AN INVESTIGATION OF PROJECT MANAGEMENT PRACTICES ON SUSTAINABILITY OF SELECTED ROAD PROJECTS IN KIAMBU COUNTY, KENYA

Fiona Kahuthu Nyanduku & Dr. Josphat Kyalo, PhD

The Strategic JOURNAL of Business & Change MANAGEMENT
ISSN: 2312-9492 www.strategicjournals.com
Vol. 10, Iss.4, pp 762 – 777. November 4, 2023. www.strategicjournals.com, ©Strategic Journals

AN INVESTIGATION OF PROJECT MANAGEMENT PRACTICES ON SUSTAINABILITY OF SELECTED ROAD PROJECTS IN KIAMBU COUNTY, KENYA

[1] Nyanduku, F. K., & [2] Kyalo, J.

[1] MBA (Project Management) Candidate; BCOM (Procurement), Kenyatta University, Kenya
[2] Lecturer, School of Business, Economics and Tourism, Kenyatta University, Kenya

Accepted: October 18, 2023

DOI: http://dx.doi.org/10.61426/sjbcm.v10i4.2785

ABSTRACT

This study investigated the effect of project management best practices on the sustainability of road construction projects in Kiambu County, Kenya. The specific objectives were determining the effect of stakeholder participation and involvement, management skills, resource allocation, and technological resource on the sustainability of road construction projects. The research study adopted explanatory and descriptive research design to establish the relationship between project management practices and sustainability of road construction projects. The target population was nine completed road construction projects and stratified random sampling used to draw a sample of 100 respondents. The data was analyzed using both descriptive, relational and inferential statistics. The findings of the study indicated that managerial skills had a positive and significant effect on sustainability of road construction projects. This was attributed to development and adherence to systematic work plans and schedules by project managers which ensured that road construction projects are completed within time, budget, and required quality. The study also established that resource allocation had a positive and significant effect on sustainability of road construction projects. This was attributed to adequate allocation of physical resources, human resources, and funds for road construction projects. Stakeholder involvement also had a positive and significant effect on sustainability of road construction projects. There were negotiations with stakeholders to build a consensus which made stakeholders feel that they felt part and parcel of these construction projects. Finally, technology resources had a positive and significant effect on sustainability of road construction projects. This was attributed to utilization of management information system to coordinate road construction projects, and utilization of different software to complete specific tasks. This research study recommended that road construction project management should prioritize effective resource allocation, as it was established to have the most significant effect on both project quality and sustainability.

Keywords: *Managerial Skills, Project Management Practices, Resource Allocation, Stakeholder Involvement, Project Sustainability, Technology Resource*

CITATION: Nyanduku, F. K., & Kyalo, J. (2023). An investigation of project management practices on sustainability of selected road projects in Kiambu County, Kenya. *The Strategic Journal of Business & Change Management,* 10 (4), 762 – 777. http://dx.doi.org/10.61426/sjbcm.v10i4.2785

INTRODUCTION

One of the key industries in any economy of a country is the road construction industry. In fact, statistics shows that the road construction industry contributes up to 10% of the world's GDP. Moreover, as stated by Barykina (2019), the accumulative resources utilised in this industry is approximated to be equivalent to 50% of the global resources. These figures imply that the construction industry has a significant impact on the world's economy and therefore, it is essential to plan activities efficiently and effectively within this industry. From a global perspective, collaboration and knowledge-sharing among countries and stakeholders are crucial for promoting sustainable road construction practices. International organizations, such as the United Nations and World Bank, can play a vital role in disseminating best practices, providing technical assistance, and facilitating partnerships to advance sustainability in road construction projects worldwide. According to Tam et al. (2020) the success of road projects in developed countries is attributed to availability financial resources, availability of skilled human resources and more importantly proper planning. A combination of all these factors ensures that a project can be completed within the planned time and cost to guarantee quality service to the beneficiaries.

In Kenya, the perspective of sustainability in road construction projects is shaped by several key factors. Kenya's road infrastructure plays a vital role in facilitating economic growth and development. Sustainable road construction projects aim to improve connectivity, enhance trade routes, and promote regional integration. Emphasis is placed on constructing roads that support the movement of goods and services, attract investments, and stimulate job creation and economic opportunities. According to Gituro and Mwawasi (2017), Kenya embraces technological advancements and innovative solutions to enhance the sustainability of road construction projects. This includes leveraging digital technologies for project planning, monitoring, and maintenance, adopting advanced construction techniques that minimize environmental impacts and enhance efficiency, and exploring alternative materials and energy sources. Incorporating solar-powered street lighting, intelligent traffic management systems, and other smart infrastructure solutions is also considered. Truong et al. (2020) notes that effective governance, transparency, and accountability are critical for the sustainability of road construction projects in Kenya. Ensuring proper project planning, budget allocation, and efficient implementation is important to avoid delays, cost overruns, and corruption. Strengthening institutional capacity, promoting good governance practices, and implementing effective monitoring and evaluation systems contribute to the long-term sustainability of road infrastructure.

Sustainable road construction projects in Kenya aim to improve social inclusivity and accessibility. The government focuses on ensuring that road infrastructure benefits all citizens, including marginalized communities, women, children, and people with disabilities. This involves integrating pedestrian walkways, cycling lanes, and safe crossing facilities. Enhancing accessibility to schools, hospitals, markets, and other essential services for remote and underserved areas is a priority. Gituro and Mwawasi (2017) averse that the Kenyan government, in collaboration with international development partners, emphasizes sustainability in road construction through policies, regulations, and guidelines. Musau and Kirui (2018) notes that over 70% of the road projects in Kenya have taken long or failed because of poor planning, lack of stakeholder involvement and inappropriate financial allocation. Therefore, engaging local communities, involving stakeholders, and promoting knowledge sharing and technology transfer contribute to the successful implementation of sustainable road construction projects in Kenya.

