

MONITORING PROJECT RISKS AND PERFORMANCE OF WATER PROJECTS IN LOWER EASTERN REGION, KENYA

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**International Academic Journal of Information Sciences and Project Management
(IAJISPM) | ISSN 2519-7711**

Received: 12th September 2026

Published: 23rd September 2026

Full Length Research

Available Online at: https://iajournals.org/articles/iajispm_v3_i7_496_518.pdf

Citation: Mbii, J., Senelwa, A., Muchelule, Y. (2026). Monitoring project risks and performance of water projects in lower eastern region, Kenya. *International Academic Journal of Information Sciences and Project Management*, 3(7), 496-518.

ABSTRACT

Performance of water projects remains a major concern in Kenya despite increased public investment in water infrastructure. Many projects continue to experience delays, cost overruns, implementation challenges and failure to achieve planned objectives, partly due to inadequate monitoring of project risks. This study examined the influence of monitoring project risks on the performance of water projects in Lower Eastern Region, Kenya, and assessed the moderating effect of project environment on this relationship. The study adopted a cross-sectional research design guided by the pragmatism research philosophy and employed a mixed methods approach. A sample of 336 water projects was selected through proportionate stratified random sampling from a target population of 2,665 water projects, while 39 key informants were purposively selected. Primary data were collected using structured questionnaires and interview guides and analyzed using descriptive statistics, Pearson correlation, simple linear regression and hierarchical regression analysis. The findings established that monitoring project risks positively and

significantly influenced the performance of water projects. The study further found that project environment significantly moderated the relationship between monitoring project risks and project performance by strengthening the effectiveness of risk monitoring practices. The study concludes that continuous risk identification, assessment, reassessment and control improve project implementation and enhance project performance, particularly when supported by favourable organizational and operational environments. The study recommends that implementing agencies strengthen risk monitoring systems, invest in technical capacity building, allocate adequate resources for risk mitigation and create supportive organizational environments to enhance the successful implementation of water projects.

Keywords: Monitoring project risks, project environment, project performance, water projects, risk management, Kenya.

INTRODUCTION

Project monitoring practices refer to all the activities undertaken to determine whether desired results are being achieved according to planned implementation schedules, with the objective of measuring project progress against established targets (World Bank, 2024). Through continuous assessment of project implementation against predefined plans, monitoring enables project managers to identify deviations early and institute corrective measures that enhance project success (Fox & Macleod, 2023). Effective project monitoring contributes to improved project performance by providing timely information on project progress and ensuring that

intended benefits are delivered to beneficiaries. Project performance is reflected in the efficient and effective achievement of project objectives in terms of time, cost, scope and stakeholder satisfaction (Decotiis & Dyer, 2022; Lonnerfford & Johansson, 2021).

Globally, project monitoring has become an indispensable management practice for improving project implementation and supporting sustainable development. Monitoring provides continuous information on project progress, enabling implementing agencies to identify emerging challenges and make timely decisions that facilitate successful project delivery (UNDAF, 2023; Saiful, 2021). Similarly, the OECD (2021) notes that project monitoring strengthens transparency, accountability, communication and responsiveness to unforeseen events while enabling managers to evaluate project progress against planned objectives. Among the various monitoring practices, monitoring project risks has attracted considerable attention because projects operate in environments characterized by uncertainties that may compromise their successful completion. Renuka, Umarani and Kamal (2024) observed that effective risk identification, assessment and continuous monitoring reduce project delays and failures while enhancing project performance. Likewise, the Project Management Institute (PMI, 2023) emphasizes that continuous monitoring throughout the project life cycle improves the effectiveness of risk management strategies and optimizes risk responses. Rahman and Adnan (2020) further established that regular tracking of identified risks significantly reduces the probability of risk occurrence, while Sellestin (2021) argues that identified risks should be continuously monitored, assessed and communicated to relevant stakeholders to enhance project performance.

Within Sub-Saharan Africa, monitoring practices have increasingly been adopted to improve the performance of public infrastructure projects. Ghana institutionalized monitoring practices across the public sector to facilitate continuous tracking of project implementation and enhance decision-making, resulting in improved project performance through regular feedback and accountability (Kissi et al., 2019; Damoah, Akwei, & Momzughi, 2020). Despite these efforts, many infrastructure projects across Africa continue to experience delays, cost overruns and failure to achieve intended objectives due to inadequate risk mitigation, weak institutional capacity, corruption and bureaucratic processes (Watermeyer & Phillips, 2020; Meyer, Masehla, & Kot, 2023; Olanrewaju, Tan, & Kwan, 2023). In Rwanda, insufficient monitoring practices were associated with poor performance of electricity projects (Umugwaneza & Kule, 2022), while Moyo (2023) identifies corruption and inadequate project capacity as major impediments to successful project implementation across the continent.

