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RISK MANAGEMENT PRACTICES AND PERFORMANCE OF PUBLIC WATER PROJECTS IN KAJIADO COUNTY, KENYA

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ABSTRACT

Water supply and sanitation projects have come under a lot of criticism due to their narrow planning approaches. These projects have focused more on the expansions as well as the physical construction to increase their coverage in many target areas, rather than focusing on their sustainability after construction. Kajiado county has an acute shortage of safe and clean water for domestic uses and drinking and only 36.8% of households have access to piped and portable water and the 67.2% of the population have access to safe water. The water projects in the county have been facing performance challenges. The main objective of the study was to examine the influence of risk management practices on performance of public water projects in Kajiado County in Kenya. The specific objectives of the study were to; establish the influence of risk identification on performance of public water projects in Kajiado County, Kenya, and to examine the influence of risk response planning on performance of public water projects in Kajiado County, Kenya. The study was guided by agency theory and prospect theory. The study adopted a descriptive research design. The target was 14 water projects. The unit of observation was 14 water project managers, 14 supervisors, and 207 project steering committee members. Yamane sampling formula was used to sample 148 respondents. The study used questionnaires to collect data. A pilot was conducted with 10% of the respondents hence 15 project staff. The study used content and construct validity. Reliability of the questionnaire was tested using Cronbach's Alpha Coefficient. The study used SPSS Version 28 for analysis. Findings were presented in tables. The content of the questionnaire was validated by the project management professionals. The regression analysis revealed that risk identification ($B = 0.421$, $p < 0.05$) had the strongest influence on water project performance, followed by risk response planning ($B = 0.388$, $p < 0.000$). These findings confirm that structured risk management enhances project success, with risk identification and response planning playing the most critical roles.

Key Words: Risk Management Practices, Risk Identification, Risk Response Planning, Performance of Public Water Projects

Background of the Study

Globally, around 40% of the population is affected by water scarcity. Though there has been an improvement on water sanitation services globally, there is a shortage of drinking water and the issue has worsened due to the increase in desertification and drought (UNDP, 2020). The provision of safe water for drinking and sanitation is considered the bare minimum by any country to its citizen though it still remains to be a scarce commodity in both rural and urban areas of many developing countries (Eliab & Kisimbii, 2020). According to the World Health Organization (WHO), water as a natural resource is important in defining the shape of the human being's livelihood. Thus, in areas with insufficient and scarce water there is no evidence of human advancement and there is concern on sustainable socio-economic growth (WHO, 2022).

In Kenya, 25-30 % of community-managed water projects will be non-operational in the first three years after completion. Unsustainable programs have a low impact on the community in the long term, thus wasting human, financial, and technical start-up investments (Muriuki, 2021). Ndegwa (2020) in a study on the influence of monitoring and evaluation (M&E) on implementation of Water, Sanitation and Hygiene (WASH) project in Kajiado County found that enforcement of stakeholder participation in projects will significantly help improve implementation of WASH projects. The beneficiaries of the WASH projects were meant to be herders and pastoralists communities and more so children and women.

Water supply and sanitation projects have come under a lot of criticism due their narrow planning approaches which the projects have focused more on the expansions as well as the physical construction to increase their coverage in many target areas rather than focusing on their sustainability after construction (Eliab & Kisimbii, 2020). The sustainability of water projects is based on the purposeful involvement of the users in planning, execution, monitoring and maintenance of the water supply systems based on their needs and potential. Only 59% of Kenya have access to essential water services (WHO-UNICEF, 2019).

Project risk management is referred as the art and science of identification, analysis and responding to the uncertainties that emerges during the life period of a project in such a way as to achieve the project objectives by satisfying all the stakeholders (Doval, 2019). The objective of project risk management is to increase the likelihood and impact of positive events and decrease the likelihood and impact of negative events on the project. Project risk has its origins in the uncertainty present in all risks. Projects are prone to numerous types of risks that may affect its implementation. This are financial, strategic, hazardous and operational risks (Almoradie, et al., 2020). Unexpected events and uncertainty often result to damaging consequences for projects. If these risks are not effectively dealt with, they may pose a challenge in the completion of the project (Njuguna, 2019).

Statement of the Problem

Through the Ministry of Water and Sanitation, the Government of Kenya (GoK) has realized the implementation of more than 50 annual budgets-water projects since her independence. Other development agencies, both private through corporate social responsibility and not-for profit organizations, have since supported the course, the government handed over completed projects to the community for continuity. Access to the drinking water means the source is less than 1 kilometre away from the place of use and reliable for at least 20 litres per household member per day. Access to basic water for drinking is fetching water from an improved source in less than 30 minutes for a round-trip travel time, including queuing (WHO, 2018). While more than 30 minutes is considered to be a risky travel (Nygren et al. 2019).