Projects are critical to the overall success of any firm. Companies expect project teams to perform consistently and at a speedy pace in modern sectors because of growing competition. Kerzner (2018) averse that when compared to earlier outcomes,

only excellent project management strategies may help you improve your performance. Project managers plan, coordinate, and manage resources in order to optimize the team's production and efficiency. According to the PMI, a project manager needs a combination of business management and leadership abilities in addition to essential technical skills to ensure a project's success.

Essential managerial skills such as effective communication, leadership, technical competence, and organizational skills can influence the success of a project (Alvarenga et al., 2019). One of the best project management practices is effective communication, because even a minor misunderstanding can create delays in deadlines, which can lead to unsuccessful outcomes. To minimize misunderstandings, keep team members involved and informed at all times. As indicated by Alvarenga et al. (2019), leadership skills help a project manager to deal with challenging personnel and situations at work. It is critical that project managers and team members begin to develop their leadership abilities and concentrate on being a well-rounded individual with both leadership and technical talents. Still on managerial skills as a project management best practice, effective project management necessitates skilled planning. This may be difficult, especially when many project managers must make informed predictions regarding deadlines and resource requirements. This is where forecasting may help. Project managers must make forecasts and projections based on whatever information that is available. With regards to organization skills, deadlines, resources, and job dependencies may make anyone's head spin, but a project manager should see it as a rewarding challenge (Moradi et al., 2020). The best project managers are well-organized and capable of keeping track of all the moving parts.

Road projects are among the most heavily supported donor projects in developing countries, and they are also the most common source of relocation (Hassan, 2017). Donor organizations have backed the construction of roads as a means of reducing poverty. Road development initiatives have been identified to be essential for improving living conditions. Roads are supposed to stimulate market activity, influence input and product prices, and strengthen economic links by lowering transportation costs (Keiner, 2005). As a result, the local economy undergoes significant transformation, such as enhanced donor investment and agricultural production, which has a cascading effect on income-earning opportunities (citizens become more capable), governments can collect more revenue, and as a result, population redistribution occurs throughout the country. As noted by most researchers, better roads increase access to social service institutions, hence improving social results. According to Martens and Carvalho (2017), if the project's aims and achievements are to be accomplished, it must be monitored and evaluated based on the project management best practices. This is so because it involves a huge number of parties as owners or clients, such as contractors, consultants, stakeholders, and regulators, the construction sector is complex. Investigating the reasons of delays has become a critical component of enhancing the construction industry's performance.

In project management, sustainability is defined as the project capability to maintain its services, operations, and benefits during the course of its projected lifetime. According to Olukotun (2008), sustainability of a road project is highly dependent on its capacity to satisfy the problems of the community where it will be established. Sustainability of road projects can be easily achieved if the project manager and team have a clear vision that is in tandem with needs of the local community. The demand for sustainable road construction in Kenya is growing, necessitating the establishment of meticulous road planning procedures. As suggested by Suprayoga et al. (2020) on balancing planning, stakeholder involvement, environmental values, and sustainability, it is critical to strike a balance amongst the pillars of sustainability. The essential parts of project planning that contribute to the long-term

viability of road construction projects include project quality management, project cost management, project deliverables management, project timeline management, and project assessment. Project planners all over the world are beginning to recognize the need of creating sustainable road infrastructure for the transportation of goods. In the process of measuring components of road construction, practices, and designs that are sustainable, project planning contributes to the development of blueprints and methods for assessing sustainability.

Project management practices have a significant impact on the sustainability of road projects. Owuori et al. (2020) notes that project management practices have a direct influence on the sustainability of road projects. By integrating sustainability principles into project planning, engaging stakeholders, conducting impact assessments, optimizing resource utilization, monitoring progress, fostering collaboration, and ensuring long-term maintenance, project managers can minimize environmental impacts, address social concerns, optimize resource use, and contribute to the overall sustainability of road infrastructure. According to Owuori et al. (2020), project management practices that prioritize sustainability incorporate specific sustainability goals and targets into the project plan. This ensures that environmental, social, and economic considerations are taken into account throughout the project lifecycle. Clear goals enable project teams to focus on minimizing negative impacts and maximizing positive outcomes related to resource efficiency, environmental conservation, social inclusion, and economic viability.

Effective project management practices involve engaging stakeholders throughout the project. This includes local communities, government agencies, environmental organizations, and other affected parties. Engaging stakeholders promotes transparency, builds trust, and allows their perspectives and concerns to be considered in decision-making processes. By including diverse stakeholders, project managers can address sustainability issues and align the project with local needs and aspirations. In a similar fashion, Stanitsas et al. (2021) averse that sustainable project management practices focus on optimizing resource utilization throughout the project. This includes efficient scheduling, procurement, and use of construction materials, energy, and water. By minimizing resource consumption and waste generation, project managers can reduce the project's environmental footprint, conserve natural resources, and improve overall resource efficiency. According to Stanitsas et al. (2021), project management practices incorporate monitoring and evaluation systems to track sustainability performance. Regular monitoring of environmental indicators, social impacts, and adherence to sustainability goals enables project managers to assess progress, identify deviations, and take corrective actions. By monitoring key metrics, project teams can make data-driven decisions to improve sustainability outcomes and ensure the project stays on track.

Project management practices that promote collaboration and knowledge sharing facilitate the adoption of sustainable practices. By sharing lessons learned, best practices, and innovative approaches, project managers can leverage collective knowledge to improve sustainability outcomes. Collaborative efforts with research institutions, industry associations, and government agencies enable the exchange of expertise, leading to continuous improvement in sustainable road construction practices. According to Stanitsas et al. (2021), sustainable road projects require long-term maintenance and management strategies. Effective project management practices incorporate considerations for the ongoing operation and maintenance of the infrastructure. This includes implementing asset management systems, conducting regular inspections, and implementing preventive maintenance measures. By ensuring the long-term functionality and safety of the road infrastructure, project managers contribute to its

overall sustainability and reduce the need for costly repairs or reconstruction.

