Effect of Risk Identification on Performance of Water and Sewerage Projects in Kenya: A Case Study of Nairobi City Water and Sewerage Company

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ABSTRACT

Water and sewerage projects in Kenya have been in the spotlight for delays, abandonment, and stalling of key projects intended to provide innumerable benefits to the citizens. Various factors such as funding shortages, inadequate planning, or ill-fitting equipment have been associated with poor performance in studies. When potential issues are overlooked early, these projects are likely to suffer, resulting in quality failures, missed deadlines, and budget overruns. Thus, the primary purpose of the study was to determine the relationship between risk identification and performance of water and sewerage projects in Nairobi County, Kenya. Using a correlational research design, the study collected data through online questionnaires. The study targeted 210 participants from 45 water and sewerage projects, whereby participants were selected through stratified random sampling. Using the Yamane formula, the population was reduced to 138. Data were then analyzed and interpreted using the Statistical Package for the Social Sciences (SPSS) Version 28 for descriptive and inferential analyses. The multiple regression results indicated that risk identification was statistically and positively associated with project performance, with a coefficient value of $\beta = 0.247$, $p < 0.01$. The study concludes that risk identification directly influences the project performance of water and sewerage projects. Therefore, the study recommends that project managers should adopt standardized risk identification strategies across projects to ensure better project performance.

Keywords: risk identification, project performance, risk category, budget adherence, risk prioritization, timeliness

1.0 INTRODUCTION

1.1 Background to the Study

Most projects face risks; thus, it is crucial for project managers to understand and apply risk management principles. During project implementation, project teams and managers should pay closer attention to identifying risks, determining their causes and categories. In a study by Ramoutar-Prieschl and Hachigonta (2020), most projects face common risks, such as delays in completion, cost overruns, and failure to meet desired quality standards, which can result in poor project performance. In Kenya, most public sector projects face performance challenges, including failing to meet desired quality, time, and cost targets. Infrastructure projects in Kenya, such as water and sewerage projects, have been under scrutiny following a rise in incomplete projects and budget overruns. A study by Nyarangi (2025) shows that the water and sewerage sector faces many implementation and completion challenges, such as insufficient or delayed funding, stakeholder conflicts, unrealistic timelines, and cost overruns. Therefore, it is imperative to assess factors that directly influence water and sewerage projects in Kenya to ensure successful implementation for the public good.

Every project requires a thorough risk scrutiny to identify, evaluate, and address potential risks that may interfere with the project life cycle before they materialize. Risk identification is therefore very crucial in project implementation. According to Suvvari (2020), risk identification entails detecting, cataloging, and

describing potential threats that could negatively impact a project's success. Risk identification has numerous merits for project managers and organizational leaders. George (2020) asserts that risk identification helps project managers develop mitigating strategies to specific threats, enabling them to make well-informed decisions and allocate resources effectively. Moreover, risk identification enables a comprehensive understanding and documentation of risks that can serve as a reference for future projects (Hubbard, 2020). It also facilitates better communication among all stakeholders and project teams, ensuring everyone is aware of the risks and collectively works towards reducing their impact. Ramoutar-Prieschl and Hachigonta (2020) affirm that recognizing risks early improves project success rates and keeps projects aligned with organizational goals.

1.2 Problem Statement

With Kenya's new Constitution, access to quality sanitation is a fundamental human right for all residents. Significant water and sanitation projects and legislation have been undertaken for the past decade. For example, the Kenya Environmental Sanitation and Hygiene Policy (KESHP) and the policy framework for urban sanitation established in the Kenya Vision 2030 blueprint aim to achieve universal sanitation by increasing public investment from 0.2% to 0.9% of Kenya's GDP by 2030 (Mithika & Moronge, 2017). This ensures more financial resources are directed toward improving water and sanitation conditions for citizens.

Despite these concerted efforts, many water and sanitation projects in Nairobi County still lag, leaving many residents struggling with poor sanitation (Maina & Mungai, 2023). For instance, the World Health Organization's joint monitoring initiative estimates that only 31% of Kenya's urban population has access to improved water and sanitation facilities (World Health Organization, 2022). In addition, a Nairobi City Council (2024) report states that sewerage services in Nairobi County are characterized by inadequate, aging infrastructure and poor performance of available utilities. Consequently, concerns are increasing about sewer bursts, sewage flooding, limited access to clean water, and the discharge of semi-treated or raw sewage into the environment. Inadequate identification of risks and project needs significantly contributes to delays, poor scope, and cost overruns in water and sewerage projects.