Kajiado County has an acute shortage of safe and clean water for domestic uses and drinking. Only 36.8% households have access to piped and portable water and the 67.2% of the population have access to safe water. Though there over 1,150 public boreholes that are managed by the communities the county is still water stressed. The county lacks equitable

access to affordable and safe water (County Governement of Kajiado, 2018). All the water resources i.e. the ground water yields vary from 0.01 to 35.77 cubic metres per hour which is good quality for both domestic, irrigation and livestock usage, yet there is no reliable source of water (MoALF, 2022). According to Githinji (2019), 47.5% of community boreholes in Kajiado County have water throughout the years and 35.2% have unreliable salty water that is not safe for human consumption. In addition, the whole county has 30% of accessible safe water which indicates that the projects do not meet expected quality. The county has more than 1600 boreholes but only 30% are operational and performing to full capacity while 70% have either collapsed or operating below the expectations. This is mainly due to funds shortage leading to abandonment of the projects (Kosgey, 2020).

Musau (2022) noted that it is common to have non-functional water systems with features like no protection of the water like fencing, vandalism of equipment like solar pumps for boreholes and hand pumps for shallow wells and water pans and the unwillingness of community members to manage and maintain the water sources lead to collapse of the water projects. The project work of Kiserian water Project started in the FY 2007/2008 commenced in November 2015 and was planned to be completed by May 2017. However, only 35% of the project had been completed by end of December 2018 and 65.0% had not yet been completed (Ongwera, 2021). Several studies have looked at risk management practices or performance of water projects. Maina and Mungai (2023) examined 'risk management practices and performance of infrastructural projects in Nakuru County'; Machuka (2022) examined the influence of monitoring and evaluation principles on the sustainability of water supply projects in Kajiado County'; Mutua and Kirui (2020) in examining the influence of risk identification on core banking system project performance in selected commercial banks in Kenya. The aforementioned studies provide content and context gaps to be filled by the current study. Thus, this study examined the influence of risk management practices on performance of public water projects in Kajiado County.

Research Objectives

General Objective

The main objective of the study was to examine the influence of risk management practices on performance of public water projects in Kajiado County in Kenya.

Specific Objectives

i. To establish the influence of risk identification on performance of public water projects in Kajiado County, Kenya.
ii. To examine the influence of risk response planning on performance of public water projects in Kajiado County, Kenya.

LITERATURE REVIEW

Theoretical Review

Agency Theory

The Principal-Agent theory was propounded by Stephen Ross (1972) where he tried to explain how best to organize the relationship of the owner of resources in a project (Principal) and the person appointed or contracted to work on behalf of the principal (Agent). The success of any given project is heavily dependent on the relationship and understanding of the major stakeholders or the major parties in a contract. The theory has three assumptions; the agent is always self-interested, risk-averse, and possesses knowledge that most of the time isn't available to the principal. For the project to be successful, the assumption is that the stakeholders cooperate and exchange vital information to ensure the project goals are achieved. Thus, communication is key to the success of the project, else it becomes a major risk (Ceric, 2003).

According to Jäger (2008) based on the principal-agent theory, the relationship between the project manager and the project owner is systemized according to related asymmetric information and the corresponding type of risk. Hidden characteristics are associated with adverse selection; hidden intentions are associated with hold-up; and hidden information associated with moral hazard. Hidden characteristics cause the adverse selection problem before signing the contract between the parties since at this stage it means the project owner lacks all the information about the project manager and similarly the PM doesn't have all the information about the owner of the project. Adverse selection occurs at the early stages of the project. Hidden information caused moral hazard risk which normally occurs after the contract has been signed this is a result of the uncertainty that information will be shared appropriately as each party has its self-interest involved. Hidden intentions cause hold –up risks. For example, the project owner invests in the project hoping that there is trust in the project manager and he will cooperate but instead he becomes an opportunist. Thus, hidden intentions and the hold-up risk are related to trust (Awour, 2015).

Prospect Theory

The prospect theory was developed by Tversky and Kahneman (1979). The theory helps in decision-making under conditions of risk. Decisions often involve internal conflicts over value trade-offs. This theory is designed to help organizations and individuals to better understand, explain and predict choices in a world of uncertainty. The theory explains how these choices are framed and evaluated in the decision-making process. Prospect theory is descriptive and empirical in nature. It focuses on two parts of decision making: the framing phase and the evaluation phase (Tversky, 1967). The framing phase describes how a choice can be affected by the manner in which it is presented to a decision maker. The evaluation phase consists of two parts, the value function and the weighing function, where the value function is defined in terms of gains and losses relative to the reference point.

Prospect theory is used in decision-making where the decision maker multiplies the value of each outcome by its decision weight. Decision weights not only serve as measures of perceived likelihood of an outcome, but also as a representation of an empirically derived assessment of how people arrive at their sense of likelihood (Tversky & Kahneman, 1979). Risk is an exposure to the possibility of economic or financial loss or gain, or delay as a result of the uncertainty associated with pursuing a certain course of action. When assessing risks in a project, relevant data must be available to enable statistical analysis, otherwise, the experience and knowledge of the decision makers is used to assess the probability of an adverse event. Risks impact projects in a great way by affecting the planned expenses, quality of work and expected project performance. Therefore, risk identification is important in managing projects that are exposed to risks in order to ensure that the objectives of the projects are achieved within the constraints of the project. In case the risks happen, the project managers will have to made solid decisions on how to reduce the risks.