Project management practice that embraces the use of advanced technologies also facilitate the adoption of sustainable practices. According to Gituro and Mwawasi (2017), technology advancements in construction techniques and equipment contribute to sustainability in road projects. Innovations such as intelligent compaction systems, GPS-guided construction equipment, and automated machine control enable more precise and efficient construction processes. This results in reduced material waste, improved quality control, and minimized energy consumption during construction. In addition to this, advanced sensor technologies and remote monitoring systems enable real-time monitoring of road infrastructure. This allows for early detection of maintenance needs, structural integrity issues, and potential safety hazards. By proactively identifying and addressing maintenance requirements, technology-enabled monitoring systems help extend the lifespan of road infrastructure and minimize disruptions, reducing resource consumption and costs.

Statement of the Problem

Over the years, the road construction industry has been identified as one of the most essential industries in the country's economy. This industry plays a significant role in the development of a country and therefore, its importance and role need to be over-emphasized. According to Gu and Qiu (2019), the road construction industry contributed 5.6% to the country's GDP in 2019, an increase of 1.2% from 2016. These figures imply that the road construction industry is an integral part of the country's national output because it contributed to a sizeable portion of the country's Gross Domestic Product. Moreover, as stated by Gu and Qiu (2019), the road construction industry necessitates the apparent need to generate necessary products for public infrastructure as well as private physical structure to ensure that there is ease for various activities such as commerce, services, utilities, and development of other industries.

Despite the relationship between project management practices and sustainability of selected road projects, there is still no certain consensus of the impact of project management practices on the sustainability of the road projects. The empirical studies conducted locally are still inconclusive as their findings differ in a wide range. For instance, a study by Choge and Muturi (2014) was aimed to examine the factors affecting adherence to cost estimates of KeNHA Road projects. The variables considered in this study were summed up to design variation and contractor experience. As a result, the study established that poor planning, ground conditions, and unrealistic initial requirements were significant determinants of cost adherence. However, the study did not consider the emerging trend of digitization in road construction projects and how they would impact on sustainability.

Despite the significant efforts the Government of Kenya (GoK) continues to make in the road construction industry, Macharia (2016) states that approximately 55% of the road construction projects in Kenya continues to experience a myriad of challenges such as ineffective planning, delay in sub-contractor works, and poor communication and coordination which affects their completion within the stipulated time hence, incurring cost overruns and failure to meet the sustainability objectives. Like the study of Gitau (2015), this study too did not point out the role of stakeholder involvement in sustainability of road construction projects.

Even though the reviewed studies highlight factors determining project sustainability, the studies are specific to certain areas which includes planning, risk management, communication, coordination and project funding among others. There is still a gap in understanding how stakeholder engagement practices can contribute to sustainable road construction projects. This includes investigating effective strategies for engaging stakeholders at various project stages to ensure their involvement and support in achieving sustainability objectives, such as minimizing environmental impacts, promoting social inclusivity, and enhancing

economic benefits. In addition, exploring the role of emerging technologies and innovations in promoting sustainable project management practices in road construction is an important research area. This could involve studying the adoption and impact of technologies like information management system, construction software, and digital tools used to coordinate communication in enhancing project management practices and sustainability outcomes. In this premise, this research study sought to examine how project management practices such as managerial skills, resource allocation, stakeholder involvement, and technology resource influence the sustainability of selected road construction projects in Kiambu County, Kenya.

Research Objectives

The overall objective of this research study was to establish the effect of project management practices on sustainability of selected roads of selected roads in Kiambu County, Kenya. The research study sought to fulfil the following specific objectives:

- To determine the effect of managerial skills and sustainability of selected road projects in Kiambu county, Kenya.
- To evaluate the relevance of resource allocation and sustainability of selected road projects in Kiambu county, Kenya.
- To explore the role of stakeholder involvement and sustainability of selected road projects in Kiambu county, Kenya.
- To establish influence of technology resource and sustainability of selected road projects in Kiambu county, Kenya.

LITERATURE REVIEW

Empirical Literature Review

Chepkemoi (2020) conducted a research study to examine the influence of project management skills on performance of road construction projects in Machakos County, Kenya. The study adopted descriptive research design and a target population of 135 contractors who were involved in various construction projects in Machakos County. The study utilised secondary data and through descriptive analysis, it was established that there is a strong correlation between project management skills and on performance of road construction projects in Machakos County. The findings of Chepkemoi (2020) are relevant to this study as it aims to establish the role of managerial skills on sustainability of road projects in Kiambu County.

A similar research study by Mucheke and Nyang'au (2019) was bent towards establishing the factors influencing performance of road construction projects in Nairobi City County, Kenya. The study adopted a descriptive research methodology, and the 72 firms working on road building projects in Nairobi City County were the study's target population. Data collecting methods included the use of questionnaires. Using both descriptive and inferential statistics, the study established that project management competence has a significant and strong positive correlation on how well road construction projects perform because managers who are competent increase the efficacy and efficiency of the projects they lead. This finding implies that proper project management skills are essential for the performance and sustainability of road projects.

A similar study by Elmezain et al. (2021) was aimed to evaluate the influence of project manager's skills and age on construction projects success in Egypt. This study used a quantitative research design to collect data from 400 project managers in five well-known construction businesses in Cairo, Egypt, utilizing survey questionnaires. The components of a project manager's talents, that is, conceptual, technical, human, and political skills; and project success dimensions: cost, schedule, and quality were ranked using descriptive statistics and the Relative Importance Index (RII). The influence of project managers' abilities on project success was determined using multiple regression analysis, whereas the association between project manager's age and project success was investigated using simple linear regression. This study established that project success is dependent on a diverse collection of project management skills, which includes

conceptual, technical, political, and human skills. Furthermore, this study noted that, it is critical to distinguish between project manager age and experience, and not to use age as a determining factor in project success.

