

Moderating Effect of External Environment on the Relationship Between Risk Management and Project Performance of County-Funded Construction Projects

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Received: 13 January, 2025

Final Revision: 22 June, 2025

Accepted: 25 June, 2025

Published: 23 August, 2025

 [10.52283/NSWRCA.AJBMR.20251001A04](https://doi.org/10.52283/NSWRCA.AJBMR.20251001A04)

Abstract

This study investigates the moderating effect of the external environment on the relationship between risk management and project performance in county-funded construction projects in Nakuru County, Kenya. The research problem encompasses an overview of external environmental factors, including technological advancements, political conditions, social dynamics, and physical surroundings. The literature review further emphasizes the complex interplay between project performance and risk management in the construction sector, highlighting the significant influence of the external environment. The study is grounded in systems theory and contingency theory, which provide the theoretical framework for contextual analysis.

A predictive research design was employed to enable a systematic examination of the causal relationship between project risk management strategies and construction project performance. Both quantitative and qualitative analysis techniques were utilized for descriptive evaluation of project outcomes. Data were collected from 314 respondents, including contractors, subcontractors, project engineers, finance managers, and county project managers, using structured questionnaires and semi-structured interviews.

The findings indicate that risk management variables account for 58.9% of the variance in project performance. The inclusion of external environmental factors significantly increased the explained variance ($\Delta R^2 = .021$, $p < .001$). Hierarchical multiple regression analysis further revealed that the external environment significantly moderates the relationship between risk management and project performance, explaining an additional 3.3% of the variance ($\Delta R^2 = .033$, $p < .001$). The strong influence of the external environment, particularly the moderate to high impact of technological, regulatory, political, and financial factors, underscores the necessity for adaptive risk management strategies.

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The study concludes that effective risk management strategies must be tailored to specific external contexts, especially in more challenging environments. This research contributes to both theory and practice by underscoring the importance of integrating environmental considerations into project risk management and by offering recommendations to enhance the performance of county-funded construction projects.

Keywords: *Risk management, project performance, external environment, construction projects, county government, moderating effect*

I. Introduction

Project performance is critical in construction projects to ensure the achievement of objectives related to time, cost, quality, client satisfaction, alignment with the client's original plan, business outcomes, and health and safety considerations (Ndambuki et al., 2019). According to Zama (2018), construction projects are exposed to diverse risks that undermine project performance. Effective risk management processes are therefore essential to address and minimize risks arising from both external factors and the scale of the project. Risk management plays a pivotal role in ensuring optimal performance in construction initiatives.

According to Lima and Verbano (2019), project risk management refers to the systematic identification, analysis, treatment, and monitoring of risks associated with project implementation. These processes aim to eliminate or reduce the likelihood of project-related risks that could potentially disrupt the project cycle in terms of time, cost, quality, performance, and expected return on investment (ROI), while also addressing emerging risks to ensure maximum project impact.

The external environment significantly influences the relationship between risk management and construction project performance. It consists of factors beyond the control of the project team, which can affect various aspects of project execution. Lamprou and Vagiona (2018) define the external environment as encompassing elements such as clients, technological advancements, political landscape, social dynamics, and physical surroundings. Similarly, Alashwal et al. (2017) identify political, social, and economic contexts as critical components of the external environment. Political risks, in particular, have been recognized as a major challenge to construction project performance. Studies that highlight political risks as obstacles include Chang, Deng, et al. (2018), who focused on Chinese construction projects; Mahamid (2017), who linked political interference to project delays in Saudi Arabia; and Murithi et al. (2017), who identified political interference as a hindrance to construction performance in Kenya. Murithi et al. (2017) further concluded that professional conduct by project management teams could mitigate the negative impact of political interference.

Construction projects encounter diverse risks that impede their performance. According to Lima and Verbano (2019), risk refers to the deviation from expected outcomes, creating uncertainty in achieving predefined objectives. Koul et al. (2018) define risk as exposure to hazards that could prevent the attainment of project goals. Tayeh et al. (2020) emphasize that project risks involve the potential occurrence of adverse events during execution, which may jeopardize project success. Dhivya and Prabu (2019) attribute the heightened risk levels in construction projects to their inherent complexity and the challenging environments in which they are executed. Risks typically encountered in construction include legal, regulatory, technical, economic, political, operational, and environmental risks (Alipour et al., 2017). Darwish et al. (2018) broadly categorize these into internal and external risks.