Conceptual Framework

A conceptual framework is a graphical representation of the interdependence of variables that depicts a phenomenon in a study. Figure 2.1 depicts the conceptualization of the study variables.

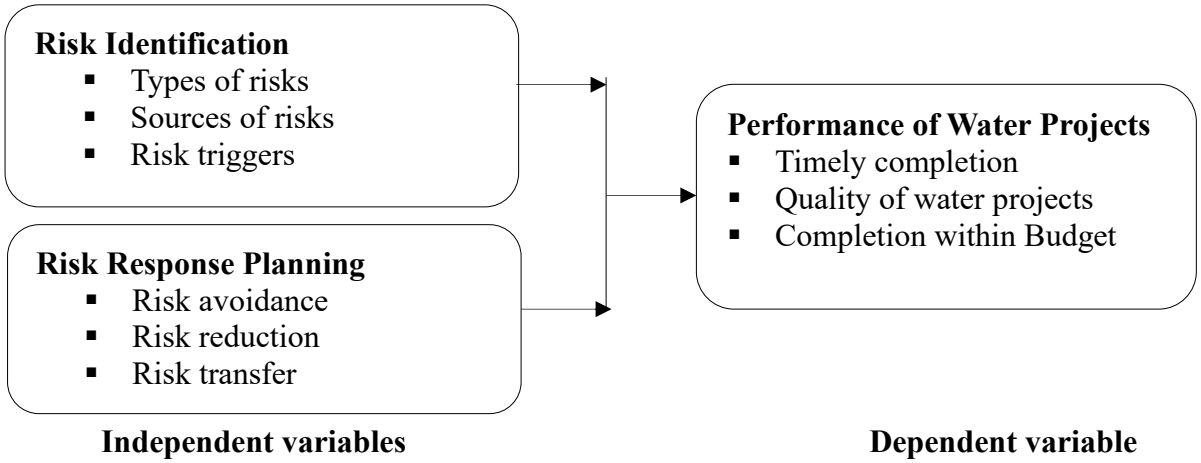

Figure 2. 1: Conceptual Framework

Risk Identification

Risk identification entails determining threats that might hinder a project from attaining its goals (Alsaadi & Norhayatizakuan, 2021). It is the process of determining which risks may affect the project and documenting their characteristics. The key benefit of this process is documentation of existing risks and the knowledge and skills offered by the project team to anticipate risky events. The procedures used in risk identification include meetings with project managers and stakeholders, identifying the area with high risk, breaking down risk according to their magnitude and putting across ways to mitigate the risks (Matere, 2016). Risk identification is used by project personnel to document risks attributes and its possible effect on project outcome. The identification of risk enables one to understand its nature and gives an idea of how such risk should be handled. It influences project stakeholder's decisions in creating a sustainable project (Murungi, 2020).

The identification of the project risk should be captured in a Risk Log that during the life of the project the log will be updated to reflect the new information on each risk and update their risk impact and probability. The project team should list all risks that may have an impact on the project. One way to start this process is to review each one of the project process areas, such as scope, schedule, budget and quality, as a way to identify potential risks (Abebe, 2021). Effective risk identification promotes risk management efficacy, and if risk managers fail to identify all potential gains or losses that threaten the firm, these unidentified risks would become unmanageable. The manager responsible for risk the coordinates with other managers to assess how the firm's strategies, plans and processes are expected to be affected by various probable outcomes (Alsaadi & Norhayatizakuan, 2021). Mwangi and Ndegwa (2020) argues that the process of risk identification ordinarily starts before the project is initiated and the number of risks increase as the project matures through the lifecycle. When project managers and their teams identify a risk, they need to first assess it to ascertain whether it has a possibility of occurring, the degree of its impact to the scheduled plan, scope, cost, and quality, and then prioritized through ranking. Risk events may impact on only one or while others may impact the project with multiple impact categories. The basis of assigning risk priority is dependent on the probability of occurrence of the risk, number of categories impacted and the degree (low, medium, high) to which they impact the project. All identifiable risks should be entered into a risk register, and documented as a risk statement (Tabi, 2016).

Risk Response Planning

Risk response planning is the process of developing options and determining risk responses that reduce risks to and increase opportunities for project success (Ahmadi-Javid, 2020). Risk response planning includes the identification and assignment of individuals or parties to take responsibility for each agreed risk response. This process ensures that identified risks are properly addressed. The effectiveness of response planning will directly determine whether risk increases or decreases for the project. Risk response planning must be appropriate to the severity of the risk, cost effective in meeting the challenge, timely to be successful, realistic within the project context, agreed upon by all parties involved, and owned by a responsible person. Selecting the best risk response from several options is often require (Trigunarsyah & Putrianti, 2022).

Several risk response strategies include risk avoidance, transference, and acceptance. The strategy that is most likely to be effective should be selected for each risk. Then, specific actions should be developed to implement that strategy. Risk avoidance is changing the project plan to eliminate the risk or condition or to protect the project objectives from its impact. Although the project team can never eliminate all risk events, some specific risks may be avoided. Some risk events that arise early in the project can be dealt with by clarifying requirements, obtaining information, improving communication, or acquiring expertise. Reducing scope to avoid high-risk activities, adding resources or time, adopting a familiar approach instead of an innovative one, or avoiding an unfamiliar subcontractor may be examples of avoidance (Ghaeb, 2023).