Although much literature explores the main principles of risk management and their influence on public and private projects, gaps remain. For instance, most studies examine how risk management strategies, such as risk assessment, affect project success; few focus on key risk identification, a crucial step in identifying, categorizing, and prioritizing risks (Kamau & Njuguna, 2019; Mithika & Moronge, 2017). This reveals a conceptual gap that this study addressed by examining how risk identification directly affects the performance of water and sewerage projects.

1.3 Main Objective of the Study

The main objective of the study was to examine the effect of risk management practices on the performance of water and sewerage projects in Nairobi County.

1.4 Significance of the Study

The study's findings will be useful for a wide range of project stakeholders. The findings will give project managers across sectors actionable recommendations to adopt effective risk identification practices. Project managers will also gain better insight into process-level risks and vulnerabilities, resulting in better-informed strategic decisions. Earlier risk detection will also help project stakeholders set more realistic budgets and schedules, satisfying stakeholder interests and meeting project deliverables. Consequently, the findings will enhance project quality and success rates not only in the water and sewerage sector but also in other sectors.

1.5 Scope of the Study

The study explored contingency theory as the anchoring theoretical framework. The study employed a correlational research design, using surveys to collect data and statistical methods to quantify results. The target population comprised 45 water and sewerage projects. The unit of observation was 210 participants,

including 45 project managers/engineers, 30 project supervisors or site managers, 25 project committee members, 50 contractors and consultants, and 60 technical staff/project team members. Stratified sampling helped narrow the project pool, from which participants were selected using simple random sampling. The study sample size was 138, based on the Yamane formula. The study period was from July 2025 to October 2026.

2.0 LITERATURE REVIEW

2.1 Theoretical Literature

First proposed by Fred Fiedler in 1964, contingency theory offers an alternative framework for anticipating risk events and their impacts (Otley, 2016). The theory posits that decision-making and risk management vary by project and organization; thus, it argues that risks and choices should be tailored to the situation (Shala et al., 2021). Since contingency theory refutes the rule-of-thumb approach, Otley (2016) argues that risk identification should also vary with the specific conditions of a project. Projects may differ in size, resources, routines, uncertainty, complexity, and scope; thus, contingency theory argues that project managers should consider these factors when identifying risks to develop the best mitigation strategies (Omazić et al., 2023). Otley (2016) asserts that contingency theory emphasizes the use of defined risk identification techniques, such as Strengths, Weaknesses, Opportunities, and Threats analysis, the Delphi method, and simulations, to identify risks based on their unique factors.

2.2 Empirical Literature Review

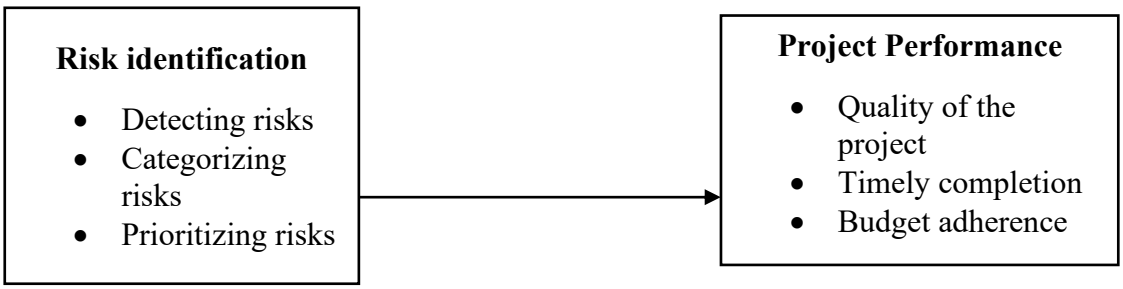
In a study by Ali (2024), the author sought to investigate the impact of risk identification strategies on the overall performance of construction initiatives in Garissa County, Kenya. The study used a descriptive research design and targeted eight road projects. A census technique was used to select the participants. The research was anchored in project management theory and portfolio theory to elaborate more on the independent variables. Using questionnaires as the primary data collection method, the findings revealed a strong positive association between the performance of road construction projects and risk identification. The authors noted that when risks are identified individually before construction begins, projects are more likely to be completed on time, within budget, and deliver value.

