



International Journal
of Project Management Studies
and Research

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**INFLUENCE OF PROJECT PLANNING ON THE
PERFORMANCE OF SOLID WASTE MANAGEMENT
PROJECTS IN NAIROBI CITY COUNTY, KENYA**

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Article History:

Published on:1/14/2026

DOI:

<https://doi.org/10.5281/zenodo.18248850>

How to cite in APA format:

Kimani, B. M., & Tumuti, J. (2026). INFLUENCE OF PROJECT PLANNING ON THE PERFORMANCE OF SOLID WASTE MANAGEMENT PROJECTS IN NAIROBI CITY COUNTY, KENYA. *International Journal of Project Management Studies and Research*, 3(1),1-20.

<https://doi.org/10.5281/zenodo.18248850>

Abstract:

Purpose: This study sought to examine the influence of project planning on the performance of solid waste management projects in Nairobi City County, Kenya, with particular focus on the role of Project Management Information Systems (PMIS) in enhancing planning effectiveness and project outcomes.

Methodology: A descriptive and correlational research design was employed. A census approach targeted 156 respondents

drawn from five major solid waste management projects within Nairobi City County, achieving a 91% response rate. Primary data were collected using structured questionnaires and analyzed using descriptive statistics and multiple linear regression with the aid of SPSS.

Findings: The results revealed that project planning has a statistically significant and positive influence on project performance ($\beta = 0.324$, $p < 0.001$). Project planning accounted for 57.7% of the variation in solid waste management project performance ($R^2 = 0.577$). While PMIS was found to be effective in document organization and milestone tracking, notable deficiencies were identified in change log maintenance and user competency.

Unique Contribution to Theory, Practice and Policy: The study contributes to systems theory by empirically demonstrating the integrative role of project planning and PMIS in complex public service projects. Practically, it provides evidence-based guidance for improving planning processes in solid waste management projects. From a policy perspective, the findings inform county governments on the need to institutionalize robust project planning frameworks, capacity building, and monitoring mechanisms to enhance service delivery.

Keywords: *Project Planning, Project Performance, Solid Waste Management, PMIS, Nairobi City County*

JEL Codes: O22, Q53, H54

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1. INTRODUCTION

Background of the Study

The critical role of solid waste management is to effectively collect, transport, treat, and dispose of waste from generation points to final disposal sites. Accordingly, good performance of solid waste management projects is gauged on their convenient provision of reliable, adequate, and sustainable waste management services to urban populations. In their mission to meet waste management demands effectively, these projects encounter various challenges. The main challenge that is usually overlooked is that global urbanization has led to exponential increases in solid waste generation, with waste volumes expected to rise by 70% by 2050 according to the World Bank (Kaza et al., 2018). Waste management inefficiency is aggravated further by inadequate planning during project implementation, which is nevertheless within the control of project managers and implementing agencies. In Nairobi City County particularly, solid waste generation has escalated to approximately 3,000 tonnes daily, yet only 45% of this waste is collected and properly managed (Mberu et al., 2021). The remaining 55% is either dumped illegally, burned in open spaces, or left to accumulate in informal settlements, creating significant public health and environmental hazards. Comparatively, global waste collection rates in urban areas average 75%, with developed nations achieving rates above 90% (Kaza et al., 2018). This disparity highlights the performance gaps in Nairobi's solid waste management projects.

Urban waste management challenges which affect Nairobi City County are common globally. Cities in developing countries struggle with inadequate infrastructure, limited financial resources, weak institutional frameworks, and poor project planning mechanisms (Guerrero et al., 2013). In Kenya, solid waste management projects are typically implemented through county governments following devolution in 2013, with Nairobi City County bearing the responsibility for waste collection, transportation, and disposal within its jurisdiction (Mberu et al., 2021). However, many waste management projects in Nairobi suffer from poor planning, resulting in project delays, cost overruns, incomplete facilities, and suboptimal service delivery. The use of Project Management Information Systems has emerged as a critical tool for enhancing project planning and performance across various sectors. PMIS platforms enable project managers to develop comprehensive project plans, schedule activities systematically, track changes effectively, and monitor progress in real-time (Kerzner, 2022). In the context of solid waste management, PMIS can facilitate the planning of collection routes, scheduling of waste transportation, tracking of equipment deployment, and monitoring of disposal operations. Despite these potential benefits, the adoption and effective utilization of PMIS in solid waste management projects in Nairobi remains limited.