Risk transfer is seeking to shift the consequences of a risk to a third party together with ownership of the response. Transferring the risk simply gives another party responsibility for its management; it does not eliminate it. Transferring liability for risk is most effective in dealing with financial risk exposure. Risk transfer nearly always involves payment of a risk premium to the party taking on the risk. It includes the use of insurance, performance bonds, warranties, and guarantees. Contracts may be used to transfer liability for specified risks to another party. Use of a fixed-price contract may transfer risk to the seller if the project´s design is stable. Although a cost-reimbursable contract leaves more of the risk with the customer or sponsor, it may help reduce cost if there are mid-project changes (Hossny et al.,2021). Risk acceptance indicates that the project team has decided not to change the project plan to deal with a risk or is unable to identify any other suitable response strategy. Active acceptance may include developing a contingency plan to execute, should a risk occur. Passive acceptance requires no action, leaving the project team to deal with the risks as they occur (Al-Mukahal, 2020).

Empirical Review

Risk Identification and Project Performance

Hassanen and Abdelalim (2022) studied effect of risk identification on performance of Mega Industrial Projects in Egypt. This study was based on extensive literature review. The study showed that there is a problem in allocating risks in the Mega projects and the top-ranked risk factors were procurement problems, subcontractors' failure to comply with the schedule, unclear responsibility matrix, indecisive management, compliance risks, and delay due to permit and consent from statutory bodies. These risk factors demonstrated that the current risk allocation practice in construction projects were inefficient and led to several other problems, such as claims, disputes, and aggressive relationships. The conclusion was that being vigilant about priority risk factors and implementing risk mitigation measures through the terms of the contract can contribute to satisfactory results for the project.

Ali and Chege (2024) studied effects of risk mitigation practices on performance of road construction projects in Garissa County, Kenya. The study adopted a descriptive research design. The target included and 8 road construction projects within Garissa County comprising of 14 road engineers, 4 road supervisors, 8 road inspectors, 12 road surveyors and 146

contractors. The study sample size was 145 respondents. The study adopted a stratified random sampling technique. The researcher used questionnaires to collect data. The study findings indicated that there existed strong positive relationship between performance of road projects in Garissa County, Kenya and risk identification. In addition, risk identification strategies included recognizing the type of the risk which improved the building and construction value-chain.

Mutula and Eng'airo (2024) sought to analyse the effect of risk identification on project implementation among Catholic Church construction projects in the Diocese of Ngong. The study adopted a descriptive case design. The target population involved 240 members. The questionnaires were used to collect data. The results showed that there was a weak positive significant relationship between risk identification and project implementation. Otieno and Mutiso (2021) sought to examine the influence of project risk management on performance of agricultural projects in Nakuru County. The study adopted a descriptive research design. The sample size was 116 agricultural projects drawn from the 11 sub-counties in Nakuru County. Data was collected using questionnaires. The findings showed that the unproductive departments in the agricultural project are always identified. Auditors were always involved in identification of risk in the agricultural projects. Results also showed that risk identification has a significant influence on performance of agricultural projects.

Risk Response Planning and Project Performance

Tahir, Tahir and Shujaat (2017) examined the effects of risk response planning on project completion in the construction industry of Pakistan. The study aimed at investigating through the use of questionnaires, whether a relationship between effective risk response and improved project completion exists, and whether the organisations that undertake risk management processes are able to achieve a better project completion rate and, in the process, establish a link between the two. The study established a positive and significant effect between risk response planning and project completion.

Urbański, Haque and Oino (2019) study examined the moderating role of risk management in project planning and project success: evidence from construction businesses of Pakistan and the UK. The data was gathered from 152 project managers (76 from both economies each) using a survey questionnaire. The results demonstrated that project success is positively affected by project planning and effective planning improves the performance of a construction business. The findings also confirmed that appropriate planning for managing risks has been perceived to improve the possibilities of project success.

Igihozo and Irechukwu (2022) sought to assess the risk management process and performance of construction projects. The descriptive research design with a mixed qualitative and quantitative approach was used. The target was 168 respondents and 118 were sampled. Questionnaires were used to collect data. Results showed that there is existence of project risk management process in the construction project through project risk management plan and project risk plan response as the mean to those statements were high and regression analysis revealed a positive relationship between project risk plan response and project performance.

Sangwa and Dushimimana (2023) analysed the effect of risk management on project performance in Rwanda. The study used a census survey. The sample size was 200 respondents. Questionnaires were used to collect the primary data. Secondary data was also used to conduct the study. The findings showed that risk response planning had a significant effect on performance of the Twiceceka Project. Risk management plans contribute to project performance by establishing a list of internal and external risks. This plan typically includes the identified risks, probability of occurrence, potential impact and proposed actions. Low risk events usually have little or no impact on cost, schedule or performance.