A similar study was conducted by Abdi (2020) to examine the effect of resource management practices on the performance of road infrastructure projects in Kenya with reference to Wajir County. In this study, a descriptive survey design was used. The goal was to reach 193 project stakeholders, including 5 county officials from the County Transport and Infrastructure Department, 141 members of the project management committee, who were involved in the county government's 47 major road projects in the Wajir North, Wajir East, and Wajir South sub counties, as well as all county-wide projects from 2013 to 2017, and 47 project managers. Stratified random sampling was used to choose the sample. Primary data was collected using semi-structured questionnaires. Using multiple linear regression, the study established that there is an association between resource management practices and the performance of road infrastructure projects in Wajir County. The effects of resource planning, scheduling, allocation, and monitoring on project performance were shown to be favourable and significant. A fundamental benefit of resource planning, according to the study, is that it aids organizations in efficiently completing job descriptions. Successful resource scheduling enables you to tackle difficulties connected to resource availability and task efficiency in a variety of ways. Project managers can plan ahead of time to allocate resources to the work and effectively manage them with efficient resource allocation.

A study conducted by Kabiti and Kikwatha (2022) delved on the influence of project planning practices on performance of KeRRA Road construction projects in Meru County, Kenya. The study adopted descriptive research design and a population target of 203 employees working on road construction projects in Meru County. Primary data was collected through structured questionnaires and interview schedules. Using descriptive statistics and inferential analysis, the scholars established that there is a significant effect of project resource, scope planning, schedule, and communication on the performance of KeRRA road construction projects in Meru County. Based on these findings, one of the recommendations of the research study was the need for close monitoring of individual and total expenses of various project packages. The research by Kabiti and Kikwatha (2022) is in tandem with research study as it aims to evaluate the relevance of resource allocation and sustainability of selected road projects in Kiambu County, Kenya.

Mandala (2018) conducted a study to investigate the impact of stakeholder involvement in project management on the performance of road construction projects in Siaya County Kenya. The study adopted descriptive research design and cross-sectional survey design. Using semi-structured questionnaires, the scholars collected primary data from 396 respondents who among them were projects managers and residents residing in Bondo Sub-County in Siaya County. Using qualitative and quantitative analyses, the study found that stakeholder involvement in project identification, initiation, planning, implementation, and monitoring and evaluation had a significant influence on the performance of road construction projects in Bondo Sub-County, Siaya County. These findings imply that project managers should make a point to involve stakeholders in the five phases of a project to ensure that there is effective sustainability. These phases include project identification, project initiation, project planning, project implementation, and project monitoring and evaluation. The findings of Mandala (2018) are relevant to this study as it seeks to explore the role of stakeholder involvement and sustainability of selected road projects in Kiambu County, Kenya.

A similar study by Matu et al. (2020) was bent to examine the influence of stakeholder participation in project planning for effective completion of urban road transport infrastructure projects in Kenya. The study adopted correlation and descriptive research

design. The study utilised five-point Likert type scale to collect quantitative data and interview guides to collect qualitative data from 309 respondents. Using correlation and regression analysis, this study established that stakeholder involvement in project planning had a positive and significant impact on the completion of urban road transport infrastructure projects in Kenya. The study recommended that there is an apparent need to enhance training and awareness on participation of project planning.

Ngundo (2018) conducted a study to establish the association of project management practices and implementation of government projects in Machakos County, Kenya. Using descriptive survey design, the study focused on 128 projects implemented by the county government. Structured questionnaires were administered to the respondents to collect primary data for analysis. Using descriptive analysis, the research study established that there is strong positive nexus between project planning, monitoring and evaluation, stakeholder participation, technology and implementation of government projects in Machakos County. Further, the project highly recommended the apparent need to involve and consult stakeholders in all the phases of a project implementation. Sustainability and ownership by the stakeholders should be encouraged for all projects. The research by Ngundo (2018) is in tandem with research study as it aims to explore the role of stakeholder involvement and sustainability of selected road projects in Kiambu County, Kenya. These findings were in tandem with the assertion of Charles and Chang-Richards (2021) who suggested that the performance of a project is directly impacted by the ability of the project manager to establish a strong project commitment through stakeholder endorsement and influence on project plans.

A study conducted by Odhiambo and Paul (2021) was designed to evaluate the impact of project management practices on the sustainability of road projects in Kenya with reference to Kiambu County. A descriptive survey research design was utilised in this study. The target population were junior and senior construction company employees in Kiambu County who had started and completed projects or were in the process of closing them down. Stratified sampling procedure was utilised to determine the sample size for the study, and structured questionnaires were administered to collect the primary data. Using descriptive and inferential statistics, the study established that project technology and innovation had a positive impact on the performance of road projects in Kiambu County. Further, the study recommended project managers should work closely with the IT professionals and experts to keep up with the emerging trends in the technology space.

In a similar fashion, Ngaira and Malenya (2019) conducted a study to establish the influence of technical capacity on county road construction projects performance in Busia County, Kenya. The study used a descriptive survey design and had 123 officers as its primary target population, including prequalified contractors in Busia County, KeRRA officers, KURA officers, local community leaders which among them included youth leaders and ward administrators, area MCAs, contractors' technical staff, government road engineers, technical staff from surveying department, civic education leaders from civic education department, and engineers from national engineering firms. Structured questionnaires were used to gather the data. According to the research study findings, technical ability has a significant impact on how well road construction projects perform. As a result, any advancement in the road contractors' technical capabilities would result in a considerable increase in the performance of road construction projects in Busia County. Further, the study recommended that in order to enhance the quality and effectiveness of county road construction projects, all road contractors, road maintenance personnel, and regulatory authorities associated with county road constructions must possess the necessary technical capacity in road construction and maintenance.