Poor performance of solid waste management projects affects the entire city, mainly due to inadequate waste collection coverage, inefficient resource utilization, and environmental degradation. Waste collection coverage in Nairobi stands at approximately 45%, which is very low

compared to other African cities such as Cape Town (90%), Kigali (85%), and Johannesburg (80%) (UN-Habitat, 2020). This poor coverage results in illegal dumping, blocked drainage systems, air and water pollution, and proliferation of disease vectors.

Strategy Implementation

Strategy implementation is the third step in strategic management practices. It involves taking actual steps toward resourcing the organizational structure and equipping personnel with skills, tools, and capabilities that will enable the organization to attain sustainable competitive advantage. In that regard, solid waste management projects in Nairobi City County have to equip, motivate, and engage all internal stakeholders in order to enable them to implement strategies most effectively and propel them to higher project performance. Effective strategy implementation requires the integration of project planning tools, clear communication channels, adequate resource allocation, and systematic monitoring and evaluation mechanisms.

Performance and its Measurement

Project performance is a multidimensional aspect of project management. The definition of performance has remained fluid (Ogolla, 2020), but in project management, performance can be considered as a comparative measure of a project's success in delivering intended outputs within specified time, cost, and quality parameters. Project success is gauged on timely completion, cost efficiency, stakeholder satisfaction, and achievement of intended outcomes (Iqbal et al., 2024). Non-financial success is based on service coverage, environmental impact, community acceptance, and sustainability, most of which are subjective, qualitative metrics (Kairu, 2022). Performance measurements are both inward-looking using longitudinal data to track progress over time and outward-looking using cross-sectional data for benchmarking with other projects to appraise effectiveness. The balanced scorecard is a multidimensional measuring tool that facilitates holistic performance measurements across multiple dimensions (Senaji & Ogolla, 2017).

Statement of the Problem

Nairobi City County is experiencing a persistent solid waste management (SWM) crisis that poses serious environmental, public health, and socio-economic risks. The county generates approximately 2,400 tons of solid waste daily, a volume projected to increase significantly by 2030 due to rapid urbanization, population growth, and changing consumption patterns (Kaza et al., 2022; United Nations Human Settlements Programme [UN-Habitat], 2023). Despite numerous county-led and donor-funded SWM projects, performance outcomes remain unsatisfactory, characterized by cost overruns, schedule delays, and limited stakeholder satisfaction, particularly in informal settlements (World Bank, 2021). These challenges suggest fundamental weaknesses in project planning practices.

Recent studies emphasize that effective project planning including clear scheduling, resource allocation, risk analysis, and stakeholder coordination is a critical determinant of project performance (Kerzner, 2022; Too & Weaver, 2020). Moreover, empirical evidence indicates that the use of integrated project planning tools such as Project Management Information Systems (PMIS) enhances efficiency, transparency, and decision-making in public sector projects (Macharia & Kwasira, 2023; Muhammad et al., 2024). However, within Nairobi City County, empirical research explicitly linking project planning practices to the performance of SWM projects remains limited. The lack of context-specific evidence constrains informed policy decisions and undermines investments aimed at improving SWM project outcomes. Consequently, this study seeks to examine the influence of project planning on the performance of solid waste management projects in Nairobi City County, Kenya.

Purpose of the Study

The purpose of the study was to determine the extent to which project planning influences the performance of solid waste management projects in Nairobi City County, Kenya.

Research Hypothesis

H01: Project planning does not significantly influence the performance of solid waste management projects in Nairobi City County, Kenya.

2.0 LITERATURE REVIEW

System Theory

Ludwig von Bertalanffy first defined the concept of this theory in 1940 as a technique for the analysis of complex systems of different kinds throughout various disciplines (Whitchurch & Constantine, 1993). The theory lays out a paradigm that every system component supports the others in their quest for a common goal. System theory interprets the system as a whole, not as mere parts brought together. The significance of the interaction and relationship among those constituent parts is highlighted, and it is suggested that the system's behavior is a result of these dynamics. For example, changing one part can create a chain of reactions that will influence the entire system, thus illustrating the complex dependencies that exist. However, Wamsler et al. (2021) were of the opinion that the system theory approach sometimes focuses so much on project internal factors that it overlooks external ones.