To optimize project performance, it is imperative to address and mitigate the risks faced through effective risk management processes (Kumar et al., 2017). Project risk management encompasses proactive measures to reduce the likelihood and impact of potential threats. Lima and Verbano (2019) reiterate that project risk management involves a systematic process of identifying, analyzing, treating, and monitoring risks during implementation. Elhoush and Kulatunga (2017) further elaborate that this process includes identifying potential risks, ranking them by severity, developing action plans to address them, and continuously monitoring the effectiveness of these strategies. Effective risk management is essential for achieving performance goals related to cost, time, quality, and other relevant indicators (Darwish et al., 2018). Aras and Amirhosseini (2016) also affirm that risk management facilitates the development of contingency plans in anticipation of risk events.

Construction projects are vital to the socio-economic development of Nakuru County. According to the Second Nakuru County Integrated Development Plan (CIDP), these projects contribute to urban development, early childhood education (ECDE), enhancement of county competitiveness, and infrastructure growth. The CIDP aligns with Kenya's Vision 2030 by promoting economic development, contributing to GDP, and creating employment opportunities (Ndambuki et al., 2019). Specific projects include the construction of hospitals and their perimeter walls, ECDE centers, water projects, and town roads.

However, a significant disconnect exists between the expectations and perceptions of Nakuru residents, project developers, and contractors due to a high rate of missed milestones and cost overruns in county projects. The Office of the Auditor General (2017) raised concerns regarding incomplete projects such as boreholes, community

water initiatives, and public office buildings. The report also criticized several non-viable projects that had been initiated.

This research holds considerable significance by examining the impact of operational and strategic risk management processes on the success of county-funded construction projects in Nakuru County. By analyzing these effects, the study aims to provide valuable insights into the effectiveness of risk management practices. These insights are expected to equip county officials and project managers with the knowledge necessary to improve project outcomes.

Moreover, the study explores the external environment's critical dimensions and how associated risks can be managed within Nakuru County's construction context. By evaluating external influences on project outcomes, the research offers a comprehensive understanding of the challenges and opportunities in this domain. This knowledge can assist county administrators, the national treasury, donors, project stakeholders, and policymakers in developing effective risk mitigation and financial strategies to ensure project success.

Furthermore, the study highlights how project characteristics and broader external environmental factors such as technological advancements, political conditions, social dynamics, and physical surroundings interact with risk management efforts to influence project outcomes. These nuanced findings offer critical insights into contextual variables that can either enhance or hinder the effectiveness of risk management, supporting project leaders and decision-makers in tailoring their strategies to the specific demands of each project environment.

Research Problem

The main objective of this research is to investigate the influence of various risk management strategies on the performance of construction projects financed by Nakuru County. Furthermore, the study aims to examine the roles played by the external environment and project magnitude in shaping the relationship between risk management methodologies and the effectiveness of county-funded projects. By addressing existing gaps in the literature concerning the interplay between risk identification, monitoring, mitigation strategies, and project outcomes, this research seeks to elucidate the relationship between risk management approaches and the success of county-backed construction projects. Accordingly, the study evaluated multiple determinants of project success, including operational efficiency, client satisfaction, adherence to safety protocols, and overall stakeholder contentment (Iwu et al., [2018](#)).

This research explores the critical role of county construction projects in fulfilling the core mandates of county governments and advancing socio-economic development. These projects encompassing health facilities, roads, market stalls, Early Childhood Development Centres (ECDC), and various public works are designed to deliver essential services to citizens. However, challenges such as delays, limited value for money, and incomplete works have been reported, as highlighted by the Office of the Auditor General. To address these issues, this study undertakes a comprehensive investigation of project risk management strategies, focusing on operational, strategic, legal, and financial dimensions. The goal is to gain a thorough understanding of how these diverse risk management strategies are effectively employed to mitigate risks and enhance overall project performance in alignment with socio-economic development objectives (Office of the Auditor General, [2018](#), [2019a](#), [2019b](#), [2019c](#)).

Existing literature on the impact of risk management on project performance in county-funded construction projects is limited in both geographic scope and academic depth. Prior studies have explored this association in different national contexts. For example, Nguyen and Watanabe ([2017](#)) in Vietnam emphasized contractor commitment as a key determinant of project success. Tanojo et al. ([2018](#)), in a study on hospital construction in Indonesia, identified bureaucratic obstacles in permit acquisition as a significant strategic risk. The current study addresses contextual gaps, as previous studies were not based on the Nakuru County setting.