Kavuli and Kirui (2020) sought to establish the effect of risk response planning on completion of women group projects in Katulani Ward, Kitui County. The research adopted a descriptive

research design. Primary data was collected using semi-structured questionnaires. The target population was 8 women Self Help Groups. The target was 583 management staff and beneficiaries and 175 were sampled using stratified random sampling. Data was collected using questionnaires. The study found that risk response planning positively and significantly influenced the completion of women group projects in Katulani Ward, Kitui County. The study concluded that risk response planning helps in the development of the procedures and techniques to enhance opportunities and reduce threats to the project's objectives. They help in reducing the effect or probability of the identified or even the unidentified risks. Risk response planning addresses the risks by their priority, inserting resources and activities into the budget, schedule, and project management plan, as needed.

Ororu and Juma (2022) sought to establish the influence of project risk response strategies on completion of constituency funded construction projects in Nyamira County, Kenya. The study adopted a descriptive research design. The target population was 719 persons from the 216 National Government Constituency Development Fund construction projects. The sample included 432 project management committee members (chairmen and secretaries), 12 NG-CDF key staff, 15 consultants and 216 contractors from the county. Questionnaires were used to collect data. The results showed that risk avoidance strategy had a positive statistically significant effect on completion of constituency funded construction projects in Nyamira County; risk reduction strategy had a positive statistically significant effect on completion of constituency funded construction projects in Nyamira County, and risk transfer strategy had a positive significant effect on completion of constituency funded construction projects and that the risk retention strategy.

RESEARCH METHODOLOGY

The study adopted a descriptive survey research design. A descriptive research design provides accurate presentation of factors that are relevant to the research question (Creswell, 2013). The unit of analysis in this study was the 14 public water projects. These projects were selected based on their significance in addressing water accessibility, sanitation, and sustainability challenges in Kajiado County. The unit of observation included 14 water project managers, 14 supervisors, and 207 project steering committee members. The project respondents are targeted since they are conversant with management of the water projects. They also work closely with the project financiers and the committee responsible for overseeing implementation of water projects. The sample size of the respondents was determined using Yamane 1967 formula. The study adopted a stratified random sampling technique.

The projects used simple random sampling whereby project managers, supervisors, and project steering committee members were randomly selected. This ensured that all the water projects had equal chances of being represented in the study. The study used both primary and secondary data. Primary data was conducted using questionnaires while secondary data was conducted using data collection sheets. A pilot study was conducted to assess the validity and reliability of the questionnaire. Wright (2018) recommended that a pilot study should be conducted with 10% of the sample size. As a result, a pilot study was conducted with 10% of sample resulting in 15 project management professionals who were not included in the actual study. After data collection, it was sorted, and exported to SPSS Version 28 for analysis. The study used descriptive and inferential statistics. The descriptive analysis included percentage, mean and standard deviation. The inferential statistics included correlation and regression. The significance level for all tests were 95% confidence.

RESEARCH FINDINGS AND DISCUSSION

The study targeted a sample size of 148 respondents, including water project managers, supervisors, and project steering committee members. Out of the 148 distributed questionnaires, 133 were successfully completed and returned, representing a 89.9% response

rate. A response rate above 70% is considered adequate for data analysis in social science research (Mugenda & Mugenda, 2003)

Descriptive Analysis

This section presents the descriptive analysis of the study variables, including risk identification, risk response planning and project performance. The analysis summarizes respondents' perceptions regarding risk management practices in water projects in Kajiado County using mean scores and standard deviations. The mean score represents the central tendency of responses, while the standard deviation measures the level of variation in responses. Mean values were interpreted based on the following scale: 1.00 – 1.50 → Strongly Disagree; 1.51 – 2.50 → Disagree; 2.51 – 3.50 → Neutral; 3.51 – 4.50 → Agree; 4.51 – 5.00 → Strongly Agree. A mean closer to 1.00 indicates high disagreement, while a mean closer to 5.00 indicates strong agreement. A lower standard deviation (<1) suggests respondents had similar opinions, while a higher standard deviation indicates greater variability in responses.

Risk Identification

The first objective of the study was to establish the influence of risk identification on performance of public water projects in Kajiado County, Kenya. Risk identification is the first step in risk management and involves detecting, classifying, and assessing potential risks in projects. The study examined the extent to which risk identification practices are implemented in water projects in Kajiado County. Table 1 presents the findings obtained.

Table 1: Descriptive Statistics for Risk Identification

Statement	Mean (M)	Standard Deviation
There is a formal risk identification strategy	4.123	0.678
Project team is able to identify potential risks and risky events	4.201	0.715
Risk identification helps to manage various risks, even the unforeseen	4.254	0.748
Risks are classified to identify and anticipate potential risks in the project	4.302	0.672
Risk recognition helps to identify and differentiate high-potential risks	4.181	0.703
Project managers always break down risk according to level of severity	3.980	0.792
Auditors are always involved in identification of risk in the water projects	3.750	0.854
There is constant identification of areas of high risk in the water projects	4.354	0.631
Aggregate Score	**4.018**	**0.761**