System theory has found its application in various disciplines like engineering, biology, psychology, economics, sociology, and especially project management, among others (Metcalf et al., 2021). The theoretical framework is an effective tool for the exploration of complicated structures, the detection of behavior patterns, and the formulation of tactics for enhancing the performance of systems in all domains. Systems theory has an immense influence on project

management by allowing project teams to identify the interconnection of project components like monitoring and evaluation, resource allocation, risk management, and team communication inputs, thus forming a complete whole. From such a view, project managers can efficiently assess and control the complicated interactions among project elements (Matusik et al., 2019).

The utilization of system theory in waste management projects in Nairobi implies that resource management and monitoring and evaluation practices must be top-notch to yield desired results. It also points to the feedback loops that make adjustments to projects possible and thus enhance their responsiveness to changing conditions. PMIS makes it possible for project groups to monitor resource consumption and evaluate the performance of solid waste management activities through continuous data analysis. The components of PMIS are particularly important in Nairobi where resources are limited and the effectiveness of waste collection and processing plays a crucial role in determining the state of public health and the environment.

Empirical Review

Project Planning Capability and Project Performance

Project planning is not only the most necessary element in project management but also the main contributor to project success. A number of researchers (Stanitsas et al., 2021; Pan & Zhang, 2021) support the position that substantial and meticulous planning at the initial stage greatly increases the chances of success of the project. Sithambaram et al. (2021) point out that planning and scheduling done in an efficient manner have a big impact on the success of infrastructure projects, as they lead to the efficiency of processes and the alignment of goals. It follows that project managers must do proper and strategic initial planning if they are to realize their project objectives effectively.

In the year 2020, Ondiek performed a study which aimed at evaluating the impact of project planning on the performance of road construction projects in Uasin Gishu County, Kenya. The study looked into the specific ways that planning factors like time, cost, scope, and risk management contributed to or detracted from project outcomes. The descriptive research design was used in the study, which targeted a sample consisting of forty-nine individuals who were actively involved in fifteen government-funded road construction projects ongoing in the county. The census approach was adopted in the study which involved project managers from each road project, thus having a total of fifty-one respondents. Data collection was done through a questionnaire consisting of both structured and semi-structured questions, thus representing the collection of primary data. The data was subjected to regression analysis. A very strong positive linkage between project success and the four fundamental planning dimensions of time, scope, cost, and risk was established. Together, these factors accounted for 83.4% of the differing results in project success. However, the focus of this study was solely on road construction projects, which made its conclusions less widely applicable to other sectors such as waste management.

Irfan et al. (2021) carried out another study which looked into the impact of project planning and project manager competency on project success within the framework of the Project Management Institute. The authors distributed a questionnaire to two hundred sixty project engineers. The analysis was based on partial least squares structural equation modeling. The results indicated that both planning and managerial competency matter significantly in project success, with more significant impact coming from the planning side. Nonetheless, the study did not address the issue of how diversity regarding the gender, age, and professional backgrounds of project team members affects project planning efficacy and results.

The study by Iqbal and coworkers (2024) tried to find out the effects of project planning on the success of a project. The team surveyed 263 project members as the source of the data. The PLS model equation was generated with the help of SmartPLS software. The study concluded that project planning had a considerable and beneficial impact on project success. Besides, risk management and safety climate were established as partial mediators of this relationship. Nevertheless, the researchers recognized a deficiency in empirical literature addressing the connection between project planning and project success in the context of developing countries, particularly in the waste management sector.

Tuyishime and Nyambane (2021) likewise looked into the contribution of planning to project performance in Rwanda's public institutions. A causal research design was applied. The research was conducted with 106 employees, who were selected according to Yamane's formula. A structured, validated, and pre-tested questionnaire was used to collect the data. The researchers used SPSS Version 21 for conducting descriptive and inferential analyses. It was found by the researchers that one unit increase in the formulation of objectives, targets, and key performance indicators resulted in project performance increase by 0.183 units. The correlation and regression analyses verified the presence of a strong and positive linear relationship between the main variables. However, the theoretical basis of the study was rather limited, as it concentrated solely on project performance without including theories related to the independent planning variables.