One major strategic risk that requires mitigation is political risk. Hwang et al. ([2018](#)) conducted a study examining political risk management in international construction projects, utilizing data from 155 questionnaires distributed to global experts in the field. In this context, political risk was conceptualized as the uncertainty arising from political events. Their study found that construction projects are vulnerable to a range of political risks, including credit crises, political instability, wars, regime changes, and terrorist attacks. Recommended political risk mitigation strategies included establishing partnerships with local businesses, submitting higher tender offers, and forming joint ventures with local contractors.

Pawar and Ambure ([2017](#)) conducted research in India and identified delays in obtaining government permits as a significant strategic risk affecting residential construction projects. These studies underscore the necessity of managing risks associated with contractor commitment, bureaucracy, and permit delays. In the Kenyan context, prior studies have emphasized the importance of accurate cost estimation in financial risk management. Thiong'o, M.K and Muchelule ([2019](#)) found that precise cost estimation positively influences project risk management. The present research incorporates the Technology Acceptance Model (TAM) to assess the adoption of technology in risk management and seeks to address a theoretical gap in understanding how risk management processes

influence project performance. To explore this relationship, the study draws upon systems theory, contingency theory, and the theory of constraints.

Within the context of Nakuru County-funded projects, there is a notable lack of information and understanding regarding risk analysis relative to project size. This study seeks to bridge this contextual gap. Furthermore, there is limited empirical research addressing how operational, strategic, legal, financial, and project magnitude factors affect performance in county-funded construction projects in Nakuru County, Kenya. The research also examines the moderating effect of the external environment on this relationship. Overall, the study endeavors to provide a comprehensive understanding of how risk management practices influence the performance of county-funded construction initiatives in Nakuru County.

Additionally, a conceptual gap persists in the literature. While research from other countries highlights the significance of factors such as contractor commitment, bureaucratic hurdles, delays in permit approvals, and cost estimation in financial risk management, these dimensions have not been rigorously analyzed in the context of Nakuru County projects. In particular, issues related to project inefficiencies such as budgetary deviations, discrepancies in work hours, significant cost variations, and unmet project milestones have not been explicitly linked to performance outcomes in county-funded construction. Although studies like Idan and Dheyab (2019) employed quantitative methodologies to examine factors affecting project performance, the present study adopts a mixed-methods approach. By integrating both qualitative and quantitative data collection techniques, this research aims to provide a more nuanced and comprehensive understanding of the subject. Identifying a methodological gap, the study is guided by the following main research question: *What is the influence of project risk management, project size, and the external environment on project performance in county-funded construction projects specifically located in Nakuru?*

II. Literature Review and Development of Hypotheses

Theoretical Review

Construction projects face diverse risks that impede their performance. According to Lima and Verbano (2019), risk refers to the deviation from expected outcomes, creating uncertainty regarding the achievement of pre-planned objectives. Koul et al. (2018) opine that risk constitutes exposure to hazards with the potential to hinder the attainment of project objectives. Tayeh et al. (2020) emphasize that project risks denote the likelihood of detrimental events occurring during project execution, which can jeopardize the fulfillment of project goals. Dhivya and Prabu (2019) attribute the heightened risk levels in construction projects to the complexity of such projects and the contexts in which they are implemented. Among the risks encountered in construction projects are legal risks, regulatory risks, technical risks, economic risks, political risks, operational risks, and environmental risks, among others (Alipour et al., 2017). Darwish et al. (2018) categorize these project risks into two broad types: internal and external risks.

In reference to Kumar et al. (2017), to optimize project performance, external environmental risks and the various risks encountered in construction projects must be addressed and mitigated through effective project risk management processes. Project risk management refers to the measures undertaken to mitigate project-related risks. According to Lima and Verbano (2019), project risk management involves the systematic identification, analysis, treatment, and monitoring of risks associated with project implementation. This is carried out with the aim of eliminating or reducing the likelihood of such risks occurring. Elhoush and Kulatunga (2017) conceptualize project risk management as the identification and ranking of diverse potential risks a project might face, followed by the development and implementation of action plans to address any emerging issues, along with ongoing monitoring of the effectiveness of these action plans. Effective project risk management is essential for achieving project performance goals, encompassing elements such as cost, time, quality, and other relevant performance metrics (Darwish et al., 2018). Aras and Amirhosseini (2016) further affirm that effective project risk management supports the identification of contingency plans in the event of risk occurrence.