In Kenya, reforms within the water sector have progressively strengthened project monitoring to improve service delivery. The establishment of the National Integrated Monitoring and Evaluation System (NIMES) enhanced monitoring of government projects by providing policy makers with information for informed decision-making, although inadequate resources and weak institutional feedback initially limited its effectiveness (GOK, 2007; Anderson, Jensen, Naitore, & Christopher, 2024). Recent legislative reforms, including the Water Act 2022 and Water Bill 2024, have further emphasized effective monitoring in water project implementation (GOK, 2022). Empirical studies in Kenya demonstrate the importance of

monitoring project risks in enhancing project performance. Aduma and Kimutai (2021) found that risk management practices significantly influenced organizational performance, while Macharia (2023) established that risk avoidance had the strongest influence on the performance of public construction projects. Similarly, Singh, Chandurkar and Dutt (2023) and Obegi and Kimutai (2023) advocate continuous monitoring of project risks as a prerequisite for successful project delivery, whereas Chapman (2019) attributes poor project performance largely to inadequate monitoring and management of project risks. Despite increased investment in the water sector, many water projects in Kenya continue to experience delays, cost overruns and failure to achieve intended objectives (Munyiri & Muchelule, 2021). In Lower Eastern Region, declining water availability, ageing infrastructure and growing demand for water services continue to threaten project performance, underscoring the need to examine the influence of monitoring project risks on the performance of water projects in the region.

Statement of the Problem

In pursuit of the Government of Kenya's commitment to provide universal access to adequate and safe water by 2030, substantial public and private investments have been directed towards the development and implementation of water projects (GOK, 2007; COK, 2010). Despite increased budgetary allocations to the water sector (Budget Watch, 2019/2020; WASREB, 2019/2020), the performance of water projects continues to be characterized by delays, cost overruns, project stalling and failure to achieve intended objectives. Reports indicate that six mega dams in Makueni County and several water projects in Kitui County remained stalled, while only 20–30% of the planned boreholes had been successfully implemented (County Government of Makueni, 2019; Nyanga, 2019; POK, 2019). Similarly, only 21% of planned water projects in Machakos County achieved their intended targets, with the remaining 79% either delayed or abandoned (World Bank, 2020). Nationally, over half of development projects perform unsatisfactorily, while abandoned water projects had reached 47% by 2023 (Abdi, 2024; Sakamoto & Kiarie, 2024).

Poor management of project risks has consistently been identified as one of the major causes of project failure, resulting in schedule overruns, escalating costs and compromised project quality. Although previous studies have examined project risk management in sectors such as construction, state corporations and public infrastructure, limited empirical evidence exists on the influence of monitoring project risks on the performance of water projects, particularly within Lower Eastern Region, Kenya (Hussein, 2020; Kituku, 2020; Singh, Chandurkar, & Dutt, 2023; Turner & Xue, 2021). Furthermore, existing studies have rarely examined whether project environment moderates the relationship between monitoring project risks and project performance. Consequently, the contextual and empirical evidence necessary to guide effective risk monitoring within water projects remains inadequate. This study therefore sought to establish the influence of monitoring project risks on the performance of water projects in Lower Eastern Region, Kenya, while examining the moderating effect of project environment.

Objectives of the Study

General Objective

To establish the influence of monitoring project risks on the performance of water projects in Lower Eastern Region, Kenya.

Specific Objectives

- i. To assess the influence of monitoring project risks on the performance of water projects in Lower Eastern Region, Kenya.
- ii. To determine the moderating influence of project environment on the relationship between monitoring project risks and the performance of water projects in Lower Eastern Region, Kenya.

Research Hypotheses

- i. **H₀₁:** Monitoring project risks have no significant influence on the performance of water projects in Lower Eastern Region, Kenya.
- ii. **H₀₂:** Project environment has no significant moderating influence on the relationship between monitoring project risks and the performance of water projects in Lower Eastern Region, Kenya.

LITERATURE REVIEW

Theoretical Framework

This study is anchored on Contingency Theory and Environment Theory. Contingency Theory, advanced by Fred Edward Fiedler in 1964, posits that organizations operate in dynamic environments where management decisions should be adapted to prevailing circumstances rather than relying on a single best management approach (Chandra, 2020). The theory recognizes that projects are unique and are exposed to uncertainties arising from internal and external environments, necessitating continuous monitoring and flexible responses to emerging risks (Chihuri & Pretorius, 2020). It further argues that organizations face financial, operational, political and technical risks whose impacts can only be minimized through continuous identification, analysis, reassessment and control (Ghani & Mohamood, 2020; Theuri, 2024). In the context of this study, Contingency Theory provides the theoretical basis for monitoring project risks by explaining how continuous risk monitoring enables project managers to respond appropriately to changing project conditions, thereby minimizing delays, cost overruns and project failure while improving the performance of water projects.

The study further adopts Environment Theory, advanced by Florence Nightingale in 1859, to explain the moderating role of project environment. The theory postulates that internal and external environmental conditions influence the success of organizational interventions by either facilitating or constraining desired outcomes (Iram, 2021). In project management, environmental factors such as organizational culture, team cooperation, budget availability and technical competency determine how effectively project activities translate into desired performance outcomes (Akanni et al., 2020; Alon, 2023). Accordingly, project environment may strengthen or weaken the relationship between monitoring project risks and project

performance depending on the prevailing organizational and operational conditions. Environment Theory therefore provides an appropriate foundation for examining the moderating influence of project environment on the relationship between monitoring project risks and the performance of water projects in Lower Eastern Region, Kenya.

