
The Relationship between Monitoring and Evaluation Performance Measurement and Sustainability of Water Projects in Nairobi City Water and Sewerage Company, Kenya

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Abstract

Effective monitoring and evaluation performance measurement is critical to the sustainability of water projects as it provides timely information for tracking progress, evaluating outcomes, and informing corrective actions throughout the project lifecycle. Despite substantial investments in water infrastructure, Nairobi City Water and Sewerage Company continues to face persistent sustainability challenges and the need for effective performance measurement to improve project outcomes. This study aimed to analyze the relationship between performance measurement and the sustainability of water projects at the Nairobi City Water and Sewerage Company (NCWSC), Nairobi, Kenya. The study was anchored on Information Theory, which explains how accurate, timely, and reliable information generated through performance measurement supports evidence-based decision-making and enhances project sustainability. The study adopted a descriptive research design employing a quantitative approach. Data were collected from 83 respondents drawn through a census of 17 completed water projects at the Nairobi City Water and Sewerage Company using structured questionnaires and analyzed using descriptive statistics, Pearson correlation and simple regression analysis. Regression analysis further established that monitoring and evaluation performance measurement had a strong positive and statistically significant influence on project sustainability (Beta = 0.880, $t = 16.66$, $p < 0.001$), explaining 77.4% of the variation in project sustainability ($R^2 = 0.774$), indicating that improved performance measurement enhances the long-term sustainability of water projects. The study recommends that the Nairobi City Water and Sewerage Company strengthen performance measurement systems by institutionalizing regular performance monitoring, enhancing feedback mechanisms, and integrating evaluation findings into project planning to improve the long-term sustainability of water projects.

Keywords: *Performance measurement, Monitoring and evaluation, Project sustainability, Water projects, Nairobi City Water and Sewerage Company.*

INTRODUCTION

Monitoring and evaluation (M&E) performance measurement has become a cornerstone of effective development programming by providing systematic mechanisms for tracking implementation progress, assessing outcomes, and generating evidence for adaptive decision-making. Monitoring provides continuous information on project performance against predefined indicators, while evaluation assesses the relevance, effectiveness, efficiency, impact, and

sustainability of interventions (OECD-DAC, 2021). Consequently, robust M&E performance measurement systems enhance accountability, facilitate organizational learning, and improve the likelihood of achieving sustainable development outcomes (Amponsah, 2022; Hilgers, 2020). In the water sector, performance measurement is particularly important because sustainable water management underpins public health, food security, environmental conservation, and economic growth. Despite global investments, sustainability remains a challenge, with the Food and Agriculture Organization reporting that while approximately 50% of development projects attain moderate sustainability, nearly 33% fail to achieve satisfactory sustainability standards (FAO, 2020). Likewise, the United Nations World Water Development Report (2024) emphasizes that sustainable water resource management is fundamental to global prosperity and resilience.

Globally, countries and development agencies have increasingly institutionalized comprehensive M&E systems to enhance the sustainability of water and infrastructure projects. Organizations such as the World Bank, European Union, USAID, and African Development Bank integrate rigorous monitoring frameworks, stakeholder participation, digital technologies, and evidence-based evaluations to improve project performance and long-term sustainability (European Commission, 2020; USAID, 2020; AfDB, 2020). In Africa, however, persistent challenges including inadequate institutional capacity, fragmented coordination, insufficient funding, and weak data utilization continue to undermine the effectiveness of M&E systems (Harkness, 2019; Kemunto, 2020; Bonge, 2021).

In Kenya, the Government has strengthened M&E through the National Integrated Monitoring and Evaluation System (NIMES) and County Integrated Monitoring and Evaluation System (CIMES), aligning project implementation with the country's Vision 2030 development agenda (Government of Kenya, 2020). Within the water sector, institutions such as the Ministry of Water, Sanitation and Irrigation and the Water Services Regulatory Board have incorporated performance monitoring frameworks to improve service delivery and project sustainability. The Nairobi City Water and Sewerage Company (NCWSC), established in 2003, has implemented major water infrastructure projects, including the KSh 8.049 billion Ndakaini–Kigoro–Gigiri Water Transmission Pipeline, expected to supply an additional 140,000 m³ of water daily to more than 1.2 million residents. Despite these investments, rapid urbanization, population growth, climate change, resource constraints, and limited stakeholder participation continue to threaten the sustainability of water projects, underscoring the need to strengthen M&E practices to enhance long-term project outcomes (Nairobi City Water and Sewerage Company, 2023; Ong'ayo & Kiprop, 2020).

