 5.

Table 5: Correlation Analysis Results

		Project Implementation	Project Planning	Resource Mobilization
Implementation of Road Construction Projects	Pearson Correlation	1.000		
	Sig. (2-tailed)			
	N	186		
Project Planning	Pearson Correlation	0.671**	1.000	
	Sig. (2-tailed)	0.000		
	N	186	186	
Resource Mobilization	Pearson Correlation	0.643**	0.498	1.000
	Sig. (2-tailed)	0.000	0.054	
	N	186	186	186

** Correlation is significant at the 0.05 level (2-tailed).

Project planning and project success (r = 0.671, p < 0.05). The strongest correlation was recorded between Project Planning and Project Success (r = 0.671). This positive and significant relationship suggests that detailed scheduling, realistic timelines, comprehensive

budgeting, and integration of risk management were instrumental in ensuring the project's successful completion. This finding aligns with Nguyen and Hadikusumo (2020) and Kerzner (2022), who stressed that well-structured project planning reduces uncertainty, enhances coordination, and improves project outcomes. For the Thika Superhighway, robust planning likely enabled KENHA to anticipate potential risks, allocate resources efficiently, and monitor progress effectively, thus minimizing delays and cost overruns. This validates the literature's assertion that project planning is the backbone of successful large-scale infrastructure projects.

Resource Mobilization and Project Success ($r = 0.643$, $p < 0.05$). The correlation between Resource Mobilization and project success was also strong and significant ($r = 0.643$), underlining the importance of adequate financial resources, skilled labor, timely procurement of materials, and continuous monitoring of resource usage. This aligns with Almarri (2024) and Ranganathan and Foster (2020), who observed that efficient resource mobilization and allocation directly impact infrastructure project success. In the case of the Thika Superhighway, the ability to mobilize resources on time likely prevented disruptions, supported consistent progress, and ensured quality delivery. However, the moderate standard deviation noted in resource sufficiency suggests occasional challenges, reinforcing the literature's observation that resource constraints remain a common risk in African infrastructure projects.

Regression Analysis

This section presents beta coefficients, allowing us to compare the magnitude and significance of each predictor.

Table 6: Regression Coefficients

Variables	Unstandardized B	Std. Error	Standardized Beta	t	Sig.
(Constant)	1.152	0.231	-	4.989	0.000
Project Planning	0.278	0.062	0.314	4.484	0.000
Resource Mobilization	0.297	0.059	0.332	5.034	0.000

a. Dependent Variable: Implementation of Road Construction Projects

The regression equation is:

Implementation of Road Construction Projects = 1.152 + 0.278(Project Planning) + 0.297(Resource Mobilization)

The regression results reveal that Resource Mobilization is the most significant predictor of the successful implementation of road construction projects in Nairobi City County. With a coefficient of $B = 0.297$ ($p = 0.000$), the findings indicate that an increase in resource mobilization by one unit will lead to a 0.297 unit increase in the implementation success of road construction projects. This emphasizes that timely availability and proper allocation of financial, human, and material resources are critical for project success. These results support Almarri (2024), who noted that resource sufficiency directly enhances infrastructure project delivery.

Similarly, Project Planning ($B = 0.278$, $p = 0.000$) has a significant positive influence on project implementation. The results suggest that an increase in project planning by one unit will result in a 0.278 unit improvement in implementation success. This highlights that proper scheduling, budgeting, and risk management practices directly improve project execution. The finding aligns with Nguyen and Hadikusumo (2020), who emphasized that detailed planning minimizes uncertainties and project failures.

Conclusions

The study concludes that effective project planning significantly contributes to the success of road construction projects. Proper scheduling, budgeting, communication, and risk

management enhance project coordination and execution, leading to timely and efficient completion.

The study concludes that resource mobilization and allocation are critical to project success. Adequate financial resources, skilled personnel, and timely availability of materials ensure smooth implementation, while resource shortages can disrupt progress.

Recommendations

Project Planning

Road construction agencies like KENHA should strengthen their planning processes by institutionalizing regular review and updates of project schedules and budgets. A stronger emphasis should be placed on developing comprehensive contingency plans to anticipate potential risks and disruptions. Project teams should also be trained on advanced project management tools and techniques that enhance real-time monitoring and enable adjustments to plans when necessary. This will ensure projects remain on track even when faced with unforeseen challenges.