Conceptual Framework

The conceptual framework illustrates the hypothesized relationship between monitoring project risks and the performance of water projects, with project environment acting as a moderating variable. Monitoring project risks is conceptualized through risk reassessment, risk analysis, risk auditing and risk control, while performance of water projects is measured using the number of water projects completed, timely delivery, stakeholders' satisfaction and delivery within cost. Project environment, represented by organizational culture, team cooperation, budgeted funds and technical competency, is expected to influence the strength of the relationship between monitoring project risks and performance of water projects. Figure 1 presents the conceptual framework guiding this study.

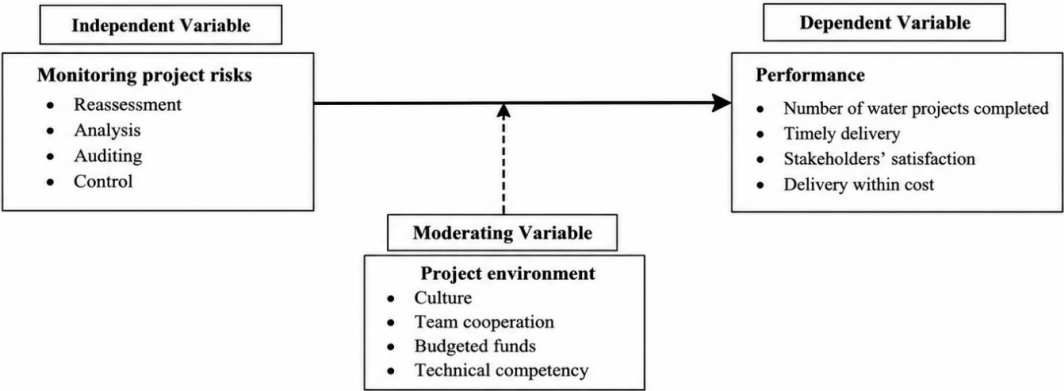


Figure 1: Conceptual Framework

Monitoring Project Risks

Monitoring project risks refers to the continuous identification, assessment, reporting and control of risks throughout the project life cycle to minimize their adverse effects on project performance (Barere, 2024). Since both internal and external environments expose projects to uncertainties, effective risk monitoring enables project teams to identify potential threats early, analyze their likely impacts and implement appropriate mitigation strategies before they affect project implementation (Chang, Hwang, Deng, & Zhao, 2021). Continuous monitoring also facilitates timely reporting of emerging risks and supports corrective decision-making that enhances project delivery (Ahmad, Behzadian, Ardeshir, & Kapelan, 2023). Gregore, Ionescu and Necoluscu (2021) observed that involving relevant stakeholders in risk monitoring and control enhances project success by strengthening implementation of risk response strategies. Similarly, the Project Management Institute (PMI, 2023) notes that continuous risk reassessment and control improve project outcomes by reducing delays, cost overruns and quality deficiencies.

Performance of Water Projects

Project performance refers to the extent to which project objectives are achieved efficiently and effectively (Lonnerfford & Johansson, 2021). It is commonly evaluated using indicators such as timely completion, adherence to budget, achievement of intended outputs and stakeholder satisfaction (Bass, 2022). Akanni et al. (2020) further argue that project performance should reflect successful delivery within planned scope, cost and schedule while meeting beneficiaries' expectations. In this study, performance of water projects is measured using the number of completed water projects, timely delivery, stakeholders' satisfaction and delivery within the approved budget.

Project Environment

Project environment refers to the internal and external organizational conditions that influence project implementation and outcomes. Organizational culture, team cooperation, availability of budgeted funds and technical competency create conditions that may either strengthen or weaken project performance (Akanni, Oke, & Akpomimie, 2020). Boone et al. (2019) observed that organizational culture significantly influences collaboration and project effectiveness, while Damoah, Akwe and Mouzughi (2020) identified financial constraints and institutional weaknesses as major contributors to project failure. In this study, project environment is conceptualized as a moderating variable that may influence the relationship between monitoring project risks and performance of water projects.

Empirical Review

Monitoring Project Risks and Performance of Water Projects

Monitoring project risks has increasingly been recognized as a critical project management practice that enhances project performance by facilitating continuous identification, assessment and mitigation of uncertainties throughout the project life cycle. An African Development Bank (ADB, 2023) assessment of agricultural projects in Nepal established that continuous monitoring of financial risks through tracking expenditure, procurement compliance and cash flows significantly improved project performance. Similarly, Renault and Agumba (2022), while examining risk management in South Africa's construction industry, found that close supervision and continuous monitoring enabled project teams to respond effectively to emerging risks, resulting in improved project delivery. Carvalho and Rabechini (2020) further reported that routine risk monitoring and the appointment of competent risk managers positively influenced project performance among Brazilian companies by strengthening timely decision-making and effective risk response. Likewise, Aladdin (2020) found that continuous risk monitoring significantly enhanced organizational performance within Jordanian insurance firms, recommending continuous capacity building for project teams to improve monitoring effectiveness.