Gachungi (2017) conducted a study to establish the impact of Information and Communication Technology application on management of road projects in Kenya with reference to National Highway Authority. The study adopted descriptive explanatory research design, with the target population being all the staff in KeNHA. The study utilised stratified random sampling to select the 88 respondents. Since the study utilised both primary and secondary data, structured and unstructured questionnaires were administered to the respondents to collect primary data, while secondary data were obtained from the KeNHA public reports for the last five years.

METHODOLOGY

According to Dannels (2018), research design is a framework for achieving specific research objectives by outlining the rationale for data source, collection, and analysis selections. Descriptive research research design was preferred in this study because subjects were typically observed in their natural environment, resulting in accurate and dependable information.

As defined by Story and Tait (2019), target population refers to the accumulated number of persons, objects, or any other subject of concern that is of interest to the researcher because of a common trait and may lead to the gathering of valuable information about phenomena under investigation. According to KeRRA (2021), Kiambu County had 9 completed new road construction projects between 2017 and 2022. These road construction projects included E1531 Kangoo – Kamwangi, Jacaranda Gwa Kairu, Wangige – Nyathuna, Nyathuna – Rironi, Kimende – Kagwe Ruiru River/1, Kimende – Kagwe Ruiru River/2, Kimende – Kagwe Ruiru River/3, Kirangari – Nyathuna, and Wamwangi – ruburi. Since this research study sought to measure sustainability in terms of quality of service, length of service, and road user satisfaction all the aforementioned road construction projects were considered as they were completed between 2019 and 2020. In light of this, the target populations for this research study were 100 employees working in the road construction projects, board members of committees, and community beneficiaries of the 9 road construction projects in the County.

According to Oribhabor and Anyanwu (2019), sample size is the number of items that will be constituted in a research study. For descriptive research, a sample of 10% to 30% of the entire population is considered adequate. To ensure that different strata (projects) of the population were represented in the study, stratified random sampling was adopted. The 100 respondents were chosen using stratified random sampling. Stratified random sampling entails classification of research subjects into sub-groups known as strata then randomly selecting subjects from each stratum (Buntin, 2020). This sampling technique was essential because sub-groups that would otherwise be completely ignored by other sampling approaches due to their small population numbers were included in the sample.

Table 1: Sample Size

Category	Frequency	Percentage
Project Managers	12	12%
Project Team	30	30%
Civil Engineers	12	12%
Structural Engineers	12	12%
County Government Official	12	12%
Members of Local Community	22	22%
Total	**100**	**100%**

Source: Author (2022)

According to Zhou et al. (2018), data collection is the act of gathering information for an inquiry or study, and research instruments are the equipment used to collect data in a research project. As such, this research study utilized questionnaires to collect the research data. As noted by Ibáñez et al. (2018) questionnaires are an essential tool for collecting data in research. Questionnaires were justified for this study because they were cost-effective and efficient technique of gathering information from a large population in a fleeting period of time. They also make coding and analysis of the data obtained more easily. The researcher visited the respondents in person with the help of a research assistant to deliver the surveys.

Data analysis is the process of inspecting, cleansing, transforming, and modelling raw data to discover useful information, draw conclusions, and support decision-making. It involves applying various techniques and methodologies to extract insights from data, identify patterns, detect trends, and make predictions or inferences. The data collected was examined using quantitative methodologies with the help R-Software. Quantitative analysis entailed descriptive statistics, regression analysis, ANOVA test, and correlation analysis. Descriptive analysis summarized and described the data using measures such as mean, standard deviation, range, and proportions.

This study utilized multiple linear regression to estimate the relative effect of each of the four variables in relation to Sustainability of selected road projects. Multiple regressions are a versatile data analysis tool that can be used whenever quantitative variables (the dependant) need to be investigated in connection to other variables. The following will be the regression model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where:

Y – Sustainability of Road Projects

β_0 - Constant Term

X_1 – Managerial Skills

X_2 – Resource Allocation

X_3 – Stakeholder Involvement

X_4 – Technology Resource

β_1, β_2, β_3, and β_4 are the regression coefficients which measure how much the outcome variable changes when the predictor variable changes by one unit. Finally, ε is the random error term that accounts for all other variables that influence the sustainability of road project.

FINDINGS

Inferential analysis in this study encompassed the utilization of correlation analysis, ANOVA, and multiple regression models. These statistical methods were utilized to assess the significance of relationships between sustainability of road projects, managerial skills, resource allocation, stakeholder involvement, and technology resource with a significance level set at 5% (percent). Consequently, the obtained results were employed to test the study's objectives. This research study utilized multiple linear regression analysis to evaluate the significance of relationships between the dependent variables and independent variables at 5% (percent) level of significance. The summary of the model is presented in table 2 below.

Table 2: **Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.753[a]	.567	.564	.699

a. Predictors: (Constant), Technology Resource, Managerial Skills, Resource Allocation, Stakeholder Involvement

Source: Research Data (2023)

The coefficient of correlation R is .753 implying that project management practices had a strong and positive effect on sustainability of road construction projects in Kiambu County, Kenya. The overall regression model appears to be well-suited, as evidenced by the coefficient of determination (R

square) of .567. Furthermore, the adjusted R square value of .564 signifies that 56.4% of the variations in project sustainability was explained in managerial skills, resource allocation, stakeholder involvement, and technology resource, while 43.7% were explained by other factors.