Statement of the Problem

Rapid urbanization and population growth have intensified water demand in Nairobi City County, where daily demand stands at approximately 850,000 m³ against a supply of only 570,000 m³, creating a daily deficit of 280,000 m³ (NCWSC, 2023). Nearly 60% of residents in informal settlements receive only 20 liters of water per person per day, far below the 50 liters recommended by the World Health Organization, while illegal connections result in 3.5 billion liters of non-revenue water losses monthly (NCWSC, 2023). Although robust monitoring and evaluation (M&E) systems significantly enhance project sustainability ($r = 0.715$, $p < 0.05$) (Njuguna, 2022), existing M&E performance measurement systems still exhibit weaknesses in stakeholder engagement, planning, partnerships, and capacity development (Chepkoech, 2023). Climate change, inadequate community participation, weak accountability, poor maintenance, and limited stakeholder involvement further threaten project sustainability (Haider et al., 2023; Silva et al., 2023; Chinnasamy & Gupta, 2024). Despite recognition of participatory M&E as a

driver of sustainable water projects (Mgoba & Kabote, 2020; Venessa & Gitahi, 2023), limited empirical evidence exists on how M&E practices influence the sustainability of Nairobi City Water and Sewerage Company projects. This study addresses this gap by examining the relationship between M&E practices and the sustainability of water projects in Nairobi City County.

Objective of the Study

The objective of the study is to analyze the relationship between monitoring and evaluation performance measurement and sustainability of water projects in NCWSC Nairobi, Kenya.

Theoretical Literature Review

Performance measurement is a core monitoring and evaluation (M&E) practice that involves the systematic collection, analysis, and use of qualitative and quantitative performance information to determine whether project objectives are being achieved and to identify areas requiring corrective action. It employs indicators such as monitoring visits, surveys, testimonials, and scorecards to assess project progress, promote organizational learning, and facilitate adaptive management for improved project outcomes (Kimani & Njagi, 2022; Muriithi & Mwangi, 2020). Given that performance measurement relies on the continuous generation and utilization of accurate, timely, and reliable information, this study is best underpinned by Information Theory. Developed by Claude Shannon (1948), the theory explains how information should be efficiently generated, transmitted, processed, and utilized to minimize loss and maximize clarity in decision-making (Shannon & Weaver, 1949). In the context of water projects, effective performance measurement depends on high-quality information that enables project managers and stakeholders to evaluate implementation progress, detect performance gaps, and institute timely corrective actions that enhance project sustainability (Cover & Thomas, 2006). Although Information Theory has been criticized for emphasizing the technical transmission of information while overlooking contextual interpretation (Floridi, 2010), it provides a strong theoretical foundation for this study by demonstrating that effective performance measurement is dependent on credible information for evidence-based decision-making, continuous performance improvement, and the long-term sustainability of water projects.

Empirical Literature Review

Omondi and Kariuki (2021) investigated how surveys influence the sustainability of water projects in Kilifi County, Kenya. This study was grounded in survey methodology theory, which emphasizes the design and execution of surveys to collect accurate data. A cross-sectional survey design was employed, utilizing a population of 400 water project beneficiaries from which a sample of 80 was selected via stratified random sampling. Data were gathered through surveys and analyzed with SPSS. The study revealed that surveys are vital for improving project sustainability, as projects conducting regular surveys achieved a 50% higher sustainability rate ($r = 0.70$, $p < 0.01$). The authors concluded that surveys are an effective tool for monitoring project progress and recommended their regular use in project evaluation.

Kariuki and Wambugu (2020) investigated the role of monitoring and evaluation performance measurement in ensuring the sustainability of community development projects in Nairobi County, Kenya. The study was guided by Results-Based Management (RBM) theory, which emphasizes achieving outcomes through systematic performance measurement. A cross-sectional survey design was utilized, drawing a sample of 200 participants from a population of 1,000 community project members via stratified random sampling. Data were gathered through structured interviews and analyzed using both descriptive and inferential statistics. The results showed that projects featuring strong monitoring and evaluation frameworks were significantly

more likely to achieve sustainability ($\beta = 0.70$, $p < 0.01$). The authors concluded that performance measurement is essential for tracking progress and facilitating informed decision-making, and they recommended integrating it into every stage of project management.