Recent studies on waste management projects have emphasized the importance of comprehensive planning. Mberu et al. (2021) examined solid waste management in Nairobi's informal settlements and found that projects with detailed planning frameworks achieved better coverage and sustainability outcomes. Similarly, Kinobe et al. (2015) investigated factors influencing waste management performance in East African cities and identified planning inadequacies as a major constraint to effective service delivery.

3.0 RESEARCH METHODOLOGY

The study adopted a positivist research philosophy to enable objective measurement and analysis of relationships between variables. A descriptive and correlational research design was employed to generate both quantitative and qualitative insights and to determine the extent of association

between project management practices and project performance. The target population comprised five major solid waste management projects in Nairobi City County, involving 156 respondents drawn from county executives, site employees, regulatory agencies, and development partners. A census approach was used to capture data from all respondents. Data were collected using a semi-structured questionnaire with Likert-scale and open-ended items. Data analysis involved descriptive statistics and multiple linear regression using SPSS to assess the influence of project planning, communication, resource management, and monitoring and evaluation on project performance. Ethical considerations, including research approvals, informed consent, confidentiality, and voluntary participation, were strictly observed throughout the study.

4.0 RESEARCH FINDINGS AND DISCUSSION

Response Rate

In total, 156 questionnaires were distributed, with 142 being completely filled in and returned, which represents a response rate of 91%.

Table 1: Response Rate

Category	Target Population	Actual Response	Response Rate (%)
County Executives	25	23	92.0%
Site Employees	78	72	92.3%
Regulatory Agencies	32	28	87.5%
Development Partners	21	19	90.5%
Total	156	142	91.0%

Source: Field Survey Data (2025)

This response rate is categorized as excellent and is well over the 80% threshold that is considered very good in survey research (Babbie, 2020). The reliability and generalizability of the results are strengthened by the high response rates, as they help to reduce the impact of nonresponse bias (Meterko et al., 2015). Singleton and Straits (2010) mention that a response rate above 70% in academic research is sufficient; this, in turn, emphasizes the present study's rate as adequate. The high response rate can be attributed to the use of a census approach, follow-up reminders, and the relevance of the research topic to the respondents' professional responsibilities. The distribution across different categories of respondents ensured diverse perspectives were captured, enhancing the validity of the findings.

Descriptive Analysis

Descriptive Statistics for Project Planning

Descriptive statistics for project planning items are summarized in Table 2.

Table 2: Descriptive Statistics for Project Planning

Variable	SD	D	NS	A	SA	Mean	Std. Deviation
1. The PMIS ensures the project plan document is well-organized and easily accessible to all stakeholders.	2.1%	4.9%	8.5%	39.4%	45.1%	4.21	1.02
2. Using a PMIS facilitates the creation of a detailed and accurate project plan document.	2.8%	4.9%	10.6%	40.1%	41.5%	4.13	1.04
3. The PMIS enables efficient tracking of progress against the activities schedule.	3.5%	5.6%	8.5%	41.5%	40.8%	4.11	1.03
4. The PMIS allows for real-time updates to the project plan document, ensuring it reflects the latest project information.	5.6%	9.2%	15.5%	41.5%	28.2%	3.78	1.13
5. The activities schedule generated by the PMIS provides clear and actionable timelines for project tasks.	7.0%	10.6%	17.6%	38.0%	26.8%	3.67	1.16
6. Updates and adjustments to the activities schedule are promptly communicated through the PMIS, keeping the team informed.	8.5%	11.3%	14.1%	40.1%	26.1%	3.64	1.19
7. The PMIS maintains a detailed and accurate change log, capturing all modifications to the project scope, schedule, and resources.	26.1%	29.6%	25.4%	13.4%	5.6%	2.39	1.21
8. Using a PMIS for project planning enhances decision-making by providing real-time data on the project plan	5.6%	8.5%	15.5%	41.5%	28.9%	3.8	1.15

document, activities schedule, and change log.							
9. I have adequate skills and confidence to use all planning features of the PMIS effectively.	28.2%	26.1%	23.2%	15.5%	7.0%	2.43	1.25
10. Management encourages and reviews the use of PMIS tools during project planning.	9.2%	10.6%	14.1%	40.1%	26.1%	3.63	1.18
11. The PMIS operates reliably without frequent downtime or data loss.	5.6%	8.5%	14.1%	41.5%	30.3%	3.83	1.14
12. I intend to continue using the PMIS for planning future projects.	3.5%	6.3%	11.3%	40.8%	38.0%	4.04	1.06
Aggregate Mean Score						3.64	1.13