Table 3: Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	**Std. Error**	**Beta**	**t**	**Sig.**
(Constant)	.056	.180		.310	.756
Managerial Skills	.164	.040	.154	4.062	<.001
Resource Allocation	.162	.039	.160	4.197	<.001
Stakeholder Involvement	.442	.046	.419	9.588	<.001
Technology Resource	.211	.049	.173	4.269	<.001

a. Dependent Variable: Sustainability of Road Projects

Source: Research Data (2023)

Based on table above, the coefficients of the regression model are given by the following equation. $Y = 0.056 + 0.154X_1 + 0.160X_2 + 0.419X_3 + 0.173X_4$; Where, Y is Sustainability of Road Projects, X_1 is Managerial Skills, X_2 is Resource Allocation, X_3 is Stakeholder Involvement, and X_4 is Technology Resource.

Based on the above results, managerial skills had a positive and significant effect on sustainability of road projects (β_1 = 0.154, P <0.05). Resource allocation also exhibited a positive and significant effect on sustainability of road projects (β_2 = 0.160, P <0.05). In a similar fashion, stakeholder involvement had a positive and significant effect on sustainability of road projects (β_3 = 0.419, P <0.05). Finally, technology resource also had a positive and significant effect on sustainability of road projects (β_4 = 0.173, P <0.05).

The findings of this research study were in tandem with the findings of Chepkemoi (2020), who established that project management competence has a significant effect on how well road construction projects perform because managers who are competent increase the efficacy and efficiency of the projects they lead. According to Chepng'eno and Kimutai (2021) resource allocation and project planning exhibited a positive and significant relationship with project sustainability. Similarly, Abdi (2020) established that, the effects of resource planning, scheduling, allocation, and monitoring on project performance in Wajir County were shown to be favourable and significant. These findings are in conformity with findings of this research study, which shows that resource allocation exhibit a positive and significant effect on sustainability of road projects. As indicated in this research study, Mandala (2018) also established that stakeholder involvement in project identification, initiation, planning, implementation, and monitoring and evaluation had a significant influence on the performance of road construction projects in Bondo Sub-County. A similar study by Matu et al. (2020) also established that stakeholder involvement in project planning had a positive and significant impact on the completion of urban road transport infrastructure projects in Kenya. Similarly, to the findings of this research, a study by Odhiambo and Paul (2021) also established that project technology and innovation had a positive impact on the performance of road projects in Kiambu County.

CONCLUSIONS AND RECOMMENDATIONS

Managerial skills findings revealed that project team members developed systematic work plans and schedules for the various road construction projects and there was adherence to these work plans and schedules. Furthermore, it was revealed that communication during the road construction projects was done through channels between project team and stakeholders. Finally, it was revealed that prior to undertaking a road construction project, the

project management team conducted resource estimation, budgeting, and formulation of policies and procedures. These managerial skills ensured that road construction projects in Kiambu County are completed within time, budget, and are of quality standard. In light of this, managerial skills had a positive and significant influence on the sustainability of road construction projects in Kiambu County, Kenya. Resource allocation findings revealed that there was proper utilization of road construction project resources. Furthermore, there were adequate physical resources, human resources, and funds allocated to road construction projects in Kiambu County. However, this research study noted that there was mismanagement of these funds. Regardless, resource allocation had a positive and significant effect on the sustainability of road construction projects in Kiambu County.

Stakeholder involvement revealed that there was engagement with project stakeholders throughout the road construction projects. These project stakeholders included sub-contractors, county government officials and local community members. In addition, there were negotiations with these stakeholders with an aim of building consensus prior to commencement of road construction project. To this regard, this research study established that local community members and county government officials influenced decisions made during road construction projects in Kiambu County. As a result, stakeholder involvement ensured that road construction projects in Kiambu County are completed within time, budget, and are of quality standard. In light of this, stakeholder involvement had a positive and significant effect on the sustainability of road construction projects in Kiambu County, Kenya. Finally, technology resource revealed that project managers utilize management information system to coordinate road construction projects, and different software to complete specific tasks. It was also revealed that, project managers utilized digital tools to keep track of project operations, including the capacity to keep up-to-date and structured records and verify that concerns are being resolved or closed on time. Finally, the research study established that digital operations technologies were used by project managers and civil engineers to simplify workflow management and project progress. These technologies ensured that that road construction projects in Kiambu County are completed within time, budget, and are of quality standard. Therefore, technology resource had a positive and significant effect on the sustainability of road construction projects in Kiambu County, Kenya.

This research study concluded that managerial skills have a positive and significant effect on sustainability of road construction projects. Additionally, the study concludes that there was development and adherence to systematic work plans and schedules by project managers which ensured that road construction projects are completed within time, budget, and required quality. The study also concluded that project managers conducted resource estimation, budgeting, and formulation of policies and procedures prior to undertaking any road construction project.

The study concluded that resource allocation has a positive and significant effect on sustainability of road construction projects. This was attributed to adequate allocation of physical resources, human resources, and funds for road construction projects. However, funds allocated for road construction projects were mismanaged hence necessitating the apparent need for accountable utilization of project funds. The study concluded that stakeholder involvement had a positive and significant effect on sustainability of road construction projects. Negotiations with stakeholders to build a consensus ensured that they felt part and parcel of these construction projects. Moreover, through such engagements, they were able to influence certain decisions which ensured that the roads are constructed within time, budget and quality standard.

Technology resources had a positive and significant effect on sustainability of road construction projects. This was attributed to utilization of management

information system to coordinate road construction projects, utilization of different software to complete specific tasks, and utilization of digital tools to keep track of project operations which ensured that they were up to date with all the issues raised during the ongoing of the projects. However, utilization of these technologies should not be limited to specific users.

This research study recommends that road construction project management should prioritize effective resource allocation, as it was established to have the most significant effect on both project quality and sustainability. Ensuring adequate resource allocation is crucial to facilitate the construction of high-quality, long-lasting roads within budget and time. This research study also recommends that project managers should develop and adhere to systematic work plans and schedules, as it was established that they have an impact on project quality, time and schedule. In addition, it is essential to conduct resource estimation, budgeting, and formulation of policies and procedures prior to commencing a road construction project. This research study recommends that project managers and their team members should prioritize utilization of latest technologies in road construction projects, as it was established that technology resources can significantly influence the quality of the project and completion within time and budget.