Project risk management can be implemented through various forms of environmental risk management, including considerations related to technological advancements, political conditions, social factors, and physical surroundings. According to Paquin et al. (2016), external project risks relate to the extrinsic nature and consequences of risks encountered throughout the project lifecycle. Orori and Njeru (2016) observe that environmental risks arise from the management of people, processes, or systems during project execution. Risk management, in this regard, becomes a vital component of project governance. As Wanjohi and Omwenga (2017) state, external environmental risk management focuses on addressing risks that could hinder the realization of organizational or project-specific strategic goals. These risks may originate within either the internal or external environments in which the project operates. In this context, Bromiley and Rau (2016) identify several strategic risks requiring mitigation, including industry-related risks, reputational risks, economic risks, and political risks, among others. Managing external risks is a critical aspect of project risk management. As noted by Holcomb (2017), external risk management involves addressing extrinsic challenges and potential liabilities that projects

may encounter. Miao et al. (2019) document challenges in construction projects that could lead to litigation, identifying external risks related to the use of emerging technologies, political dynamics, and social factors during project execution. Many scholars have identified external environmental risks as a major obstacle to construction project performance. For instance, technological advancements influence efficiency while necessitating adaptation to evolving digital tools and automation systems. Political conditions, such as government stability, affect project approvals and timelines. Social factors include community dynamics and cultural elements that shape stakeholder engagement, whereas physical surroundings may pose logistical challenges due to geographic, climatic, or infrastructural constraints. These interconnected external factors create a complex operational environment that moderates the relationship between risk management strategies and project performance. Construction managers must develop comprehensive and adaptable strategies tailored to specific environmental contexts, with more challenging settings necessitating increasingly robust risk management practices to mitigate threats and enhance project success rates.

According to Wu et al. (2018), project performance can be evaluated based on a project's ability to achieve the constraints of the "iron triangle": time, cost, and quality. The iron triangle is a widely accepted model for measuring project performance. Additional performance dimensions include customer satisfaction, alignment with project owner's strategic goals, adherence to safety standards, and stakeholder satisfaction (Wu et al., 2018). Project delays represent a significant obstacle to effective construction project performance. In a study conducted in Saudi Arabia, Alzara et al. (2016) analyzed the performance of construction activities through a comprehensive review of literature on construction projects in the country. Their findings revealed prevalent issues such as time and cost overruns, noting specifically that more than 70% of public sector construction projects in Saudi Arabia experience delays. In the context of county-level projects, performance is defined by the timely and cost-effective achievement of objectives while maintaining quality standards. Ultimately, the success of such projects is gauged by the satisfaction of taxpayers with project outcomes and the financial accountability of associated expenditures. This study adopted use of system theory and contingency theory that underpinned the context of the study as explained below.

System Theory

The researcher incorporated Bertalanffy's general system theory and Margaret Mead's contributions to explore the connection between risk management processes and project performance (Von Bertalanffy, 1993). External stakeholders are considered integral to this system, impacting project performance and necessitating their inclusion in risk management processes (Javed et al., 2018). The emergence of project-based working in the defense industry in the mid-1990s created a strong link between project management and Systems Engineering (SE) (Njue et al., 2019). Systems theory became embedded in project management dynamics, providing a comprehensive understanding of organizational dynamics and enabling executives to address complexity in project execution (Javed et al., 2018). Despite its advantages, systems theory faces criticism for its abstract nature and limitations in practical applications. Acknowledging these limitations, the study adopted systems theory to interlink various risk management components, including operational, strategic, legal, financial, and project size risk management. The emphasis was on cohesive risk mitigation strategies across these dimensions to enhance overall project performance.

Contingency Theory

The theory was developed by a group of management scholars in 1967, including Fiedler, March, and Herbert Simon. The theory was a response due to the rigidity and prescriptive management approaches that were popular at the time, such as Taylorism and Bureaucratic Management (Cheng & Fisk, 2022). These scholars argued that these approaches did not take into account the unique circumstances of different organizations and that a more flexible, context-specific approach was needed. Fiedler formulated the "Least Preferred Coworker" (LPC) theory, positing that a leader's management approach should be contingent upon the degree of favorability in their connection with subordinates (Pang et al., 2020). The theory was established in the context of the changing business environment at the time, which saw an increased focus on organizational efficiency and effectiveness. This was driven by factors such as increased competition and rapid technological change.