N = 142

SD = Strongly Disagree; D = Disagree; NS = Not Sure; A = Agree; SA = Strongly Agree

Source: Survey Data (2025)

The average scores for individual items ranged between 2.39 and 4.21, which showed different attitudes of the participants towards the PMIS planning features' effectiveness. The item which received the highest score (M = 4.21, SD = 1.02) "the PMIS ensures the project plan document is well-organized and easily accessible to all stakeholders" showed that the majority opinion is that the system really does enhance organization and accessibility of planning documents effectively. This finding is particularly significant for solid waste management projects in Nairobi, where coordination among multiple stakeholders including county government officials, waste collection contractors, recycling entities, and community representatives is essential for effective service delivery.

Besides, the respondents were almost fully united in their opinion that "using a PMIS facilitates the creation of a detailed and accurate project plan document" (M = 4.13, SD = 1.04) and "the PMIS enables efficient tracking of progress against the activities schedule" (M = 4.11, SD = 1.03). Thus, they showed the PMIS's strengths in terms of reliability and planning support. The same results were obtained by Stanitsas et al. (2021), who observed that PMIS tools, in turn, build up project transparency and communication by improving coordination and document accessibility. In the context of waste management, this translates to better coordination of waste collection schedules, tracking of vehicle deployment, monitoring of disposal site operations, and management of maintenance activities.

On the other hand, the scores with the lowest mean were assigned to "the PMIS maintains a detailed and accurate change log..." (M = 2.39, SD = 1.21) and "I have adequate skills and confidence to use all planning features of the PMIS effectively" (M = 2.43, SD = 1.25) respectively. This disagreement is a signal that two factors, documentation management and user competence, remain critical issues in PMIS adoption. Previous research showed that limited user training, inadequate technical capacity, and weak change management processes are often the main factors that prevent the full utilization of PMIS functions (Ondiek, 2020). The low score on change log maintenance suggests that waste management projects in Nairobi struggle with documenting and tracking modifications to project scope, schedules, and resource allocations. This gap can lead to confusion, disputes, accountability challenges, and difficulties in learning from project experiences.

The inadequate skills and confidence in using PMIS features (M = 2.43, SD = 1.25) highlight a significant capacity gap among project personnel. This finding aligns with Iqbal et al. (2024) who noted that the effectiveness of planning tools depends heavily on user competency and organizational support. In Nairobi's solid waste management projects, this skills gap may be attributed to limited training opportunities, high staff turnover, inadequate technical support, and resistance to technology adoption among some personnel. Addressing this gap requires comprehensive capacity building initiatives, user-friendly system interfaces, ongoing technical support, and management commitment to PMIS utilization.

To sum up, the aggregate mean score of 3.64 indicates that there is moderate to strong agreement regarding the effectiveness of PMIS in project planning, although this agreement is diminished by specific operational and capacity-related gaps. This aligns with observations by Kerzner (2022) who noted that well-implemented PMIS platforms improve planning accuracy, progress monitoring, and decision-making effectiveness. However, the findings also underscore the importance of addressing change management documentation and user capacity building to maximize the benefits of PMIS in waste management projects.

Project Performance

Herein the findings corresponding to the dependent variable (project performance) are presented. The project performance was measured through a number of Likert-scale items representing timely milestone tracking, cost efficiency, stakeholder satisfaction, and progress reporting.

Table 3: Descriptive Statistics for Project Performance

Variable	SD	D	NS	A	SA	Mean	Std. Deviation
1. The PMIS ensures real-time tracking of project milestones,	2.1%	3.5%	9.2%	33.1%	52.1%	4.26	0.86