The highest-rated aspect of risk identification in water projects in Kajiado County is the constant identification of high-risk areas, with a mean score of 4.354 (SD = 0.631). This suggests that project teams are proactive in continuously monitoring potential risk zones, ensuring that risk mitigation is an ongoing process rather than a one-time activity. The classification of risks to anticipate potential threats follows closely, with a mean score of 4.302 (SD = 0.672), indicating that project teams systematically categorize risks based on their impact and probability. This structured approach ensures that risk management efforts are focused on high-priority threats that could significantly impact project performance. Risk identification in managing unforeseen risks scored 4.254 (SD = 0.748), reinforcing the importance of risk identification as a preventive measure rather than a reactive one. This implies that water project teams actively engage in strategies to recognize unexpected risks, enhancing overall project resilience. The ability of project teams to identify potential risks and risky events was rated at 4.201 (SD = 0.715), reflecting the competence of stakeholders in recognizing potential project

threats. This suggests that risk awareness and risk literacy among project teams are well-developed, allowing them to anticipate and address possible challenges before they escalate.

Risk recognition in differentiating high-potential risks was rated at 4.181 (SD = 0.703), showing that project managers effectively distinguish between critical and non-critical risks. However, the practice of breaking down risks according to severity received a slightly lower score of 3.980 (SD = 0.792), suggesting that while risks are identified, there may be gaps in their detailed assessment and prioritization. The involvement of auditors in risk identification had the lowest mean score of 3.750 (SD = 0.854), indicating that external oversight in risk identification is not consistently applied across all projects. This could imply a reliance on internal project teams rather than independent auditors to assess risks, which might affect the objectivity of risk assessment processes.

With an aggregate mean score of 4.018 (SD = 0.761), the findings confirm that risk identification is a well-integrated practice in water projects. The results align with Ali and Chege (2024), who emphasized that effective risk identification enhances infrastructure project performance by improving decision-making and reducing uncertainties. Their study demonstrated that recognizing risk types in construction projects enhances risk management across the value chain. Similarly, Mutua and Kirui (2020) found that proactive risk identification in banking system projects allowed project managers to conduct thorough risk assessments, ensuring that potential threats were addressed early in the project lifecycle. These findings reinforce the argument that structured risk identification enhances project resilience, reducing the likelihood of delays, cost overruns, and implementation failures. By ensuring that risks are systematically classified, recognized, and continuously monitored, water projects in Kajiado County can improve sustainability and long-term efficiency.

Risk Response Planning

The third objective of the study was to examine the influence of risk response planning on performance of public water projects in Kajiado County, Kenya. Risk response planning involves developing strategies to mitigate, transfer, or accept risks in project execution. The study evaluated the effectiveness of contingency plans, risk transfer mechanisms, and quality assurance checks in water projects. Table 2 presents summary of findings obtained.

Table 2: Descriptive Statistics for Risk Response Planning

Statement	Mean (M)	Standard Deviation
Risk avoidance is used properly in risk response plans	4.101	0.714
Risk sharing is used properly in risk response plans	3.954	0.784
Risk acceptance is considered in risk response plans	4.021	0.752
Contingency plans are efficient in risk response planning	4.204	0.704
The water projects have quality assurance checks	4.302	0.654
Risks are always reduced by deliberate actions	4.083	0.725
The risk reduction programs are well-instituted in the projects	3.954	0.785
The water projects transfer risk to third parties using legal agreements	3.854	0.823
Aggregate Score	**4.059**	**0.756**

The highest-rated aspect of risk response planning in water projects in Kajiado County is the existence of quality assurance checks, with a mean score of 4.302 (SD = 0.654). This indicates that most water projects have structured quality control mechanisms in place, ensuring that risk response strategies are implemented effectively. These checks help maintain project integrity, minimize errors, and ensure compliance with safety and operational standards. The efficiency of contingency plans in risk response planning follows closely, with a mean of 4.204 (SD = 0.704), suggesting that most projects have well-prepared backup plans for handling unexpected risks. This finding implies that project teams actively plan for uncertainties by setting aside

resources, establishing protocols, and developing mitigation strategies to ensure project continuity even when risks materialize.

Risk avoidance strategies in risk response planning received a mean score of 4.101 (SD = 0.714), indicating that project teams prioritize preventive measures to eliminate risks before they escalate. This means that instead of waiting for risks to occur, project managers make proactive decisions, such as modifying project designs, adjusting schedules, or changing suppliers to reduce the likelihood of encountering risks. Reducing risks through deliberate actions was rated at 4.083 (SD = 0.725), showing that water project teams actively take steps to mitigate risks through strategic interventions. This could include regular inspections, process adjustments, and additional training for project teams to handle risk-prone activities effectively. Risk acceptance as part of risk response planning was rated at 4.021 (SD = 0.752), indicating that while some risks are actively mitigated, others are acknowledged as unavoidable but manageable within project constraints. This suggests that project teams assess risks based on cost-benefit analysis, accepting certain risks when mitigation is impractical or too costly.