The contingency theory proposes that the best way of organizing and managing an enterprise depends on the conditions present in the environment. It is a reaction against the universal principle of management and the notion that there is a single best way of managing (Childs et al., 2022). The theory underscores the necessity for managers to tailor their management strategies to align with the distinct requirements of the organization and external influences, including organizational size, industry context, and external environment (Csaszar & Ostler, 2020). The theory postulates that in organizational management and leadership, any universal or one-size-fits-all approach is not applicable. Instead, it emphasizes the success or effectiveness of management and leadership

styles hinges on specific situational variables and contexts. However, critics argue that this theory lacks prescriptive guidance, is complex and ambiguous, makes it difficult to identify relevant factors, has limited predictive power, doesn't integrate well with other theories, and tends to overemphasize external factors. Implementing contingency theory can also be resource-intensive and may face resistance from those accustomed to traditional approaches. Notwithstanding these criticisms, it emphasizes the significance of adaptation and the consideration of various aspects in organizational decision-making.

In Nakuru's county-funded construction projects, contingency theory is instrumental in examining the nuanced relationships between operational, strategic, legal, and financial risk management processes and project performance. This theoretical framework underscores the idea that the effectiveness of these processes hinges on their adaptability to the unique conditions of each project. External environment must align with specific project demands such as impending factors like: technological advancements, political conditions, social factors, and physical surroundings that calls for strategic risk management that are adaptable. Moreover, contingency theory accommodates the moderating influences of external environmental factors while emphasizing the need for tailored risk management practices. This approach provides a cohesive lens for understanding the dynamic interplay of variables within Nakuru's construction projects, aligning with the principles of contingency theory for optimal project outcomes.

III. Methodology

This study adopted the pragmatism research philosophy, as elucidated by Gathii et al. (2019). Pragmatism is fundamentally concerned with achieving research objectives through practical means, utilizing a diverse array of research approaches as necessary. In this context, the study aims to understand truth by evaluating Nakuru County-funded projects within a real-world setting, emphasizing their tangible impacts and consequences on the local population in relation to the projects' predefined goals and objectives. Rather than relying on abstract principles, the philosophy of pragmatism guided the study's core objectives, which center on project risk management, project size, external environmental factors, and project performance within Nakuru County.

This pragmatic philosophy aligns well with the objectives of the study, as it emphasizes practicality in research and allows for multiple methodological approaches to effectively pursue the research goals. The investigation focuses on understanding the actual impact of Nakuru County-funded projects on the local population in comparison with the intended project objectives, deliberately avoiding abstract notions. Accordingly, the study employs a mixed-methods research approach.

Research Design

This study employed a predictive research design, specifically a correlational approach using regression analysis, as outlined by Gathii et al. (2019). The primary aim is to examine whether project risk management strategies can predict various aspects of performance in construction projects. As emphasized by Creswell and Clark (2013), this design is suited for exploring predictive relationships between independent variables (project risk management processes) and a dependent variable (construction project performance). The selection of this design is consistent with the pragmatism research philosophy, which supports a mixed-methods approach, incorporating both quantitative and qualitative methods to effectively accomplish the research objectives.

The chosen design facilitates a structured investigation into potential cause-and-effect dynamics between project risk management practices and construction project performance. It supports both quantitative and qualitative analyses, aiming to determine whether specific risk management strategies serve as reliable predictors of project outcomes. By utilizing this methodology, the study ensures a thorough assessment of the predictive capabilities of risk management techniques, thereby enhancing understanding of how effective risk management influences construction project success.

As defined by Mugenda and Mugenda (2019), the population refers to the total set of individuals or objects under investigation in a particular discipline, sharing a common characteristic. In this study, building projects executed by county governments constituted the unit of analysis. These projects within the Nakuru County Government include:

- the construction and improvement of county health facilities,
- construction of county roads (Class D, E, and unclassified roads),
- trade development initiatives such as market stalls,
- construction of Early Childhood Development Centres (ECDC), and
- other diverse county-level public works.

The total number of these projects is 390.