Studies conducted within Africa and Kenya similarly demonstrate the importance of monitoring project risks in improving project outcomes. Maina (2023) established that risk mitigation through continuous monitoring and control significantly improved the performance of infrastructure projects in Nakuru County, Kenya. Mutua (2020) likewise found that monitoring project risks positively influenced the performance of core banking system projects

in Kenyan commercial banks. In the construction sector, Obondi (2021) reported a strong positive relationship between project risk monitoring and project success, while Nyarangi, Ogolla and Kitheka (2021) established that project risk control significantly enhanced the performance of borehole water projects in Mombasa County. Similar findings were reported by Ubangi et al. (2020), who concluded that continuous risk identification, analysis and response enabled organizations to minimize losses and improve project outcomes, whereas Megangha and Lewa recommended strengthening project risk control mechanisms to minimize the severity of project losses after occurrence.

The reviewed empirical literature consistently demonstrates that continuous monitoring of project risks contributes significantly to improved project performance through early identification of threats, timely corrective action and effective implementation of risk response strategies. However, most previous studies concentrated on construction projects, financial institutions, manufacturing firms and general infrastructure projects, with relatively few focusing specifically on water projects. Furthermore, the majority employed descriptive or correlational research designs and primarily examined the direct influence of project risk monitoring without considering how project environment may alter this relationship. Consequently, empirical evidence on the influence of monitoring project risks on the performance of water projects in Lower Eastern Region, Kenya, particularly under varying project environmental conditions, remains limited, thereby justifying the present study.

Project Environment as a Moderator

Project environment has increasingly been acknowledged as an important contextual factor influencing the effectiveness of project management practices and project performance. Idris and Kolawole (2022) found that organizational culture enhances knowledge management practices, which subsequently improve project performance in Nigerian construction projects. Similarly, Chaudhry, Yuan, Hu and Cooke (2022) observed that organizational culture shapes employee behaviour and collaboration, thereby influencing project implementation outcomes. Adeleke, Bahraini and Kamarudden (2023) further argued that flexible organizational structures facilitate knowledge sharing and strengthen project implementation through improved communication and coordination among project teams.

Several African studies have also demonstrated that project environmental factors significantly influence project outcomes. Sinesilassie, Zafar, Tabish and Jha (2023) established that poor cooperation among project participants, inadequate management support and weak human resource relations negatively affected the performance of water projects in Ethiopia. Likewise, Njeri and Were (2023) found that management support, employee commitment and teamwork significantly enhanced project performance in Kenyan non-governmental organizations. Financial resources also remain an important environmental determinant, with Mahamid (2022) reporting that inadequate project financing and delayed contractor payments constrained construction project performance, while Lindh and Larsen (2022) found that the financial capacity of implementing organizations significantly influenced project productivity. Empirical evidence further indicates that technical competency, organizational culture and financial capacity collectively determine how effectively project management practices

translate into project performance. Kativhu et al. (2023) emphasized the importance of equipping project committees with technical, managerial and financial management skills to improve water project implementation, while Mutunga and Mutiso (2020) reported that technical competency among project teams significantly enhanced the implementation of county-funded water projects in Kenya. Despite these findings, most previous studies have examined project environment as an independent determinant of performance rather than as a moderating variable. Consequently, limited empirical evidence exists on whether project environment strengthens or weakens the relationship between monitoring project risks and the performance of water projects. This study addresses this empirical gap by examining the moderating influence of project environment on the relationship between monitoring project risks and performance of water projects in Lower Eastern Region, Kenya.

RESEARCH METHODOLOGY

This study adopted a cross-sectional research design to examine the influence of monitoring project risks on the performance of water projects in Lower Eastern Region, Kenya. The design was considered appropriate because it enabled data to be collected from multiple water projects at a single point in time while facilitating the examination of relationships among the study variables. Guided by the pragmatism research philosophy, the study employed a mixed methods approach that integrated quantitative and qualitative techniques to provide a more comprehensive understanding of the research problem than would have been achieved using either approach independently (Creswell & Creswell, 2023; Molina-Azorín, 2022). Quantitative data were collected using structured questionnaires, while qualitative data were obtained through interviews to complement and explain the statistical findings.

The target population comprised 2,665 water projects implemented in Lower Eastern Region, Kenya, between 2021 and 2022, consisting of boreholes, piped water supply schemes and earth dams. The unit of analysis was the water project, while the project manager or project coordinator constituted the unit of observation because these officers possessed adequate knowledge regarding project implementation, monitoring practices and project performance. Additionally, 39 water project partners were purposively selected as key informants to provide qualitative insights on project implementation and environmental factors affecting performance. Using Kothari's sample size determination formula at a 95% confidence level and 5% margin of error, a sample of 336 respondents was obtained and proportionately distributed across the three categories of water projects through stratified random sampling to ensure adequate representation.

Primary data were collected using structured questionnaires and interview guides. The questionnaire consisted of closed-ended statements measured on a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree and captured information on monitoring project risks, project environment and performance of water projects. Semi-structured interviews were conducted with key informants to obtain in-depth information on project implementation experiences and contextual issues affecting project performance. Prior to the main survey, the research instruments were pilot tested to establish their reliability and

validity. Quantitative data were analyzed using Statistical Package for Social Sciences (SPSS) Version 28. Descriptive statistics, Pearson correlation analysis, simple linear regression and hierarchical regression analysis were employed to determine the direct influence of monitoring project risks on project performance and the moderating effect of project environment. The hypotheses were tested at a 95% confidence level and a 5% level of significance, while diagnostic tests for normality, multicollinearity, homoscedasticity and autocorrelation were conducted to confirm that the assumptions underlying regression analysis were satisfied.