Kimani and Njoki (2022) examined how monitoring and evaluation visits impact the sustainability of agricultural projects in Murang'a County, Kenya. This study was grounded in Monitoring and Evaluation Theory, which underscores the significance of conducting regular assessments within project management. The study utilized a descriptive research design, drawing a sample of 120 participants from a population of 600 through cluster sampling. Data were gathered through structured questionnaires and examined using descriptive statistics and regression analysis. The results showed that regular monitoring and evaluation visits were significantly linked to project sustainability ($\beta = 0.74$, $p < 0.05$). The authors concluded that frequent site visits facilitate early issue identification and timely interventions, thereby improving sustainability. They advised that project managers make regular M&E visits a core component of project management by institutionalizing them.

Conceptual Framework

Independent Variable

Dependent Variable

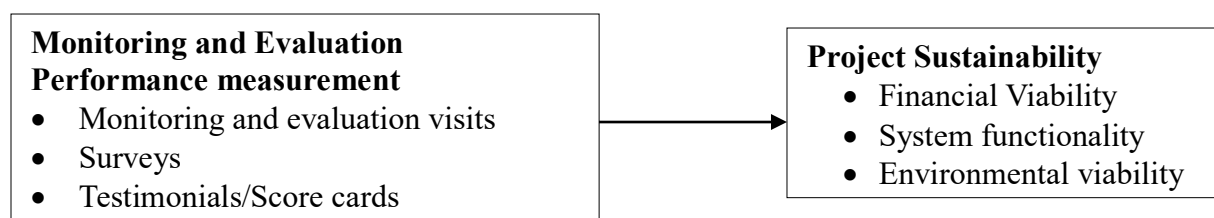


Figure 1: Conceptual framework

Research Methodology

This study adopted a descriptive research design integrating quantitative approach to examine the relationship between performance measurement and the sustainability of water projects (Creswell, 2017; White, 2023). The target population comprised 17 completed Nairobi City Water and Sewerage Company (NCWSC) water and sanitation projects implemented between 2021 and 2025, involving 119 project personnel, including project managers, engineers, M&E officers, procurement managers, community mobilization officers, and environmental officers (NCWSC, 2025). A census approach was employed due to the small population (Mugenda & Mugenda, 2003). Data were collected using self-administered questionnaires, with instrument validity established through expert review and pilot testing involving 12 respondents, while reliability was assessed using Cronbach's alpha ($\alpha \geq 0.70$). Quantitative data were analyzed using SPSS version 28 through descriptive statistics and correlation and simple linear regression analysis.

Findings and Discussion

The study targeted a total of 119 respondents, who included NCWSC's project expert. By the end of the study, only 83 respondents were able to successfully participate in the study, yielding a response rate of 69.7%. Males constituted 59.0% of the respondents, while females accounted for 41.0%, indicating relatively balanced gender representation. Most respondents were aged 26–35 years (33.7%), followed by those aged 36–45 years (25.3%), reflecting a predominantly mid-career workforce. Regarding education, 49.4% held undergraduate degrees, 22.9% possessed diplomas, and 21.7% had postgraduate qualifications, demonstrating a highly educated respondent base. In terms of organizational experience, 26.5% had worked at NCWSC for 1–3

years, while 65.1% had served for four years or more. Similarly, 30.1% had occupied their current positions for 1–3 years, with 57.9% serving for at least four years. Notably, 73.5% of respondents had participated in monitoring and evaluation activities, indicating that the majority possessed direct experience with project monitoring processes. The results imply that the study drew responses from a knowledgeable, experienced, and actively engaged workforce, thereby enhancing the credibility and reliability of the findings on performance measurement and the sustainability of water projects.

Descriptive Analysis

Respondents were asked to indicate their level of agreement with statements measuring the study variables using a five-point Likert scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Descriptive statistics comprising means and standard deviations were computed to summarize respondents' perceptions and examine the distribution and variability of responses across the study variables.

Monitoring and Evaluation Performance Measurement

Descriptive analysis for the monitoring and evaluation performance measurement was conducted and the results presented in Table 1.

Table 1: Descriptive analysis for Monitoring and Evaluation Performance Measurement

Statement	Mean	SD
Surveys are used effectively to gather information on project performance	2.89	0.62
Testimonials and scorecards are used to gather information on project impact	2.71	0.68
Performance indicators are clearly defined and measured regularly	2.95	0.59
Project outcomes are evaluated against set targets	3.02	0.64
Lessons learnt and best practices are incorporated into future planning	2.76	0.66
Performance measurement tools are used to guide project adjustments	2.88	0.61
Performance measurement contributes to continuous improvement of sustainability	3.10	0.58
Aggregates	2.90	0.63