Table 1. Target Population (Unit of Analysis)

	Number	Percentage
County Health Centers	33	8.46%
County ECDEs	165	42.31%
Market Centers	27	6.92%
County Roads	110	28.21%
County Public Offices Constructions (CPOC)	55	14.10%
Total	390	100%

Note: Author's own work

The sampling size of this study was calculated using the Taro Yamane formula. According to Gathii et al. (2019), Taro Yamane's method is linked to ease of use and enables the production of a large sample size, thereby enhancing the representativeness of the collected sample. These advantages informs the usage of the Taro Yamane in this study as follows;

$$n = \frac{N}{1+N(e^2)}$$

where n is the samplesize, N is the target population and e is the margin of error (0.05)

$$n = \frac{N}{1+N(e^2)} = \frac{390}{1+390(0.05^2)} = 198 \text{ Projects}$$

In this study, the proportionate stratified random sampling method was employed. This approach involves allocating the sample size of each stratum based on its proportionate representation in the target population. The proportionate stratified random sampling was thus undertaken as presented in the [Table 3](#) below.

Table 2. Target Population (Unit of Analysis)

	Percentage	Sample Size
County Health Centers	8.46%*198	17
County ECDEs	42.31%*198	84
Market Centers	6.92%*198	14
County Roads	28.21%*198	56
County Public Offices Constructions (CPOC)	14.10%*198	27
Total	100%	198

Note: Author's own work

The unit of observation in this study, as defined by Gathii et al. (2019), refers to the real individuals observed by the researcher to gather knowledge about the unit of analysis. In the context of this research, the unit of observation includes key stakeholders involved in construction projects: contractors, sub-contractors, project engineers, finance managers, and senior county government employees responsible for project oversight. The total target population for the study is 1,469 individuals, as indicated in [Table 4](#) below.

Table 3. Target Population (unit of observation)

		Percentage
Contractors	254	17.2%
Sub-Contractors	947	64.4%
Project Engineers	74	5.0%
Finance Managers	47	3.2%
County government Project Managers	147	10.2%
Total	1,469	100%

Note: Author's own work

The Taro Yamane formula was used in the study to calculate the sample size of the unit of observation. The Taro Yamane formula was used as follows in the calculation;

$$n = \frac{N}{1+N(e^2)}$$

where n is the samplesize, N is the target population and e is the margin of error (0.05)

$$n = \frac{N}{1+N(e^2)} = \frac{1,469}{1+1469(0.05^2)} = 314 \text{ respondents}$$

The study utilizes the proportionate stratified random sampling method, a technique that allocates the sample size for each stratum based on its proportional representation in the overall target population. The application of this methodology is outlined in [Table 5](#) below.

Table 4. Sample Size Distribution

	Calculations	Sample Size
Contractors	17.2%*314	54
Sub-Contractors	64.4%*314	203
Project Engineers	5.0%*314	16
Finance Managers	3.2%*314	10
County Project Managers	10.2%*314	31
Total	100%	314

Note: Author's own work

In this research, the instruments utilized were pivotal for gathering data aligned with the study's objectives. Given the adoption of a mixed-methods approach, both qualitative and quantitative data were collected. The primary data gathered by the researcher constituted a foundational component of the investigation.

For the quantitative component, responses were solicited using a five-point Likert scale, ranging from 1, indicating "No Extent," to 5, denoting "Very Large Extent." This scale was designed to comprehensively measure various research-related variables. Conversely, qualitative insights were obtained through semi-structured interviews, guided by a specific interview outline. These discussions began with predetermined questions and adapted based on participant feedback, allowing for a deeper exploration of the research themes.

The data analysis phase involved processing the collected data to extract meaningful insights relevant to the research objectives. Qualitative data from structured and semi-structured interviews underwent thematic analysis. As described by Murray (2010), thematic analysis entails examining textual content to identify and extract themes pertinent to the study. In this research, thematic analysis was applied to interview transcripts to identify emergent themes associated with the key variables, which were then systematically documented and interpreted.

Conversely, quantitative data obtained from the survey was subjected to both descriptive and inferential statistical analyses. Descriptive techniques—such as frequency distributions, means, and standard deviations—were used to summarize the data. To address the primary research objectives regarding the impact of operational, strategic, legal, and financial risk management processes on project performance in Nakuru County-funded construction projects, linear regression models were constructed. In these models, risk management was treated as the independent variable, while project performance served as the dependent variable. The evaluation tested the null hypothesis that the coefficient of the risk management variable does not significantly differ from zero. Using a 5% significance level, if the computed p-value associated with the coefficient was less than 0.05, the null hypothesis was rejected, indicating a significant impact of risk management on project performance.