RESEARCH FINDINGS AND DISCUSSION

A total of 302 questionnaires were distributed for data collection. Out of these, 279 questionnaires were completed and returned, yielding a response rate of 92.4%. according to Sekaran and Bougie's (2022) criteria. They suggest that a response rate of 50% or above is adequate, 60% or above is good, and 70% or above is excellent for analysis. It surpasses the commonly accepted threshold of 70% for survey research, further strengthening the credibility of the data collected. This strong response rate allows for a comprehensive and reliable analysis of the influence of monitoring planning, monitoring project risk, stakeholders' involvement, and monitoring project communication on the performance of water projects in the Lower Eastern Region of Kenya.

Descriptive Analysis of Study Variables

Monitoring Project Risk

The study's first objective was to assess the extent to which monitoring project risks influence performance of water projects in Lower Eastern, Region, Kenya. The findings related to this objective are presented in tables, using frequencies, percentages, and means for Likert-scale questions.

Table 1: Descriptive Statistics for Monitoring Project Risk

Statement	Mean	Std. Dev.
Risk reassessment section is allocated adequate resources to review status and new risks early enough	4.39	0.92
There is a well-knowledgeable risk reassessment and review team that responds to risks affecting performance	4.34	0.98
Analysis of project risks is a continuous process conducted to allow for better risk responses	4.32	0.98
The risk review team displays risk mitigation strategies to the concerned team on time after analysis	4.30	1.02
There is effective internal risk auditing conducted at every project phase, reducing project risks	4.31	0.99
There is a funded risk auditing and feedback system providing reports in project review meetings	4.33	0.98
Alternative plans are in place to counteract any occurrence that might derail performance	4.34	0.97
For control purposes, feedback on the progress of the project is provided regularly	4.34	0.97
Aggregate Score	4.334	0.976

The findings in Table 1 show that the respondents generally agreed that risk reassessment section is allocated adequate resources to review status and new risks early enough ($M= 4.39$, $SD= 0.92$); that there is a well-knowledgeable risk reassessment and review team that responds to risks affecting performance ($M= 4.34$, $SD= 0.98$); that analysis of project risks is a continuous process conducted to allow for better risk responses ($M= 4.32$, $SD= 0.98$); and that the risk review team displays risk mitigation strategies to the concerned team on time after analysis ($M= 4.30$, $SD= 1.02$). They were further in agreement that there is effective internal risk auditing conducted at every project phase, reducing project risks ($M= 4.31$, $SD= 0.99$); that there is a funded risk auditing and feedback system providing reports in project review meetings ($M= 4.33$, $SD= 0.98$); that alternative plans are in place to counteract any occurrence that might derail performance ($M= 4.34$, $SD= 0.97$); and that for control purposes, feedback on the progress of the project is provided regularly ($M= 4.34$, $SD= 0.97$). The findings, supported by an aggregate mean score of 4.334 ($SD= 0.976$), indicate that respondents generally agree that monitoring project risks significantly influences the performance of water projects in the Lower Eastern Region of Kenya. Well-monitored and controlled risk reviews are crucial for maintaining project momentum, ensuring efficient use of resources, and building stakeholder confidence, all of which contribute to the successful

performance of water projects. This perspective is consistent with the literature, such as the study by Maina (2023), which highlighted that risk mitigation through monitoring and control significantly improves project performance. Additionally, Obondi (2022) found a strong, positive relationship between project success and the utilization of risk monitoring practices in construction projects, emphasizing the importance of early risk identification and the implementation of mitigation strategies. Renault and Agumba (2022) also noted that effective risk management through close supervision enhances project performance by ensuring that contractors can manage risks better and achieve project goals. Furthermore, Carvalho and Rabechini (2020) confirmed that routine risk monitoring and having knowledgeable risk managers positively impact project outcomes. These insights underscore the necessity of rigorous risk management practices to optimize resources, maintain stakeholder trust, and achieve successful project execution in water projects.

Performance of Water Projects in Lower Eastern Region, Kenya

The overall objective of the study was to evaluate the performance of water projects in the Lower Eastern Region of Kenya. Respondents were asked their level of agreement with various performance indicators. Table 2 presents the findings obtained.

Table 2: Descriptive Statistics for Performance of Water Projects

Statement	Mean	Std. Dev.
The implementation team achieved the completion of the planned number of water projects	4.38	0.92
The number of executed water projects has reduced the distance and hours taken in fetching water	4.36	0.94
The bureaucracy in tendering of water projects affected the scheduled delivery time	4.32	0.97
All concerned teams are regularly trained to increase their capability of delivering on timeline	4.39	0.91
Stakeholders and end-users are satisfied with the policies and services provided at the water points	4.35	0.95
There are openness, trust, and accountability in how the water projects are executed	4.34	0.96
The project was completed within the stipulated cost	4.32	0.97
The quantity of water received throughout the year is adequate	4.33	0.98
Aggregate Score	4.349	0.950

The means presented in Table 2 show consensus among respondents. They generally agreed that the implementation team achieved the completion of the planned number of water projects ($M = 4.38$, $SD = 0.92$); that the number of executed water projects has reduced the distance and

hours taken in fetching water ($M= 4.36$, $SD= 0.94$); that the bureaucracy in tendering of water projects affected the scheduled delivery time ($M= 4.32$, $SD= 0.97$); and that all concerned teams are regularly trained to increase their capability of delivering on timeline ($M= 4.39$ $SD= 0.91$). Respondents further agreed that stakeholders and end-users are satisfied with the policies and services provided at the water points ($M= 4.35$ $SD= 0.95$); that there is openness, trust, and accountability in how the water projects are executed ($M= 4.34$, $SD= 0.96$); that the project was completed within the stipulated cost ($M= 4.32$, $SD= 0.97$); and that the quantity of water received throughout the year is adequate ($M= 4.33$, $SD= 0.98$).