The findings indicate that respondents held moderate perceptions regarding performance measurement practices, as reflected by a composite mean of 2.90, which is close to the neutral threshold. This suggests that while some performance measurement practices are in place, their effectiveness is not fully optimized. Notably, performance measurement contributing to sustainability ($M = 3.10$) and evaluation of project outcomes against set targets ($M = 3.02$) recorded relatively higher mean scores, indicating that respondents recognize the role of performance measurement in enhancing project outcomes. However, comparatively lower mean scores were observed for testimonials and scorecards ($M = 2.71$) and incorporation of lessons learnt into planning ($M = 2.76$), suggesting weaknesses in feedback systems and learning mechanisms. These results imply that although monitoring structures exist, their utilization for continuous improvement and knowledge integration remains limited. The standard deviations for all items are below 1, indicating low variability and therefore a strong consensus among respondents. This consistency suggests that the observed trends in performance measurement practices are widely shared across the organization. These findings align with the study's conceptual argument that performance measurement involves systematic tracking of outcomes and results to support informed decision-making and continuous improvement. However, the results highlight the need for strengthening feedback mechanisms and ensuring that performance data is effectively utilized in planning and decision-making processes. The literature emphasizes

that effective performance measurement enhances efficiency and sustainability only when it is consistently applied and integrated into organizational learning systems.

Project Sustainability

This section presents descriptive statistics for project sustainability, focusing on mean scores and standard deviations. The analysis evaluates respondents' perceptions regarding the extent to which water projects achieve long-term sustainability outcomes.

Table 2: Descriptive analysis for project sustainability

Statement	Mean	SD
The project has strong ownership by the local community	3.21	0.57
The project is financially viable and can sustain operations independently	3.05	0.61
Projects have led to improvement in provision of quality water and sanitation standards	3.34	0.55
Environmental sustainability is integrated into the project's practices	3.12	0.60
Project is likely to benefit citizens in the long-term	3.40	0.53
Stakeholders are committed to the long-term success of projects	3.18	0.58
Projects have established mechanisms to adapt to future challenges and opportunities	3.09	0.62
Aggregates	3.20	0.58

The findings indicate that respondents generally agreed that water projects demonstrate moderate levels of sustainability, as reflected by a composite mean of 3.20. This suggests that while sustainability outcomes are being realized, there remains room for improvement in strengthening long-term project viability. Notably, perceived long-term benefits to citizens ($M = 3.40$) and improvements in water and sanitation standards ($M = 3.34$) recorded the highest mean scores, indicating that projects are delivering tangible outcomes to beneficiaries. However, relatively lower mean scores were observed for financial viability ($M = 3.05$) and adaptability mechanisms ($M = 3.09$), suggesting that sustainability in terms of financial independence and resilience to future challenges is less robust. This implies that while immediate and social benefits are evident, structural and institutional sustainability dimensions require further strengthening.

The standard deviations for all items are below 1, indicating low variability and therefore a strong consensus among respondents. This consistency suggests that perceptions regarding project sustainability are widely shared across the organization. These findings align with the study's conceptualization of sustainability as the long-term capacity of projects to maintain benefits through effective resource management, stakeholder engagement, and adaptability. Further, the literature emphasizes that sustainable water projects require strong monitoring systems, stakeholder commitment, and integration of environmental and financial considerations to ensure continued impact.

Correlation Analysis

Correlation analysis was conducted to determine the association between the dependent and independent variables. The results were presented using Table 3.

Table 3: Correlation analysis

Project sustainability		
Performance Measurement	Pearson Correlation	.880**
	Sig. (2-tailed)	.000
	N	83

The results demonstrate a strong and statistically significant positive correlation between monitoring and evaluation performance measurement and project sustainability ($r = 0.880$, $p =$

0.000). This implies that effective tracking of project outcomes, use of indicators, and feedback mechanisms are closely associated with improved sustainability of water projects. The high correlation suggests that monitoring and evaluation performance measurement enables timely decision-making, promotes accountability, and facilitates continuous improvement. This finding is supported by Omondi and Kariuki (2021), who found that the use of surveys significantly enhances project sustainability. Similarly, Kariuki and Wambugu (2020) established that robust performance measurement frameworks improve project outcomes and sustainability. Additionally, Kimani and Njoki (2022) emphasized the importance of regular M&E assessments in enhancing project success. These findings underscore the need for structured performance measurement systems to support sustainable project implementation.

Regression Analysis

Regression analysis was used to test the relationship between monitoring and evaluation performance measurement and project sustainability. Coefficients were generated to assess the contribution and direction of influence of the monitoring and evaluation performance measurement on project sustainability.