Similarly, a recent study by Mutula and Eng'airo (2024) aimed to analyze the impact of risk identification on the success and implementation of project infrastructure within the Catholic Church diocese of Ng'ong, Kajiado County. The study used a descriptive case method and a population of 240 members from 72 projects recruited through a simple random sampling method. Unlike most studies, the results revealed a weak but positive relationship between the successful implementation of projects and the early identification of risks. The study's gaps include a methodological gap, as the choice of the research method was limited to several respondents and completed projects.

Otieno and Mutiso (2021) examined the influence of risk management, focusing on the risk identification of agricultural program performance in Nakuru County, Kenya. The study was anchored in the theory of contingency. It also used a descriptive method, with a sample of 116 projects drawn from all 11 sub-counties of Nakuru County. The results showed an existing strong and positive link between project implementation and risk identification, with a high mean of 0.895. The authors recommended that project managers incorporate risk identification methods into any project plan. However, the research raises questions about the contextual framework because it solely dwelt on agricultural projects within eleven sub-counties, which may lead to generalization issues.

2.3 Conceptual Framework

A conceptual framework presents a visual map showing how two or more variables relate to each other. The figure below shows the link between risk identification (predictor) and project performance (outcome).



3.0 METHODOLOGY

This study used a correlational research design to identify the relationship between risk identification and performance of water and sewerage projects. For the target population, this study focused on 45 water and sewerage projects undertaken between 2015 and 2024, distributed across Nairobi County. The types of the projects were chosen based on the projects' significance in addressing sanitation and water accessibility challenges. The unit of observation or target population was 210 participants, selected through random sampling. Participants included 45 project managers/engineers, 30 project supervisors or site managers, 25 project committee members, 50 contractors and consultants, and 60 technical staff/project team members.

The sample size was determined using the Yamane (1967) sampling formula to a sample size of 138 respondents. The study used structured questionnaires to collect primary data, distributed online through Google Forms for the convenience of all project team members across the different geographical regions.

A pilot study involving 10% of the sample was conducted including 14 respondents. Based on their feedback, the questionnaire was refined accordingly. These participants were excluded from the study to minimize bias. Pilot testing was conducted in Mathare Sub-county. Items in the questionnaire also underwent a reliability test using Cronbach's alpha. Values that scored 0.7 and above were considered to have a higher internal consistency, whereas those below 0.7 were considered inconsistent. Construct and content validity tests were also done. Content validity was assessed after the items were administered to the supervisor for a detailed evaluation. The questionnaire was then adjusted based on the evaluation's recommendations. Moreover, construct validity was assessed using the Kaiser-Meyer-Olkin (KMO) values, whereby values above the threshold of 0.5 were considered valid, whereas those below the threshold were invalid.

To analyze data, inferential and descriptive statistics were done using Statistical Package for the Social Sciences Version 28. Inferential statistics were carried out using Pearson correlational analysis, whereas descriptive statistics included frequency distributions, standard deviation, percentages, and the mean. The researcher followed ethical principles throughout the study. The participants were informed of the key details of the study to ensure they voluntarily agreed to participate in the study. The researcher upheld confidentiality, anonymity, and collected only the necessary information.

4.0 FINDINGS AND DISCUSSIONS

4.1 Response Rate

Of the 138 questionnaires distributed digitally, only 135 were returned complete. This equates to a retention rate of 97.8%, which is significantly higher than the 65% threshold commonly used for research surveys, as cited by Holtom et al. (2022).

4.2 Reliability Test

The results showed that risk identification had a good internal consistency. The Cronbach's Alpha value was

0.868, exceeding the 0.70 threshold. The score was above 0.8, indicating it was ideal for assessing the influence of risk identification on the performance of water and sewerage projects.

4.3 Bio Data Analysis

The study captured respondents' gender to determine the representation of male and female respondents, thus ensuring a balanced view and identifying any potential gender-based variations in responses. The results showed that 61.5% were male and 38.5% were female. Despite the slight disparity, the distribution between male and female respondents was sufficient to provide meaningful insights into both genders' perspectives on risk management practices for water and sewerage project performance.