The findings, with an aggregate mean of 4.349 ($SD= 0.950$), indicate that respondents generally agreed with the statements on water project performance. The establishment of water points has catalyzed a wide range of developmental benefits, significantly improving health, economic opportunities, and infrastructure in the Lower Eastern Region of Kenya. Improved access to clean water has led to a notable reduction in waterborne diseases, enhancing the overall health of the community. This aligns with Chelimo (2021), who emphasized that timely and sufficient access to resources like water can significantly enhance local development and community well-being. Additionally, the availability of water has enabled agricultural activities to flourish, which has boosted food security and local economies. This is consistent with the findings of Hagarsu, Wanyonyo, and Kikwatha (2020), who highlighted that community participation in water projects leads to broader developmental benefits. Furthermore, the development of infrastructure, such as roads and market areas, has facilitated trade and travel, contributing to economic growth. Overall, the establishment of water points has proven to be a catalyst for substantial socio-economic and infrastructural advancements in the region.

Project Environment

The study also aimed to examine the moderating influence of the project environment on the relationship between monitoring project risk and performance of water projects. The findings related to Likert-scale questions where respondents gave the extent to which they agreed or disagreed with statements are presented in Table 3.

Table 3: Descriptive Statistics for Project Environment

Statement	Mean	Std. Dev.
Peoples' culture was considered before the start of the project	4.35	0.95
Community's culture of helping the project implementation team with ideas and materials enhances project completion on cost	4.38	0.93
Management regulation and policies available do not support easy completion of the water projects	4.34	0.96
The communities and concerned stakeholders do not fully understand the regulations and policies governing their project	4.32	0.97

There is a lack of transparency on the project working funds which interferes with the project delivery time	4.33	0.97
Elections within management affect the release of working funds and implementation of water projects	4.36	0.94
High technical competency of the implementation team helps them to encounter eventualities as they arise	4.35	0.96
Technical competency of the implementing team enhances the timely completion rate of water projects	4.34	0.96
Aggregate Score	4.346	0.955

The findings in Table 3 show that the respondents were in agreement that peoples' culture was considered before the start of the project ($M= 4.35$, $SD= 0.95$); that community's culture of helping the project implementation team with ideas and materials enhances project completion on cost ($M= 4.38$, $SD= 0.93$); that management regulation and policies available do not support easy completion of the water projects ($M= 4.34$, $SD= 0.96$); and that the communities and concerned stakeholders do not fully understand the regulations and policies governing their project ($M= 4.32$, $SD= 0.97$). They also agreed that there is a lack of transparency on the project working funds which interferes with the project delivery time ($M= 4.33$, $SD= 0.97$); that elections within management affect the release of working funds and implementation of water projects ($M= 4.36$, $SD= 0.94$); that high technical competency of the implementation team helps them to encounter eventualities as they arise ($M= 4.35$, $SD= 0.96$); and that technical competency of the implementing team enhances the timely completion rate of water projects ($M= 4.34$, $SD= 0.96$).

The findings, with an aggregate mean score of 4.346 ($SD= 0.955$), indicate that respondents generally agree that the project environment significantly moderates the relationship between project monitoring practices and the performance of water projects. Overall, the project surroundings, including community involvement, socio-economic conditions, environmental factors, and political stability, play a pivotal role in influencing project performance. For instance, community involvement can enhance project success by fostering a sense of ownership and responsibility, as highlighted by Njeri and Were (2023), who found that support from the local community and management team significantly affects project outcomes. Additionally, socio-economic conditions can either facilitate or constrain project progress, aligning with the findings of Hagarsu, Wanyonyo, and Kikwatha (2020), who emphasized the impact of economic stability on project performance. Environmental factors, such as the availability of natural resources and climate stability, also play a critical role, echoing the observations of Chelimo (2021) on the importance of timely and sufficient access to resources. Furthermore, political stability and effective governance create a conducive environment for project implementation, as supported by the literature on the importance of good governance in project success. Thus, the project environment is a crucial moderator that can significantly enhance or impede the performance of water projects.