Table 4: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.88 ^a	.774	.771	.205769

a. Predictors: (Constant), performance measurement

The model explained 77.4% of the variation in project sustainability ($R^2 = 0.774$), demonstrating that performance measurement is a major determinant of sustainability among water projects at Nairobi City Water and Sewerage Company.

Table 5: ANOVA

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.641	1	22.641	277.656	.000b
	Residual	6.605	81	0.082		
	Total	29.246	82			

a. Dependent Variable: Project Sustainability

b. Predictors: (Constant), monitoring and evaluation performance measurement

The ANOVA results indicate that the regression model was statistically significant, $F(1, 81) = 277.656$, $p < 0.001$. This implies that monitoring and evaluation performance measurement significantly predicts project sustainability at Nairobi City Water and Sewerage Company. Since the p-value is less than the 0.05 significance level, the null hypothesis that there is no relationship between monitoring and evaluation performance measurement and project sustainability is rejected. The findings demonstrate that the regression model provides a significantly better prediction of project sustainability than would be expected by chance. Therefore, monitoring and evaluation performance measurement is an important determinant of the sustainability of water projects.

Table 6: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta			
1 (Constant)	.250	.144			1.742	.085

Monitoring and evaluation Performance Measurement	.93	.056	.88 16.66 .000
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a. Dependent Variable: Project sustainability

Based on the results above, the constant is 0.250, indicating that when all factors are held constant, project sustainability is 0.250. Using the statistics in Table 6, the simple linear regression was fitted as follows:

$$Y = 0.25 + 0.93X + \varepsilon$$

Monitoring and evaluation performance measurement had a strong positive and statistically significant effect on project sustainability ($\beta = 0.880$, $t = 16.66$, $p < 0.001$). The standardized coefficient indicates that a one standard deviation increase in monitoring and evaluation performance measurement is associated with a 0.880 standard deviation increase in project sustainability. The unstandardized coefficient ($B = 0.930$) indicates that a one-unit increase in monitoring and evaluation performance measurement leads to a 0.930-unit increase in project sustainability. This indicates that effective tracking of monitoring and evaluation performance indicators and use of evaluation tools play a critical role in influencing sustainability. The finding aligns with literature emphasizing the importance of systematic performance tracking and feedback mechanisms in improving project outcomes. Empirical studies such as Kariuki and Wambugu (2020) and Kimani and Njoki (2022) similarly establish that robust performance measurement frameworks significantly enhance project success and sustainability.

Conclusion

Descriptive results indicated moderate perceptions of monitoring and evaluation performance measurement practices (composite mean ≈ 2.90 ; $SD < 1$), suggesting respondents were neutral but generally consistent in their views. This implies that performance measurement systems exist but may not be fully optimized. Correlation analysis showed a strong positive and significant relationship with project sustainability ($r = 0.880$, $p < 0.01$), indicating that improved performance tracking is strongly associated with sustainability outcomes. Regression results revealed the strongest positive and statistically significant relationship, indicating that performance measurement is a significant predictor of sustainability. This suggests that effective use of indicators, evaluations, and feedback mechanisms significantly enhances project outcomes. These findings align with Results-Based Management principles and studies by Kariuki and Wambugu (2020), Omondi and Kariuki (2021), and Kimani and Njoki (2022), which emphasize that systematic performance tracking improves project efficiency and long-term sustainability. Thus, performance measurement has a strong, positive, and statistically significant relationship with project sustainability. Descriptive results show moderate adoption of performance measurement practices. This implies that effective tracking of project performance, use of indicators, and evaluation of outcomes significantly enhance project success and long-term viability. Performance measurement enables timely decision-making, promotes accountability, and facilitates continuous improvement. Therefore, strengthening performance measurement systems is critical for ensuring that water projects remain effective, adaptive, and sustainable over time.

Recommendations

NCWSC should strengthen feedback and learning mechanisms by enhancing the use of testimonials, scorecards, and lessons learned in project planning. Greater emphasis should be placed on integrating evaluation findings into future decisions. Additionally, performance indicators should be consistently defined and applied, while survey tools should be used more

effectively. Strengthening these areas will improve accountability, learning, and continuous project improvement.

Suggestions for Further Research

Future research should examine the effectiveness of different performance measurement tools and digital performance monitoring systems in enhancing the sustainability of water projects. Longitudinal and comparative studies across different water service providers and infrastructure sectors would provide deeper insights into the long-term influence of performance measurement on project sustainability.

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