contributing to the timely completion of the project.							
2. The PMIS provides accurate updates on project timelines, helping to identify and address delays promptly.	3.5%	5.6%	9.9%	37.3%	43.7%	4.12	0.93
3. Using the PMIS, project expenditures are closely monitored to maintain cost-efficiency.	12.7%	23.2%	27.5%	24.6%	12.0%	2.99	1.15
4. The PMIS supports budget tracking, ensuring that financial resources are optimally utilized without overruns.	14.1%	29.6%	25.4%	21.1%	9.9%	2.77	1.19
5. The PMIS generates detailed cost-analysis reports that aid in achieving overall cost-efficiency in the project.	5.6%	12.0%	23.2%	38.0%	21.1%	3.57	1.1
6. Stakeholders receive timely and accurate updates through the PMIS, increasing their satisfaction with project progress.	4.9%	7.0%	17.6%	43.0%	27.5%	3.82	1.03
7. PMIS contributes to long-term project learning and institutional improvement.	7.7%	13.4%	22.5%	38.0%	18.3%	3.46	1.11
8. Information from PMIS is used to improve subsequent project designs.	8.5%	15.5%	21.1%	38.7%	16.2%	3.39	1.13
9. PMIS reports are regularly reviewed to evaluate long-term impact.	9.9%	18.3%	25.4%	31.7%	14.8%	3.23	1.18
Aggregate Mean Score						3.51	1.08

N = 142

SD = Strongly Disagree; D = Disagree; NS = Not Sure; A = Agree; SA = Strongly Agree

Source: Survey Data (2025)

The performance indicators of the project have been statistically described in Table 3 through the use of descriptive statistics. The rating of each response was based on a five-point Likert scale that had the following designations: 1 = Strongly Disagree and 5 = Strongly Agree. Among others, the indicators highlighted the main parts of project performance, such as the tracking of milestones, the accuracy of timelines, monitoring of costs, controlling of the budget, and satisfaction of stakeholders. The mean values of the indicators ranged from 2.77 to 4.26, indicating that the PMIS had both strong and weak points in its performance functionality.

The PMIS was strong in the area of milestone management and time-sensitive reporting as it was confirmed by the high-rated opinion that "The PMIS ensures real-time tracking of project milestones, contributing to the timely completion of the project" ($M = 4.26$, $SD = 0.86$). This finding is particularly important for waste management projects in Nairobi where timely completion of infrastructure such as transfer stations, sorting facilities, and composting units is critical to improving waste collection coverage. The ability to track milestones in real-time enables project managers to identify bottlenecks early, mobilize resources promptly, and take corrective actions before delays escalate.

In addition, the statement "The PMIS provides accurate updates on project timelines, helping to identify and address delays promptly" ($M = 4.12$, $SD = 0.93$) showed that people had confidence in project scheduling and monitoring accuracy. Such findings are consistent with Kerzner (2022) who says that the effective use of PMIS not only makes real-time monitoring possible but also allows correcting actions to be taken without delay during project implementation. For solid waste management projects, this capability translates to better coordination of waste collection vehicle procurement, timely deployment of equipment, and prompt completion of disposal site improvements.

On the other hand, the statements "The PMIS supports budget tracking, ensuring that financial resources are optimally utilized without overruns" ($M = 2.77$, $SD = 1.19$) and "Using the PMIS, project expenditures are closely monitored to maintain cost-efficiency" ($M = 2.99$, $SD = 1.15$) received the lowest ratings and indicated that the respondents viewed it less favorably in terms of cost-control as well as financial oversight. This finding raises serious concerns about financial management in solid waste management projects in Nairobi. Cost overruns are a common challenge in public sector projects in Kenya, often resulting from poor budgeting, inadequate cost monitoring, weak procurement controls, and limited financial accountability.

The weak performance in cost monitoring suggests that PMIS tools are either not fully equipped with robust financial tracking modules or that users lack the capacity to utilize existing financial features effectively. The opinion of Karanja and Wanyoike (2022) points out that the effectiveness of PMIS in cost monitoring is heavily dependent on the continuity of data entry, managerial accountability, and integration with accounting systems. In the context of Nairobi's waste

management projects, this may indicate gaps in linking PMIS with county financial management systems, irregular updating of expenditure data, or lack of real-time financial reporting mechanisms.

The moderate scores on stakeholder satisfaction ($M = 3.82$, $SD = 1.03$) suggest that while PMIS does facilitate communication with stakeholders, there is room for improvement. Stakeholder satisfaction in waste management projects depends not only on timely information but also on the quality of service delivery, responsiveness to complaints, and visible improvements in waste collection coverage. The findings indicate that PMIS contributes positively to stakeholder engagement, but other factors beyond information systems also influence overall satisfaction levels.