Respondents' ages were also captured to understand how they influenced the study. 38 participants were between 21 and 30 years, 32 were between 31 and 40 years, 17 were between 41 and 50 years, 20 were between 51 and 60 years, and 28 were over 60 years. The age distribution shows a diverse representation across all age brackets. Participants aged 31-40 are significant, implying that the majority take up supervisory or middle-management responsibilities, thus providing insights into risk identification in projects.

The study also assessed respondents' education level. The results showed that 36 (26.7%) had a college diploma, 68 (50.4%) had a bachelor's degree, 21 (15.6%) had a master's degree, and 10 (7.4%) had a doctorate. Individuals with a bachelor's degree were the dominant group, indicating that most project team members had credible skills and expertise in risk management practices in projects. The findings revealed a balance in the respondents' education level, implying the presence of technical skills, adequate training, and analytical and strategic expertise in risk management for water and sewerage projects.

Lastly, the findings also examined the time spent on the projects for each participant. Time spent on projects was analyzed to provide insight into how duration of involvement may affect their responses and overall contribution to the study. 8 participants spent less than a year, 20 spent between 1 and 3 years, 59 the majority spent between 4 and 6 years, followed by 48 who spent over 6 years.

4.4 Descriptive Statistics

A structured identification format exists

The majority (54.1%) of respondents disagreed that project leaders followed a structured risk identification format to identify risks. This shows a negative perception of the lack of structured risk identification criteria. This reinforces the finding that risk identification processes are either inconsistent, absent, or informal in the selected projects. According to Yousri et al., (2023), the absence of structured risk identification practices for infrastructure projects often results in missed risks, delays, and cost overruns affecting the overall performance.

Key project stakeholders involved in identifying risks

The majority (48.2%) agreed that key project stakeholders were involved in identifying risks based on their areas of expertise, with a mean of 3.30 and a standard deviation of 1.38. This suggests that stakeholder involvement in the projects was present; however, it is not deeply entrenched or consistently practiced, which may negatively affect project performance, as cited by Lumadede et al, (2025).

Risks were classified

For the third item, the majority 46.7% disagreed that the project team was able to classify and group risks based on their likelihood, scoring a mean of 3.18 and a standard deviation of 1.34. This presents a mixed perception among respondents since 37.7% agreed that the project team was able to classify the risks. The mean further indicates a slight tendency towards agreement, suggesting that some respondents were torn, whereas the standard deviation is relatively high, meaning that most respondents didn't believe in the teams' ability to identify and group different risks.

Identified risks were communicated to all project members

34.3% strongly disagreed that the risks were thoroughly communicated to all team members, registering a mean of 2.94 and a standard deviation of 1.68. The high level of strong disagreement suggests that, in most projects, crisis-related information failed to reach all relevant stakeholders or was not disseminated effectively. This reflects a systemic issue within the organization, suggesting poor communication structures. According to Sophie (2025), poor risk communication often leads to delayed responses to emerging issues, misalignment among stakeholders, and errors, thereby increasing the likelihood of project failure.

Risk identification was done at different stages

58.1% strongly agreed that the risk identification process was conducted across projects at different life cycles, with a mean of 3.69. The mean of 3.69 indicates overall agreement that risk identification was ongoing for most projects. The finding aligns with recommendations by the PMBOK, which highlight the need to identify risks throughout different stages since new risks often emerge and existing risks also evolve (Okiye et al., 2022).

Risk identification promoted preparedness

78.5% strongly disagreed that the risk identification process enhanced preparedness for project challenges, with a mean of 3.55 and a standard deviation of 1.22. In this case, the role of risk identification in enhancing preparedness was considered ineffective. These responses imply that, even with a robust risk identification framework, the risks were not prioritized or used for decision-making in water and sewerage projects. This aligns with a study by Yousri et al. (2023), which states that if risk identification is performed but not linked to other risk management practices, it may lead to its ineffectiveness in improving project performance.

The aggregate values are 3.26 for the mean and 1.42 for the aggregate standard deviation. The mean indicates a moderate extent of agreement among participants on risk identification practices within the projects. This implies that the projects had risk identification processes but were not fully or strongly institutionalized in all projects. The relatively high standard deviation indicates high variability in responses, suggesting that respondents had varying experiences with risk identification practices.