Resource Mobilization and Allocation

Project implementers must prioritize resource mobilization at the earliest stages of project design to prevent delays caused by financial constraints or material shortages. Resource mobilization plans should be comprehensive and include contingency funding provisions. Continuous monitoring and reallocation of resources should be maintained throughout the project to ensure efficient use and timely adjustments. Establishing partnerships with suppliers and contractors can also secure resource availability and reduce risks related to supply chain disruptions. Project managers should leverage technology to track resource utilization and forecast shortages proactively.

Suggestions for Further Studies

While this study explained a significant portion of project success through project design factors, future research should explore additional variables such as political influence, legal frameworks, environmental considerations, and technological advancements like digital project management tools. Comparative studies involving multiple road projects across different regions in Kenya could provide broader insights into the contextual factors affecting road construction success. Further research should also examine the long-term sustainability impacts of road construction projects on local communities and economies.

REFERENCE

African Development Bank (AfDB). (2019). *African economic outlook 2019*. African Development Bank Group.

Almarri, K., & Gardiner, P. (2014). Application of resource-based view to project management research: supporters and opponents. *Procedia-Social and Behavioral Sciences*, 119, 437–445.

Antvik, S., & Sjöholm, H. (2021). *Project management and strategic planning*. Scandinavian Project Management Press.

Deloitte. (2017). *Africa Construction Trends Report 2017*. Deloitte Touche Tohmatsu Limited.

Hwang, B. G., Zhao, X., & Goh, K. J. (2019). A review of key project management practices in construction projects. *International Journal of Project Management*, 37(3), 437–450.

Jensen, K. (2021). Cost-benefit analysis as a tool for economic appraisal in Nordic infrastructure projects. *Infrastructure Economics Journal*, 18(1), 58–75.

Kerzner, H. (2022). *Project management: A systems approach to planning, scheduling, and controlling* (13th ed.). Wiley.

Leach, L. P. (2019). *Critical chain project management* (3rd ed.). Artech House.

Lucas, K., & Roosen, P. (Eds.). (2019). *Emergence, analysis and evolution of structures: Concepts and strategies across disciplines*. Springer.

Marijana, S., Ivan, D., & Paul, M. (2019). Future infrastructure planning for economic development. *Global Infrastructure Insights Journal*, 8(1), 45–62.

Müller, R. (2021). The flexible approach to project planning: Adapting in complex environments. *Journal of Project Complexity and Flexibility*, 15(1), 34–49.

National Construction Authority (NCA). (2018). *Annual report on construction project performance in Kenya*. Nairobi: National Construction Authority.

Navon, R. (2015). Construction project management: Challenges and advancements. *Construction Management Review*, 10(2), 101–115.

Ngunjiri, P. (2018). The Thika Superhighway: Lessons from a landmark project. *East African Journal of Infrastructure*, 14(2), 56–71.

Nguyen, L. D., & Hadikusumo, B. H. W. (2020). Influence of project scope clarity on project success in construction. *Journal of Construction Management*, 14(2), 89–97.

Nguyen, V. Q., Chen, Y., & Zhang, J. (2021). Limitations of economic appraisals in developing countries: Case studies from Southeast Asia. *Journal of Public Infrastructure and Development*, 13(4), 300–318.

Osei-Kyei, R., & Chan, A. P. C. (2020). Determinants of project success in public-private partnerships: Perspectives from developing countries. *Project Management Journal*, 51(2), 139–152.

Patil, A. S., & Pataskar, S. V. (2019). Time and cost control for successful project delivery. *Journal of Construction and Infrastructure Development*, 22(3), 200–214.

Project Management Institute (PMI). (2021). *A guide to the project management body of knowledge (PMBOK® Guide)* (7th ed.). Project Management Institute.

Ranganathan, R., & Foster, V. (2020). Assessing the effectiveness of economic appraisal techniques in African road projects. *Journal of Infrastructure and Economic Planning*, 25(3), 140–155.

Tamene, E. H. (2016). Theorizing conceptual framework. *Asian Journal of Educational Research*, 4(2), 50–56.

Turner, J. R. (2020). *The handbook of project-based management* (4th ed.). McGraw-Hill Education.

Williams, T., & Samset, K. (2021). Re-evaluating project success metrics: Beyond the triple constraint. *International Journal of Project Management*, 39(5), 345–359.