Risk sharing strategies in risk response planning had a mean score of 3.954 (SD = 0.784), implying that while some projects distribute risks among stakeholders (e.g., through contracts or partnerships), this practice is not uniformly applied across all projects. Similarly, well-instituted risk reduction programs received the same mean score of 3.954 (SD = 0.785), indicating that while risk reduction strategies exist, their implementation varies depending on project type, funding, and managerial capacity. The lowest-rated aspect of risk response planning was transferring risks to third parties using legal agreements, with a mean score of 3.854 (SD = 0.823). This suggests that risk transfer mechanisms, such as insurance policies or contractual agreements, are not widely adopted in water projects. Instead, project teams may prefer internal risk management strategies rather than shifting liabilities to external entities.

With an aggregate mean score of 4.059 (SD = 0.756), the findings indicate that risk response planning is well-integrated into water project management, though risk transfer mechanisms remain underutilized. These findings align with Tahir, Tahir, and Shujaat (2017), who found that effective risk response planning significantly enhances project completion rates in the construction industry of Pakistan. Similarly, Kavuli and Kirui (2020) established that structured risk response planning positively influenced the completion of women group projects in Kitui County, Kenya. The present study reinforces these insights by showing that well-defined contingency plans and quality assurance checks contribute to better project resilience and performance. However, the limited use of risk transfer mechanisms suggests that project teams may need to incorporate more external risk-sharing strategies, such as contractual obligations, warranties, and insurance policies, to enhance project security and sustainability.

Performance of Water Projects

The main objective of the study was to examine the influence of risk management practices on performance of public water projects in Kajiado County in Kenya. Project performance is a key measure of success in public water projects and is influenced by timely delivery, cost efficiency, service quality, sustainability, and stakeholder involvement. The study examined these performance indicators to assess the effectiveness of project management strategies in Kajiado County. Table 4.8 presents the findings obtained.

Table 3: Descriptive Statistics for Project Performance

Statement	Mean (M)	Standard Deviation
The projects meet time objectives	4.312	0.695
Projects are delivered within set budget	4.254	0.709
Project clients are satisfied	4.201	0.731
Projects are of good quality	4.176	0.698
The water projects deliver the expected services	4.154	0.693
Project sustainability is ensured after completion	4.101	0.714
Stakeholder involvement contributes to project success	4.083	0.725
Projects comply with risk mitigation measures	3.954	0.784
Aggregate Score	**4.160**	**0.756**

The highest-rated aspect of project performance is the ability of projects to meet time objectives, with a mean score of 4.312 (SD = 0.695). This suggests that project schedules are generally well-managed, ensuring that delays are minimized and timelines are met. Similarly, budget adherence was highly rated, with a mean score of 4.254 (SD = 0.709), indicating that projects effectively control financial resources and minimize cost overruns. Project client satisfaction followed with a score of 4.201 (SD = 0.731), implying that beneficiaries generally perceive the projects as successful in meeting their water supply needs. The quality of projects was rated at 4.176 (SD = 0.698), suggesting that project teams adhere to construction standards and ensure the durability of infrastructure.

Service delivery by water projects had a mean score of 4.154 (SD = 0.693), reflecting that most projects fulfill their intended purpose by providing reliable water supply to communities. Project sustainability after completion received a slightly lower rating of 4.101 (SD = 0.714), implying that while most projects remain functional, long-term maintenance and operational challenges persist. Stakeholder involvement in project success was rated at 4.083 (SD = 0.725), suggesting that community participation and collaboration with local authorities contribute to better project outcomes. However, compliance with risk mitigation measures received the lowest score, 3.954 (SD = 0.784), indicating that some projects may not fully integrate risk management practices into their operations.

With an aggregate score of 4.160 (SD = 0.756), the findings suggest that water projects in Kajiado County perform well in terms of timeliness, cost efficiency, and quality but face challenges in long-term sustainability and risk mitigation. These results align with Ongati (2019), who found that effective project planning and risk management improve project performance in infrastructure projects. Similarly, Mbevi and Ndeto (2024) emphasized that stakeholder involvement and adherence to quality standards significantly enhance public project outcomes. The findings reinforce the need for enhanced sustainability strategies, stronger risk management integration, and continued stakeholder collaboration to improve water project performance in the long term.

Correlation Analysis

The study conducted a Pearson correlation analysis to examine the strength and direction of relationships between risk identification and risk response planning with water project performance. Pearson's correlation coefficient (r) ranges from -1 to +1, where: Strong positive correlations ($r \geq 0.5$) indicate a significant relationship, meaning that a higher implementation of a risk management practice enhances project performance. Moderate correlations ($0.3 \leq r < 0.5$) suggest a reasonable connection, though external factors may also influence project success. Weak correlations ($r < 0.3$) imply a limited impact, indicating that the variable may not significantly influence performance. The correlation analysis helps in identifying which risk management strategies contribute most to water project performance and where improvements are necessary.