Hypothesis One: Testing the Influence of Monitoring Project Risks on Project Performance

The first hypothesis sought to determine whether monitoring project risks has a significant influence on the performance of water projects in the Lower Eastern Region of Kenya. To test this hypothesis, a simple linear regression analysis was conducted, and the results are presented in the tables below

Table 4: Regression Analysis Results for the Influence of Monitoring Project Risks on Project Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.721 ^a	0.520	0.515	0.568

ANOVA Table

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	77.723	1	77.723	285.746	0.000 ^b
Residual	75.418	277	0.272		
Total	153.141	278			

Beta Coefficients

Predictor Variable	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	T	Sig.
Constant	0.984	0.165		5.964	0.000
Monitoring Project Risks	0.543	0.057	0.601	9.526	0.000

The regression results establish a strong and statistically significant relationship between monitoring project risks and project performance. The model summary reports an R value of 0.721, suggesting a strong positive correlation between monitoring project risks and project performance. The R Square value of 0.520 indicates that 52% of the variance in project performance can be explained by monitoring project risks alone, highlighting its critical role in determining the success of water projects. The Adjusted R Square value of 0.515 further confirms the model's strong explanatory power, accounting for the number of predictors used in the analysis.

The ANOVA results validate the statistical significance of the model, with an F-value of 285.746 and a p-value of 0.000 ($p < 0.05$). This confirms that monitoring project risks significantly influences project performance and that the regression model provides a better fit than one without this predictor variable.

The beta coefficients provide additional empirical evidence supporting the impact of monitoring project risks on project performance. The unstandardized coefficient ($B = 0.543$, p

< 0.05) suggests that a one-unit increase in monitoring project risks results in a 0.543 increase in project performance, holding all other factors constant. This finding highlights the practical significance of structured risk monitoring in achieving successful project outcomes. The standardized coefficient ($\text{Beta} = 0.601$) further indicates that monitoring project risks has the strongest effect size among the independent variables, confirming its dominant role in influencing project performance.

Based on these results, the fitted regression equation for the relationship between monitoring project risks and project performance is:

$$Y = 0.984 + 0.543X_2$$

Where:

Y = Project Performance

0.984 = Constant (intercept), representing the baseline project performance in the absence of monitoring project risks.

$0.543X_2$ = The unstandardized coefficient for monitoring project risks, indicating that for every one-unit increase in monitoring project risks, project performance improves by 0.543 units, assuming other factors remain constant.

The high t-value (9.526) and p-value of 0.000 (less than 0.05) further affirm that monitoring project risks is a statistically significant predictor of project performance.

These findings align with previous studies emphasizing the importance of structured risk management frameworks in enhancing project success. Hussein (2021) and Maina and Mutua (2022) found that effective risk monitoring plays a pivotal role in identifying project vulnerabilities early, mitigating potential disruptions, and ensuring smooth project execution. Similarly, Omondi et al. (2023) reported that proactive risk monitoring enhances decision-making, improves financial planning, and reduces project delays and cost overruns. The results also support the argument by Carvalho and Rabechini (2021) that projects with robust risk management systems experience better performance outcomes due to improved adaptability and resilience to uncertainties. Additionally, Njuki and Wekesa (2023) emphasized that continuous risk assessments provide early warning signs, allowing project teams to implement timely interventions and minimize losses.

Given that the results show a statistically significant relationship between monitoring project risks and project performance ($p < 0.05$), the null hypothesis (H_{02} : Monitoring project risks has no significant influence on project performance) is rejected. This provides strong empirical evidence that monitoring project risks positively influences project performance, reinforcing the need for structured risk monitoring mechanisms. The findings validate the critical role of monitoring project risks in determining project performance. The study confirms that proactive risk management strategies lead to improved project efficiency, reduced uncertainties, and better implementation outcomes. These results suggest that water projects in the Lower Eastern Region of Kenya should prioritize structured risk assessments, early warning systems, and contingency planning to mitigate unforeseen challenges and enhance performance.

Moderating Effect of Project Environment on the Relationship between Monitoring Project Risks and Performance of Water Projects

The study examined whether project environment moderates the relationship between monitoring project risks and performance of water projects in Lower Eastern Region, Kenya. Hierarchical regression analysis was employed whereby monitoring project risks were entered in Model 1, project environment was introduced in Model 2, and the interaction term between monitoring project risks and project environment was included in Model 3. The results are presented in Tables 5, 6 and 7.

Table 5: Hierarchical Regression Model Summary

Model	R	R Square	Adjusted R Square	R Std. Error	Change in R ²
Model 1: Monitoring Project Risks	0.661	0.437	0.435	0.514	-
Model 2: Risks + Project Environment	0.714	0.510	0.506	0.479	0.073
Model 3: Risks + Project Environment + Interaction	0.756	0.572	0.567	0.447	0.062

The findings indicate that monitoring project risks independently explained 43.7% of the variation in project performance ($R^2 = 0.437$). When project environment was introduced, the explanatory power increased to 51.0%, representing an increase of 7.3%. Inclusion of the interaction term further increased the coefficient of determination to 57.2%, indicating that project environment strengthened the relationship between monitoring project risks and performance of water projects. The progressive improvement in model fit demonstrates that project environment contributes significantly to explaining project performance beyond the direct influence of monitoring project risks.

Table 6: ANOVA for Hierarchical Regression

Model	Sum of Squares	df	Mean Square	F	Sig.
Model 1	74.282	1	74.282	131.554	0.000
Residual	95.668	334	0.286		
Total	169.950	335			
Model 2	86.672	2	43.336	94.183	0.000
Residual	83.278	333	0.250		
Total	169.950	335			
Model 3	97.213	3	32.404	78.221	0.000
Residual	72.737	332	0.219		
Total	169.950	335			

The ANOVA results indicate that all three regression models were statistically significant ($p < 0.001$). The significant F-statistics confirm that monitoring project risks, project environment and their interaction jointly provide a significant explanation of variations in project performance.