REFERENCES

Abdi, A. A. (2020). *Resource Management Practices and The Performance of Road Infrastructure Projects in Wajir County, Kenya* (Doctoral dissertation, Kenyatta University).

Ahmad, I., & Ahmad, S. (2018). Multiple skills and medium enterprises' performance in Punjab Pakistan: A pilot study. *The Journal of Social Sciences Research, Special*, (4), 44-49.

Almanasreh, E., Moles, R., & Chen, T. F. (2019). Evaluation of methods used for estimating content validity. *Research in social and administrative pharmacy*, *15*(2), 214-221.

Alvarenga, J. C., Branco, R. R., Guedes, A. L. A., Soares, C. A. P., & e Silva, W. D. S. (2019). The project manager core competencies to project success. *International Journal of Managing Projects in Business*.

Atmowardoyo, H. (2018). Research methods in TEFL studies: Descriptive research, case study, error analysis, and R & D. *Journal of Language Teaching and Research*, *9*(1), 197-204.

Aziz, R. F., & Abdel-Hakam, A. A. (2016). Exploring delay causes of road construction projects in Egypt. *Alexandria Engineering Journal*, *55*(2), 1515-1539.

Barykina, Y. (2019, November). Risks of long-term leasing transactions for construction industry development. In *IOP Conference Series: Materials Science and Engineering* (Vol. 667, No. 1, p. 012011). IOP Publishing.

Buntin, G. D. (2020). Developing a primary sampling program. In *Handbook of sampling methods for arthropods in agriculture* (pp. 99-115). CRC Press.

Charles, S. H., & Chang-Richards, A. (2021). New success factors for construction projects: a systematic review of post-2004 literature. *Construction Innovation*.

Chepkemoi, J. (2020). *Influence of project management skills on performance of road construction projects in Machakos County, Kenya* (Doctoral dissertation, University of Nairobi).

Chepng'eno, J., & Kimutai, G. (2021). Planning and resource allocation as project integrated management skills on sustainability of road projects. *International Academic Journal of Information Sciences and Project Management*, *3*(6), 443-460.

Choge, J. K., & Muturi, W. M. (2014). Factors affecting adherence to cost estimates: A survey of construction projects of Kenya National Highways Authority. *International Journal of Social Sciences and Entrepreneurship*, 1(11), 689-705.

Creedy, G. D., Skitmore, M., & Wong, J. K. (2010). Evaluation of risk factors leading to cost overrun in delivery of highway construction projects. *Journal of construction engineering and management*, *136*(5), 528-537.

Dannels, S. A. (2018). Research design. In *The reviewer's guide to quantitative methods in the social sciences* (pp. 402-416). Routledge.

De Schepper, S., Haezendonck, E., & Dooms, M. (2015). Transaction cost analysis of public infrastructure delivery. *International Journal of Managing Projects in Business*.

Durdyev, S., & Hosseini, M. R. (2019). Causes of delays on construction projects: a comprehensive list. *International Journal of Managing Projects in Business*.

Elmezain, M., Baduruzzaman, W. H. W., & Khoiry, M. A. (2021). The impact of project manager's skills and age on project success. *Brazilian Journal of Operations & Production Management*, *18*(4), 1-16.

Fakunle, F. F., & Fashina, A. A. (2020). Major delays in construction projects: A global overview. *PM World Journal, IX*, 1-15.

Fashina, A. A., Omar, M. A., Sheikh, A. A., & Fakunle, F. F. (2021). Exploring the significant factors that influence delays in construction projects in Hargeisa. *Heliyon*, *7*(4), e06826.

Gachungi, R. W. (2017). *Influence Of Information And Communication Technology Application On Management Of Road Projects In Kenya* (Doctoral dissertation, University of Nairobi).

Gehring, D. R. (2007). Applying traits theory of leadership to project management. *Project Management Journal*, *38*(1), 44-54.

Gitau, L. M. (2015). *The effects of risk management at project planning phase on performance of construction projects in Rwanda*. (Master of Science in Project Management Thesis, Jomo Kenyatta University of Agriculture and Technology).

Gituro, W., & Mwawasi, S. (2017). Time and cost overruns in road construction projects in Kenya under Kenya National Highways Authority. *ORSEA JOURNAL*, *6*(1).

Gu, J., & Qiu, S. (2019). The Belt and Road Initiative and Africa's Sustainable Development: A Case Study of Kenya. *IDS Bulletin*, *50*(4).

Harrison, J. D., Auerbach, A. D., Anderson, W., Fagan, M., Carnie, M., Hanson, C., & Weiss., R. (2019). Patient stakeholder engagement in research: a narrative review to describe foundational principles and best practice activities. *Health Expectations*, *22*(3), 307-316.

Hassan, A. I. (2017). *Evaluation of the performance of donor funded road construction projects in Kenya* (Doctoral dissertation, JKUAT-COHRED).

Ibáñez, V., Silva, J., & Cauli, O. (2018). A survey on sleep questionnaires and diaries. *Sleep medicine*, *42*, 90-96.

Kabiti, F. K., & Kikwatha, R. W. (2022). Influence of Project Planning Practices on Performance of KeRRA Road Construction Projects in Meru County, Kenya. *International Research Journal of Business and Strategic Management,* 4(3).

Keiner, M. (2005). History, definition (s) and models of sustainable development. *Eidgenössische Technische Hochschule (Zürich) Institut für Raum-und Landschaftsentwicklung*.

Kerzner, H. (2018). *Project management best practices: Achieving global excellence*. John Wiley & Sons.