Table 4: Correlation Matrix for Study Variables

Variables		**Performance of Water Projects**	**Risk Identification**	**Risk Response Planning**
Performance of Water Projects	Pearson Correlation	1.000		
	Sig. (1-tailed)			
	N	133		
Risk Identification	Pearson Correlation	0.624*	1.000	
	Sig. (1-tailed)	0.000		
	N	133	133	
Risk Response Planning	Pearson Correlation	0.572*	0.512	1.000
	Sig. (1-tailed)	0.000	0.102	
	N	133	133	133

Risk Identification ($r = 0.624$, $p < 0.05$) had the strongest positive correlation with project performance. This suggests that projects that have structured risk identification strategies tend to achieve better success rates. Effective risk identification ensures that potential project threats are recognized early, allowing managers to develop proactive mitigation measures. This aligns with Ali and Chege (2024), who found that risk identification plays a crucial role in improving project performance by preventing unforeseen challenges from escalating.

Risk Response Planning ($r = 0.572$, $p < 0.05$) also exhibited a strong correlation with project performance, showing that well-structured risk response strategies contribute to project success. This suggests that projects that incorporate contingency planning, risk sharing, and risk transfer mechanisms tend to handle uncertainties more effectively. Proper risk response planning reduces the likelihood of project disruptions by ensuring that teams are prepared for unexpected challenges. These findings are consistent with Tahir, Tahir, and Shujaat (2017), who confirmed that risk response planning significantly improves project completion rates in construction projects.

Regression Analysis

The regression coefficients provide insights into the individual influence of each risk management practice on project performance.

Table 5: Regression Coefficients

Variable	**Unstandardized B**	**Std. Error**	**Standardized B (β)**	**t-Statistic**	**Sig. (p-value)**
Constant	17.892	5.008		3.572	0.001
Risk Identification	0.421	0.076	0.407	5.539	0.000
Risk Response Planning	0.388	0.079	0.362	4.911	0.000

a. Dependent Variable: Project Performance

Based on the unstandardized regression coefficients, the fitted regression equation predicting water project performance (Y) from the four risk management practices is:

$$Y = 17.892 + 0.421X_1 + 0.388X_2$$

Where:

Y = Project Performance

X_1 = Risk Identification

X2 = Risk Response Planning

Risk Identification (B = 0.421, $p < 0.05$) showed the strongest positive influence on project performance. This suggests that projects that have robust risk identification mechanisms tend to perform better, as early risk detection allows for proactive mitigation. These findings align with Ali and Chege (2024), who found that projects that prioritize early risk identification are less likely to experience cost overruns and delays.

Risk Response Planning (B = 0.388, $p < 0.000$) had the second-highest impact, indicating that water projects with structured contingency plans, risk transfer mechanisms, and preventive strategies are more resilient to disruptions. These findings align with Tahir, Tahir, and Shujaat (2017), who confirmed that risk response planning significantly enhances project completion rates by reducing uncertainties.

Conclusions

Risk identification significantly influenced water project performance in Kajiado County. Structured identification, classification of risks, and continuous monitoring of high-risk areas enhanced project success by preventing delays and cost overruns. However, limited involvement of external auditors in risk identification affected objectivity. Strengthening independent evaluations and enhancing training on risk detection will improve project sustainability.

Risk response planning was crucial in mitigating project risks, ensuring contingency measures and quality assurance checks were in place. Structured contingency plans reduced disruptions and improved adherence to timelines and budgets. However, risk-sharing mechanisms like insurance and contractual risk transfers were underutilized. Promoting awareness and adoption of risk-sharing strategies will enhance financial protection and project resilience.

Recommendations

Risk Identification

To enhance risk identification, water projects should integrate independent risk audits and external reviews to improve the objectivity of risk assessment. Currently, many projects rely on internal evaluations, which may not comprehensively capture all potential risks. The use of structured risk classification frameworks will help categorize risks based on severity and probability, allowing project teams to prioritize high-impact threats effectively. Moreover, training programs should be implemented to improve the ability of project managers and teams to detect emerging risks and respond proactively. Additionally, leveraging data analytics and predictive modeling techniques can improve the accuracy of risk detection and enhance early-warning mechanisms for potential project failures.

Risk Response Planning

Risk response planning should be reinforced through enhanced contingency planning frameworks and more structured quality assurance mechanisms. The study found that while many projects had established contingency plans, the effectiveness of these strategies varied depending on the level of preparedness and resource allocation. To improve this, project teams should allocate contingency budgets and resources in advance to handle unforeseen project risks without significant disruptions. Additionally, risk-sharing mechanisms such as insurance coverage, contractual agreements, and public-private partnerships should be actively explored to mitigate financial risks. The integration of risk transfer policies within project financing models will help minimize financial liabilities and improve overall project sustainability.

Suggestions for Further Studies

This study explained 76.0% of the variation in water project performance, leaving 24.0% unexplained, indicating that other factors beyond risk management influence project outcomes. Future research should explore the impact of technology adoption, including AI-driven risk

tracking and predictive analytics, in enhancing risk management for water projects. Additionally, studies should assess the role of government policies and regulatory frameworks in shaping risk mitigation strategies, ensuring compliance, and enhancing project resilience. Furthermore, research should investigate the effectiveness of risk-sharing mechanisms, such as insurance policies and public-private partnerships, in improving the sustainability and financial security of water projects. Expanding on these areas will provide deeper insights into best practices for strengthening risk management in public infrastructure projects.

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