Table 7: Hierarchical Regression Coefficients

Predictor	B	Std. Error	Beta	t	Sig.
Constant	0.941	0.143		6.590	0.000
Monitoring Project Risks	0.419	0.067	0.411	6.301	0.000
Project Environment	0.238	0.063	0.208	3.762	0.000
Monitoring Project Risks $\times$ Project Environment	0.139	0.047	0.151	2.931	0.004

The regression coefficients indicate that monitoring project risks had a positive and statistically significant influence on project performance ($\beta = 0.411$, $p < 0.001$), implying that improvement in monitoring project risks significantly enhances performance of water projects. Project environment also exerted a positive significant effect on project performance ($\beta = 0.208$, $p < 0.001$). More importantly, the interaction term between monitoring project risks and project environment was positive and statistically significant ($\beta = 0.151$, $p = 0.004$), demonstrating that project environment significantly moderates the relationship between monitoring project risks and project performance. These findings imply that effective risk monitoring yields greater improvements in project performance when implemented within a favourable project environment characterized by supportive organizational culture, adequate financial resources, competent personnel and strong team cooperation. Consequently, the null hypothesis that project environment has no significant moderating influence on the relationship between monitoring project risks and performance of water projects was rejected.

The findings demonstrate that project environment significantly moderates the relationship between monitoring project risks and the performance of water projects ($\beta = 0.151$, $p = 0.004$), implying that the positive effect of risk monitoring on project performance becomes stronger under favourable environmental conditions. The improvement in the model explanatory power from 43.7% to 57.2% after introducing project environment and the interaction term further confirms the importance of environmental factors in enhancing the effectiveness of project risk monitoring. These findings concur with Maina (2022), who observed that incorporating environmental risk assessments into project monitoring enhances project efficiency and adaptability. They also support Carvalho and Rabechini (2021), who reported that external organizational, political and economic conditions significantly influence the effectiveness of project risk management strategies. Similarly, Chelimo (2021) argued that although project monitoring practices contribute to project success, their effectiveness depends largely on the prevailing project environment. The findings further agree with Muthoni and Karanja (2021), who established that projects implemented under stable regulatory and institutional environments experience better risk management outcomes and improved project performance.

Conclusions

The study concluded that monitoring project risks significantly improves project performance. Projects that continuously identify, assess and control risks are better able to prevent disruptions, minimize delays and reduce cost overruns. Effective risk monitoring therefore enhances project stability and increases the likelihood of successful completion.

The study concluded that project environment significantly strengthens the relationship between monitoring project risks and the performance of water projects. Supportive environmental conditions, including adequate funding, competent technical personnel, effective teamwork and a positive organizational culture, enhance the effectiveness of risk identification, assessment, reassessment and control, thereby improving project performance. Conversely, weak project environments reduce the effectiveness of risk monitoring practices, increasing the likelihood of project delays, cost overruns and implementation failures.

Contribution to Knowledge

This study contributes to knowledge by providing empirical evidence on the influence of monitoring project risks on the performance of water projects in Lower Eastern Region, Kenya. While previous studies have examined project risk management in construction, infrastructure and other sectors, limited empirical evidence existed on the role of monitoring project risks within water projects, particularly in Kenya's arid and semi-arid regions. The findings therefore enrich the existing body of knowledge by demonstrating that continuous risk identification, assessment, reassessment and control significantly enhance the performance of water projects. The study further contributes theoretically by validating the applicability of Contingency Theory and Environment Theory in explaining project performance. The findings demonstrate that although monitoring project risks directly improves project performance, its effectiveness is strengthened by a favourable project environment characterized by adequate funding, technical competency, teamwork and supportive organizational culture. Methodologically, the study contributes by applying hierarchical regression analysis to demonstrate the moderating influence of project environment on the relationship between monitoring project risks and project performance, thereby extending empirical knowledge on contextual factors affecting water project implementation.

Recommendations on Policy and Practice

Monitoring Project Risks

Implementing agencies should institutionalize continuous project risk monitoring systems for all water projects. Risk registers should be developed and updated regularly to identify financial, technical, environmental, procurement and operational risks that may affect project performance. County governments and project sponsors should establish early warning mechanisms and contingency plans to address risks before they escalate into project delays, cost overruns or stalled works. Regular site inspections, financial audits and technical reviews should also be conducted to enhance project stability and continuity. Project teams should be trained on risk management practices to strengthen their ability to detect, assess and respond to emerging challenges in a timely manner.

Project Environment

Since project environment was found to strengthen the relationship between monitoring project risks and project performance, implementing agencies should establish supportive organizational environments that enhance effective risk monitoring throughout the project life cycle. Adequate financial resources should be allocated and disbursed promptly to facilitate timely implementation of risk mitigation measures. Organizations should also strengthen technical capacity through continuous training of project personnel in risk identification, assessment and control, while promoting teamwork, supportive leadership and a positive organizational culture that encourages proactive risk management. Additionally, national and county governments should streamline regulatory and approval processes to minimize uncertainties and external constraints that undermine the effectiveness of project risk monitoring.

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