The relatively lower scores on organizational learning indicators, such as "Information from PMIS is used to improve subsequent project designs" ($M = 3.39$, $SD = 1.13$) and "PMIS reports are regularly reviewed to evaluate long-term impact" ($M = 3.23$, $SD = 1.18$), suggest that Nairobi's waste management projects may not be fully exploiting PMIS data for continuous improvement. This finding aligns with Mberu et al. (2021) who observed that many waste management initiatives in Nairobi operate in isolation without systematic learning from previous experiences. Strengthening knowledge management practices, conducting regular project reviews, and documenting lessons learned could enhance the long-term impact of PMIS on organizational performance.

Inferential Statistics

Model Summary

Table 4 presents the summary of the regression model. The correlation coefficient ($R = 0.651$) indicates a moderate to strong positive relationship between project planning and project performance. The coefficient of determination ($R^2 = 0.577$) shows that 57.7% of the variation in project performance can be explained by project planning. The adjusted R^2 (0.502) accounts for the number of predictors and confirms that the model provides a good fit to the data. The standard error of estimate (0.50370) suggests that deviations of the observed values from the predicted values are relatively small.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.651 ^a	.577	.502	.50370

a. Predictors: (Constant), Project Planning

Source: Survey Data (2025)

The findings reveal that project planning accounts for a substantial proportion of variance in project performance (57.7%), which is significantly higher than what was observed in similar studies. For instance, Ondiek (2020) found that planning variables explained 83.4% of variance in

road construction projects, while the current study's 57.7% is more modest but still substantial for waste management projects which face unique contextual challenges. The adjusted R^2 of 0.502 indicates that the model remains robust even after accounting for the number of predictors, suggesting that project planning is genuinely influential in determining project performance outcomes.

ANOVA

The ANOVA results in Table 5 indicate that the regression model is statistically significant ($F = 58.213$, $p < 0.001$). This demonstrates that project planning has a significant effect on the performance of solid waste management projects in Nairobi City County.

Table 5: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	14.769	1	14.769	58.213	.000 ^b
Residual	38.564	139	.254		
Total	53.333	141			

a. Dependent Variable: Performance

b. Predictors: (Constant), Project Planning

Source: Survey Data (2025)

The ANOVA results confirm the statistical significance of the regression model with an F-statistic of 58.213 and a p-value of less than 0.001. This indicates that the probability of observing such a strong relationship between project planning and project performance by chance alone is less than 0.1%. The significance of the model validates the research hypothesis that project planning significantly influences project performance. These findings are consistent with Iqbal et al. (2024) who found that project planning had a considerable and beneficial impact on project success across various project types.

Regression Coefficients

Table 6 presents the regression coefficients for the relationship between project planning and project performance. The unstandardized coefficient for project planning ($B = 0.324$, $p = 0.000$) indicates that a one-unit increase in project planning is associated with a 0.324-unit increase in project performance. The corresponding t-value ($t = 3.939$) demonstrates that this effect is statistically significant at the 0.01 level. These results confirm that project planning is a significant positive predictor of project performance in solid waste management projects.

Table 6: Beta Coefficients for Project Planning

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	2.149	.353		6.081	.000
Project Planning	.324	.082	.391	3.939	.000***

a. Dependent Variable: Performance

Source: Survey Data (2025)

The data presented in Table 6 indicate that project planning has a statistically significant positive influence on the performance of solid waste management projects in Nairobi City County. The unstandardized coefficient ($B = 0.324$) suggests that for every unit improvement in project planning practices, project performance increases by 0.324 units, holding other factors constant. The standardized coefficient ($Beta = 0.391$) indicates that project planning contributes substantially to explaining variance in project performance.

These findings are consistent with Turner and Müller (2019) who highlighted the importance of strong planning mechanisms, especially those incorporated in PMIS, to allow for the management of timelines, resources, and risks in a proactive manner, which consequently leads to improved project efficiency and performance. Similarly, Pan and Zhang (2021) emphasized that meticulous planning at the initial stages of projects significantly increases the probability of achieving project objectives within specified time and cost constraints.

The significant influence of project planning on performance can be explained through several mechanisms. First, comprehensive planning enables project managers to identify potential challenges early and develop mitigation strategies before problems escalate. In waste management projects, this could include anticipating equipment breakdowns, planning for seasonal variations in waste generation, and preparing contingency plans for disposal site closures. Second, detailed planning facilitates better resource allocation by ensuring that personnel, equipment, and finances are deployed optimally across different project activities. Third, systematic planning through PMIS enhances coordination among multiple stakeholders, reducing conflicts and improving collaboration.