This research applied a mixed-methods design to examine project risk management, external factors, project size, and performance in Nakuru County's county-funded construction projects. Structured and semi-structured interview data were analyzed thematically using NVivo software to extract detailed contextual insights that complemented the subsequent quantitative findings. Descriptive statistics and linear regression models were used to quantitatively analyze survey data and assess the impact of risk management processes on project performance. The integration of qualitative and quantitative results, achieved through triangulation, enhanced the validity and reliability of the study. The synthesized insights, produced through a cohesive mixed-method interpretation strategy, contributed to robust conclusions, practical implications, and tailored recommendations for Nakuru's county-funded construction projects, thereby fostering a comprehensive understanding of the research problem.

Findings of the Study

A hierarchical multiple regression analysis was conducted to examine the moderating effect of the external environment on the relationship between risk management and project performance. Three models were tested:

- Model 1 included only the risk management variables (RM).
- Model 2 added the external environment variable (EE).
- Model 3 incorporated the interaction terms between risk management and external environment (RM × EE).

Table 25 presents the results of this analysis:

Table 5. Hierarchical Multiple Regression Results for External Environment as Moderator

Model	R	R ²	Adjusted R ²	SE	ΔR^2	ΔF	df1	df2	Sig. F Change
1	0.768	0.589	0.584	0.490	0.589	102.847	4	287	0.000
2	0.781	0.610	0.604	0.475	0.021	15.072	1	286	0.000
3	0.802	0.643	0.633	0.458	0.033	6.485	4	282	0.000

Note: RM = Risk Management; EE = External Environment

Note: Author's own work

The analysis revealed that the external environment significantly moderates the relationship between risk management and project performance. In Model 1, risk management variables explained 58.9% of the variance in project performance ($R^2 = .589$, $p < .001$). The inclusion of the external environment in Model 2 resulted in a significant increase in explained variance ($\Delta R^2 = .021$, $p < .001$), indicating that the external environment has a direct effect on project performance beyond the influence of risk management alone.

Most notably, the interaction terms between risk management variables and the external environment in Model 3 accounted for an additional 3.3% of the variance ($\Delta R^2 = .033$, $p < .001$). This significant increase suggests that the effectiveness of risk management on project performance is conditioned by the external environment in which the project is implemented. These findings are consistent with the study by Omondi (2020), which established that external environmental factors moderated the relationship between stakeholder participation and project performance in road construction projects in Kilifi County, Kenya. The results are also in line with Chang, Deng, et al. (2018), who found that political risks an element of the external environment significantly affected the performance of international construction projects.

The moderating effect of the external environment can be interpreted through the theoretical lenses of both Systems Theory and Contingency Theory. From a Systems Theory perspective (Anagnostou, 2020), construction projects are viewed as subcomponents of broader systems, influenced by external factors such as regulatory agencies, community dynamics, and political institutions. The significant moderating role of the external environment reinforces the need to incorporate these influences into risk management strategies. From a Contingency Theory viewpoint (Pang et al., 2020), the external environment constitutes a critical contingency variable that determines the effectiveness of risk management practices. This interpretation is supported by Lamprou and Vagiona (2018), who identified various external components including clients, technological developments, political contexts, social factors, and physical conditions as key determinants of project performance.

It is worth noting that while previous studies often focused on isolated aspects of the external environment (e.g., political risks or stakeholder engagement), this study employed a more comprehensive conceptualization, demonstrating the overall moderating effect of the external environment on the relationship between risk management and project performance. This holistic approach contributes to a broader understanding of how external variables influence project outcomes, supporting the multidimensional nature of risk management in construction projects, as emphasized by Mwangi Thiong et al. (2019) in their research on Building Information Modelling (BIM) in Kenyan construction.

However, as observed in the moderation effect of project size, the magnitude of the effect (3.3% additional variance explained), although statistically significant, may be interpreted as modest. This suggests that the strength of the external environment's impact may vary depending on the specific components being assessed. This observation aligns with the complex and dynamic nature of construction environments, as discussed by Wanjohi and Omwenga (2017) in their study on strategic risk management in Kenya's telecommunications sector.

IV. Discussion and Conclusion

This study investigates how the external environment moderates the relationship between risk management and project performance in county-funded construction projects in Nakuru County, Kenya. The hierarchical multiple regression analysis confirmed that the external environment plays a statistically significant moderating role, accounting for an additional 3.3% of the variance in project performance.

