International Journal of Management and Business Research

IJMBR

Volume 6, Issue 2, pg. 122-136, 2024

ISSN 29769-91723

PROJECT QUALITY MANAGEMENT PRACTICES AND PERFORMANCE OF TANATHI WATER WORKS DEVELOPMENT AGENCY WATER PROJECTS, KENYA

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ABSTRACT

Projects face many challenges and problems which include quality, time, and cost overrun in their completion worldwide. Water projects play a fundamental role in a nation's development and help meet one of society's key needs. The general objective of this study was to examine the relationship between project quality management practices and performance of Tanathi Water Works Development Agency water projects, Kenya. The specific objectives of this study were to examine the effect of quality control, and quality improvement on the performance of Tanathi Water Works Development Agency water projects, Kenya. The study was guided by change management theory, and goal setting theory. The study adopted a descriptive survey research design. The study focused on 23 water projects by Tanathi Water Works Development Agency, Kenya. The target population was 300 respondents. Yamane's (1967) formula was used to calculate 171 respondents comprising 13 project managers from Tanathi Water Works Development Agency and 158 project steering committee members from the four counties who were the unit of observation and who were sampled using stratified random sampling. Primary data was used in the study and it was collected using questionnaires. A pilot test was conducted with 10% of the sample, hence 18 project team members. The study used content and construct validity. Reliability was tested using the Cronbach Alpha coefficient. Statistical Package for Social Sciences (SPSS version 28) was used for analysis. Findings were tabulated. Findings show that; quality control has a positive strong significant correlation with performance of TAWWDA projects, and quality improvement has a positive strong significant correlation with performance of TAWWDA projects. The study recommends that; the quality control process should include a system for dealing with problems as they are. If an error is detected, decisions on what to do should be made within the shortest time possible. The agency should create a flexible project plan in all aspects of the project to ensure that changes are accommodated to improve project outcomes.

Key Words: Project Quality Management Practices, Quality Control, Quality Improvement, Performance, Tanathi Water Works Development Agency water projects

Background of the Study

Project quality management is a project management knowledge area in the PMBOK Guide. It is the process of continually measuring the quality of all activities and taking corrective action until the team achieves the desired quality (Waduu & Rugami, 2019). Benefits of implementing QMPs include reduced costs of operations, increase in operation efficiency, productivity, financial performance and organization's ability to continuously learn and improve operations (Nwafor, 2020). Since quality management practices are a resource for creating quality, the quality management practices must be valuable, rare, inimitable and not substitutable for projects to realize key objectives (Barone, 2022).

According to the International Organization for Standardization (ISO), quality management involves coordinated activities to direct and control an organization's quality. It is a standard developed by the International Organizations for Standardization and acts as a framework for organizational quality management practices. The ISO 9000 addresses various issues of quality management and holds some of ISO's best-known standards. The standards provide guidance and tools for companies and organizations who want to ensure that their products and services consistently meet customer's requirements and that quality is consistently improved (ISO, 2017).

Project Management Body of Knowledge *(*PMBOK) refers to the implementation of quality management practices as the technical aspect of quality management which involves quality control, and continuous improvement. Zgirskas, Ruževi˘cius, and Ružele (2021) add that quality management implementation involves managing the plans, changes, risks, and defects of a project. Project team members with specific technical expertise on the various aspects of the project play an active role in quality control. They set up the technical processes and procedures that ensure that each step of the project provides a quality output from design and development through implementation and maintenance. Each step's output must conform to the overall quality standards and quality plans, thus ensuring that quality is achieved (PMI, 2016).

Project Quality Management processes include all the activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project satisfies the needs for which it was undertaken. It implements the quality management system through the policy, procedures, and processes of quality planning, quality assurance, and quality control, with quality improvement activities conducted throughout (Project Management Tutor, 2023). The overall purpose of project quality management is to provide a broad framework for identifying quality standards and requirements, implementing quality assurance and control activities, and taking corrective actions for project improvement. Olawale (2022) revealed that an organization with effective project quality management strategies would more likely fulfill the needs of clients, which could ultimately lead to client satisfaction.