4.5 Correlation Analysis

Risk identification had a positive and statistically significant impact on water and sewerage project performance ($r = 0.323$, $p < 0.01$) at the 1% level of significance or 99% confidence level. The correlation coefficient of 0.323 indicated a moderate positive relationship between the two variables, suggesting that as the extent of the risk identification process increases, the project's performance across cost, quality, satisfaction, and time is likely to improve. These results align with those of Khan (2025), who link earlier and more accurate risk identification to better resource allocation, enhanced decision-making, and stakeholder confidence, thereby increasing the success rate of project completion.

Table 1: Correlation analysis results

		Risk identification	**Performance**
Risk identification	Pearson Correlation	1	.323***
	Sig. (2-tailed)		<.001
	N	135	135
Performance	Pearson Correlation	.323***	1
	Sig. (2-tailed)	<.001	
	N	135	135

***. Correlation at 0.001(2-tailed)

4.6 Regression Analysis

Table 2: Model summary

Model	R	R Square	Adjusted R-Square	Std. Error of the Estimate
1	.620a	0.38	0.36	0.74

Predictors: (Constant), Risk identification

The findings indicated that risk identification explains approximately 38% of the variation in project performance, showing a moderate positive relationship between risk identification and water and sewerage project outcomes. In practical terms, the results can be interpreted as follows: if water and sewerage project performance improves or declines, 38% of that change is linked to how effectively the project risks are identified. The remaining 62% is influenced by other factors.

Table 3: ANOVA Analysis

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	18.42	1	18.42	33.51	.001[b]
	Residual	29.88	54	0.55		
	Total	48.30	55			
a. Dependent Variable: Project Performance						

The model is statistically significant ($p < 0.001$), meaning risk identification significantly predicts project performance. This means that risk identification directly and positively influences the performance of water and sewerage projects.

Table 4: Regression coefficient

Variable	B	Std. Error	Beta	T	Sig.
Constant	0.98	0.41	0	2.39	0.021
Risk Identification	0.71	0.12	0.62	5.79	0
Y= (project performance) X_1=risk identification Constant= 0.98 Coefficient=0.71					
$Y= 0.98+0.71X_1 +\epsilon$					

The findings show that a one-unit increase in risk identification is associated with a 0.71 increase in project performance, indicating a strong positive effect. This suggests that early detection of risks, such as operational, financial, and technical risks, likely improves water and sewerage project performance by enabling better resource allocation and timely execution. This aligns with Otieno and Mutiso (2021), who found that early risk identification minimizes surprises by identifying bottlenecks and potential deviations early that may otherwise lead to unsuccessful project implementation.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study concluded that risk identification is key in project performance, as it has a positive and significant relationship with project performance. The correlation coefficient value of r=0.323 shows a positive relationship between risk identification and project performance at the 99% confidence level. The regression coefficient value of 0.71 also confirms this relationship. The value implies that a one-unit increase in risk identification increases project performance outcomes by 0.71 units. These findings support the descriptive outcomes whereby respondents agreed on the importance of identifying risks during the early stages of project

planning and throughout the project lifecycle. Early identification of the risks enables project leaders to anticipate potential disruptions, develop suitable response measures, allocate appropriate resources, and prioritize high-level risks. Thus, when risk identification is done right using risk registers, SWOT analysis, and other effective tools, it acts as a solid foundation for subsequent risk management practices.

5.2 Recommendations

The findings revealed structural, competency, and procedural gaps in risk identification. For instance, no standardized risk identification framework ensures completeness and uniformity in identifying and categorizing risks. In this regard, the study recommends using standardized tools such as checklists and risk registers, and conducting analyses such as SWOT analyses and expert interviews. Additionally, to address gaps in risk classification accuracy due to limited technical expertise among project team members, the organization should invest in professional development and training, and recruit high-skilled personnel. Improving technical competence across the team will improve risk identification accuracy, enabling better anticipation and response to imminent threats. In this regard, NCW&SC should also foster a risk-aware culture in which all team members proactively identify, report, and openly discuss early risks. Cultivating a risk culture will ultimately promote participation and transparency, ensuring that the team embraces risk identification and takes it seriously.

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