The findings demonstrate that as environmental complexity increases, the effect of risk management practices on project performance becomes more pronounced. This conclusion aligns with Omondi's (2020) study, which suggests that this pattern is prevalent across various Kenyan construction projects. The moderating role of the external environment can be understood through Systems Theory, as presented by Anagnostou (2020), where construction projects are conceptualized as open systems influenced by multiple external factors.

Insights gathered from project team members further validate these findings. For example, the Finance team noted that “external environmental risks such as political instability, economic downturns, or changes in government policy can severely impact project performance,” emphasizing the need for flexible financing strategies and ongoing budget oversight. Similarly, the Procurement team emphasized the importance of mitigating supply chain disruptions through diversified sourcing and contingency planning.

The findings also underscore that environmental complexity influences multiple facets of project management. As complexity rises, risk management approaches must become more dynamic, involving frequent environmental scanning and proactive stakeholder engagement. A Project Manager stated that “coordination between all stakeholders is essential for ensuring the project stays on track,” particularly when navigating changing external conditions. Even in relatively stable environments, effective risk management remains valuable, although the performance impact may be less dramatic. This contextual nuance is captured in the Procurement team’s observation: “the technological environment we operate in often has a huge bearing on the projects we implement relative to other construction projects.”

The results are consistent with previous Kenyan research. Murithi et al. (2017) identified political interference as a significant barrier to successful public construction projects in Trans-Nzoia County. Similarly, Wanjohi and Omwenga (2017) advocated for adaptive risk management strategies, a view echoed by contractors who observed that “managing risk involves careful planning and handling unforeseen conditions, which vary significantly with different external environments.” The study revealed multiple dimensions of external environmental influence including financial constraints, procurement hurdles, community engagement, and political risks. For instance, a Project Engineer highlighted the increased importance of “regular inspections and communication when external conditions are challenging,” while the Finance team reiterated the value of contingency funds in adapting to shifting external realities.

In conclusion, the significant moderating effect of the external environment on the relationship between risk management and project performance highlights the need for context-aware strategies in public sector construction projects. The findings offer actionable insights for project managers and policymakers in Kenya and other similar contexts.

The external environment significantly influences the relationship between risk management and project performance. This study concludes that risk management strategies must be adaptable to the specific external contexts in which projects are implemented. Projects operating in more challenging environments require more robust and flexible risk management approaches. This finding underscores the importance for project managers to monitor external factors proactively and to craft responsive strategies that accommodate changing environmental conditions.

Additionally, the study highlights the profound impact of the external environment on the performance of county-funded construction projects. Factors such as economic conditions, workforce inclusivity (even in cases of skill shortages), political stability, regulatory environments, and climatic conditions play pivotal roles in shaping project outcomes. These insights stress the need to anticipate and integrate external factors during project planning and execution stages. Consequently, future projects will benefit from enhanced foresight and risk preparedness, resulting in greater resilience and fewer implementation disruptions.

The research carries several important implications for the future of public-sector construction in Nakuru County. Notably, it emphasizes the need to strengthen risk management practices, particularly in addressing external environmental risks. These insights will empower project stakeholders to develop more proactive strategies, reduce uncertainties, and minimize project delays or cost overruns.

Furthermore, the study draws attention to the influence of governance issues such as inadequate oversight and poor resource allocation which emerged as significant constraints. As a result, the study recommends strengthening oversight mechanisms, promoting transparency, and enhancing accountability in project execution. Collaboration among stakeholders including county officials, contractors, suppliers, and local communities was also identified as a crucial enabler of integrated and successful project management.

Finally, the study emphasizes the importance of strategic resource allocation, capacity building for project managers and contractors, and prioritizing sustainability in design and implementation. These findings aim to inform future efficient, effective, and environmentally sustainable county-funded construction projects. By doing so, the study contributes to the improvement of public-sector project governance and the optimal utilization of public resources not only in Nakuru County but potentially across other counties in Kenya.

Acknowledgement

No acknowledgements.

Competing Interest Statement

No funding was received by the researcher while preparing this manuscript. There are no conflicts of interest for the writers in relation to the article content.

Author (s) Contribution Statement

J.M.K. (PhD student) conceptualized the study, designed the methodology, collected and analyzed the data, and prepared the initial manuscript draft. C.G., H.K., and A.M. (supervisors) provided academic supervision, critical guidance, and substantive revisions that strengthened the final manuscript.

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