However, the study also identified several challenges that limit the full realization of planning benefits. The weak change log maintenance ($M = 2.39$) and inadequate user skills ($M = 2.43$) suggest that technical and capacity constraints undermine effective planning processes. Additionally, the poor performance in cost monitoring ($M = 2.77$) indicates that financial planning and budgetary controls remain weak areas that require urgent attention.

5.0 SUMMARY OF THE STUDY

The analysis reveals that solid waste management projects in Nairobi City County demonstrate varying levels of project planning practices through PMIS utilization. The study found strong evidence of PMIS effectiveness in organizing project plan documents ($M = 4.21$, $SD = 1.02$) and facilitating the creation of detailed project plans ($M = 4.13$, $SD = 1.04$). However, limitations exist in change log maintenance ($M = 2.39$, $SD = 1.21$) and user competency in utilizing all PMIS features ($M = 2.43$, $SD = 1.25$). The regression analysis confirms that project planning significantly influences performance outcomes ($\beta = 0.324$, $p < 0.001$), explaining 57.7% of performance variation. This relationship demonstrates that solid waste management projects with more comprehensive planning processes achieve superior performance across multiple dimensions including timely milestone achievement, accurate timeline management, and stakeholder satisfaction. The findings support the theoretical foundation provided by system theory, emphasizing the importance of integrated planning approaches and interconnected project components.

6.0 CONCLUSION

The study concludes that project planning is a fundamental driver of performance improvement in solid waste management projects in Nairobi City County. The significant positive relationship between project planning and project performance demonstrates that projects investing in comprehensive planning processes through PMIS achieve better outcomes in timely completion, operational efficiency, and stakeholder engagement. While solid waste management projects demonstrate strong PMIS utilization in document organization and progress tracking, significant opportunities exist for improving change management documentation and user capacity development.

The limited skills and confidence in using all PMIS features represent a missed opportunity for leveraging the full potential of planning systems. The findings reveal that effective project planning can address some of the critical challenges facing solid waste management in Nairobi, including low collection coverage (currently at 45%), illegal dumping, environmental degradation, and public health hazards. Projects that embrace comprehensive planning processes through PMIS are better positioned to navigate the complex operating environment and achieve sustainable performance improvements.

The study demonstrates that PMIS platforms enhance real-time milestone tracking, improve timeline accuracy, and facilitate stakeholder communication. However, weaknesses in cost monitoring and budget tracking indicate that financial planning dimensions require strengthening. Additionally, the limited utilization of PMIS data for organizational learning and continuous improvement suggests that knowledge management practices need enhancement. Addressing these gaps through targeted capacity building, system improvements, and

management commitment will enable solid waste management projects to fully realize the benefits of comprehensive project planning.

7.0 RECOMMENDATIONS

Based on the study findings, several practical recommendations are proposed to improve the performance of solid waste management projects in Nairobi City County through effective project planning. First, project teams should improve the way project changes are recorded by using clear and consistent procedures. All changes in scope, schedule, or resources should be formally documented, regularly reviewed, and properly approved to support better project control and accountability. Second, implementing agencies should strengthen staff capacity by providing regular training on project planning systems. This includes basic and refresher training, simple user guides, and continuous technical support. Well-trained staff are more likely to use planning tools correctly, leading to improved coordination and decision-making.

Third, financial planning and monitoring should be enhanced by closely linking project plans with budget tracking processes. Regular monitoring of expenditures against approved budgets will help identify cost deviations early and support timely corrective actions. Fourth, organizations should promote learning by documenting lessons from completed and ongoing projects. Regular review meetings and proper record-keeping will ensure that past experiences inform future project planning. Finally, strong management support is essential. Project leaders should actively support planning activities by allocating adequate resources, reviewing planning outputs, and encouraging consistent use of project planning tools to improve overall project performance.

8.0 AREAS FOR FURTHER RESEARCH

Future studies should replicate this research in other Kenyan counties to allow comparison across different contexts. Longitudinal studies are needed to assess the long-term effects of project planning systems on performance. Further research should also examine factors influencing technology adoption, conduct cost–benefit analyses, explore system integration, and assess stakeholder perceptions of planning practices.

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