Macharia, V.W. (2016). *Factors influencing completion of road construction projects in Embakasi, Nairobi county Kenya*. (Unpublished MBA Thesis, University of Nairobi).

Mandala, E. (2018). *Influence of stakeholder's involvement in project management on the performance of road construction projects in Kenya: a case of Bondo sub county, Siaya county* (Doctoral dissertation, University of Nairobi).

Martens, M. L., & Carvalho, M. M. (2017). Key factors of sustainability in project management context: A survey exploring the project managers' perspective. *International Journal of Project Management*, *35*(6), 1084-1102.

Matu, J., Kyalo, D., Mbugua, J., & Mulwa, A. (2020). Stakeholder Participation in Project Planning: Prerequisite to Effective Completion of Urban Road Transport Infrastructure Projects in Kenya. *Journal of Building Construction and Planning Research*, *8*(1), 73

Mishra, P., Pandey, C. M., Singh, U., Gupta, A., Sahu, C., & Keshri, A. (2019). Descriptive statistics and normality tests for statistical data. Annals of cardiac anaesthesia, 22(1),

Mongina, C., & Moronge, M. (2021). Project management practices and performance of road construction projects in Nairobi City County, Kenya. *The Strategic Journal of Business & Change Management,* 8 (1), 545 – 562.

Moradi, S., Kähkönen, K., & Aaltonen, K. (2020). Comparison of research and industry views on project managers' competencies. *International Journal of Managing Projects in Business*.

Mucheke, J., & Nyang'au, S. P. (2019). Factors Influencing Performance of Road Construction Projects in Nairobi City County, Kenya. *International Journal of Entrepreneurship and Project Management,* Vol.4, Issue 2, pp 85-103

Musau, P. M., & Kirui, C. (2018). Project management practices and implementation of government projects in Kenya, case of Machakos County government. *International Academic Journal of Information Sciences and Project Management*, *3*(2), 58-79.

Ngaira, A. M., & Malenya, A. (2019). Influence of technical capacity on county road construction projects performance in Busia County, Kenya. *The Strategic Journal of Business & Change Management*, 6 (4), 971 – 979

Ngundo, P. N. (2018). *Project Management Practices and Implementation of Government Projects in Machakos County, Kenya* (Doctoral dissertation, Kenyatta University).

Olukotun, G. A. (2008). Achieving project sustainability through community participation. *Journal of Social Sciences*, *17*(1), 21-29.

Oribhabor, C. B., & Anyanwu, C. A. (2019). Research sampling and sample size determination: a practical application. *Journal of Educational Research (Fudjer)*, *2*(1), 47-57.

Owuori, P. J., Ngala, M., & Obwatho, S. (2020). Project Management Practices, Corporate Governance and Sustainability: A Critical Literature Review. *Journal of Human Resource & Leadership*, *4*(2).

Rajput, B., Agarwal, A., & Yadav, S. (2020). Risk factors causing cost overrun in highway construction projects. *IUP Journal of Management Research*, *19*(3), 7-22.

Seboru, M. A. (2015). An investigation into factors causing delays in road construction projects in Kenya. *American Journal of Civil Engineering*, 3(3), 51-63.

Şimşit, Z. T., Günay, N. S., & Vayvay, Ö. (2014). Theory of constraints: A literature review. *Procedia-Social and Behavioral Sciences*, *150*, 930-936.

Stanitsas, M., Kirytopoulos, K., & Leopoulos, V. (2021). Integrating sustainability indicators into project management: The case of construction industry. *Journal of Cleaner Production*, *279*, 123774.

Stanitsas, M., Kirytopoulos, K., & Leopoulos, V. (2021). Integrating sustainability indicators into project management: The case of construction industry. *Journal of Cleaner Production*, *279*, 123774.

Story, D. A., & Tait, A. R. (2019). Survey research. *Anesthesiology*, *130*(2), 192-202.

Suprayoga, G. B., Bakker, M., Witte, P., & Spit, T. (2020). A systematic review of indicators to assess the sustainability of road infrastructure projects. *European Transport Research Review*, *12*(1), 1-15.

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in science education*, *48*(6), 1273-1296.

Tam, C., da Costa Moura, E. J., Oliveira, T., & Varajão, J. (2020). The factors influencing the success of on-going agile software development projects. *International Journal of Project Management*, *38*(3), 165-176.

Teichert, R. (2019). Digital transformation maturity: A systematic review of literature. *Acta universitatis agriculturae et silviculturae mendelianae brunensis*.

Truong, T. M. T., Friedrich, H., & Charoenngam, C. (2020). Success factors for financial sustainability of toll road projects: empirical evidence from China. *Transportation Research Procedia*, *48*, 1848-1860.

Urbinati, A., Landoni, P., Cococcioni, F., & De Giudici, L. (2020). Stakeholder management in open innovation projects: a multiple case study analysis. *European journal of innovation management*.

Vrchota, J., Řehoř, P., Maříková, M., & Pech, M. (2020). Critical success factors of the project management in relation to industry 4.0 for sustainability of projects. *Sustainability*, *13*(1), 281.

Wolff, C., Mikhieieva, O., & Nuseibah, A. (2021). Competences and the digital transformation. In *Project Management and Engineering Research* (pp. 221-234). Springer, Cham.

Yuen, K. F., Wang, X., Ma, F., Lee, G., & Li, X. (2019). Critical success factors of supply chain integration in container shipping: an application of resource-based view theory. *Maritime Policy & Management*, *46*(6), 653-668.

Zhou, D., Yan, Z., Fu, Y., & Yao, Z. (2018). A survey on network data collection. *Journal of Network and Computer Applications*, *116*, 9-23.

Zuo, J., Zhao, X., Nguyen, Q. B. M., Ma, T., & Gao, S. (2018). Soft skills of construction project management professionals and project success factors: A structural equation model. *Engineering, Construction and Architectural Management*.