According to Zenebe (2017), quality control involves monitoring specific project results to determine if they comply with relevant quality standards and identifying ways to eliminate causes of unsatisfactory results. It should be performed throughout the project. Project results include both product results such as deliverables and management results such as cost and schedule performance. This process includes setting specific standards for construction performance, usually through the plans and specifications. Variances are then measured from the standards. Actions are taken as correction or to reduce unpleasant variances and lastly plan for improvements in the standards themselves and in conformance with the standards. Quality control ensures that the physical work conforms to those standards.

Quality improvement (QI) is a systematic and continuous process of measuring, analyzing, and improving the performance and outcomes of a project. Quality Improvement involves increasing the effectiveness and efficiencies of the project management processes so that this project and future ones will better meet customer satisfaction and regulatory requirements. The processes of project quality improvement include; determining and prioritizing potential areas for improvement, collecting and analyzing data, communicating results, committing to ongoing

evaluation, and sharing project success reports (Jones, 2019). Quality improvement can be used to reduce unwarranted variation, reliably implement interventions that have been shown to improve outcomes, or discover new solutions through a process of innovation.

Statement of the Problem

Water projects play a fundamental role in a nation's development and help meet one of society's key needs. According to the Ministry of Water, Sanitation, and Irrigation (2023), water supply contributes to approximately 0.7% of GDP and total public spending on water has remained small (about 2% of total national budget). To improve access to clean water, the government collaborates with water agencies in Kenya such as TAWWDA to implement water projects, particularly in the Arid and Semiarid Areas. However, a review of contract documents from TAWWDA in the Eastern region revealed that water projects were not completed on time (TAWWDA, 2023). Out of 33 small and medium dams in Kitui and Makueni County whose design documents were provided, only 50% had their BQs (Bill of Quantity) fully implemented. Delays in the completion of water projects in TAWWDA are a common phenomenon. According to the TAWWDA (2022) achievement report, 9 of 16 (57%) completed projects were completed late while 12 of 14 (86%) ongoing projects were behind schedule.

Muiruri and Bett (2020) indicated that 62% of water projects in Kenya fail due to poor monitoring and evaluation, poor resource allocation, and staff incompetency. The projects fail to realize their objectives owing to either their organizational or managerial problems resulting in project delays, and imperfect project design. A Performance Report of Kenya's Water Services Sector 2022/23 shows that there was a drop in O+M cost coverage to below 100% since a cost coverage of less than 110% cannot guarantee the current level of service leading to deterioration of service delivery. The expenditure on personnel hit the 50% mark, a highly unsustainable model in the operations of water projects. Mbavu, Nyanchaga, and Oonge, (2021) added that 66.7% of water projects in Kitui County have failed due to poor Engineering design coupled with non-adherence to proper quality construction material standards, 26.92% due to lack of detailed site investigations and lack of community involvement in preliminary data collections or total ignorance of the community.

Several research on quality management and project performance have been undertaken locally. Boventura and Kisimbii (2019) on the influence of quality management on the performance of construction projects in Mombasa County showed that quality requirements enhance project performance. Nderitu and Nyaegah (2020) on determinants for the adoption of quality management practices on project implementation in the County Governments in Kenya revealed quality management practices significantly affect project performance. There are limited studies on the performance of water projects implemented by TAWWDA. The study hence sought to examine the relationship of project quality management practices and performance of Tanathi Water Works Development Agency water projects in Kenya.

General Objective of the Study

To examine the relationship between project quality management practices and performance of Tanathi Water Works Development Agency water projects, Kenya

Specific Objectives of the Study

i. To assess the relationship between quality control and performance of Tanathi Water Works Development Agency water projects, Kenya.
ii. To examine the relationship between quality improvement and performance of Tanathi Water Works Development Agency water projects, Kenya.

LITERATURE REVIEW

Theoretical Review

Enterprise Risk Management Theory

The theory of risk management was developed by Daniel Bernoulli in 1738. Tabish and Jha (2012) define enterprise risk management (ERM) as a discipline that supports the achievement of project objectives by addressing the full chain of risks and managing the combined impact of those risks as an interrelated portfolio (Sudhakar, 2012). Therefore, the major aim of this theory is to ensure that the project can keep creating significant value under any uncertain environment. Managers stand a high chance of saving a lot of money if they deal with uncertain project events proactively which will minimize the impact of threats and seize the opportunities that could occur (Shahu et al., 2012). Lundqvist (2015) claims that ERM includes risk governance frameworks that establish a structured approach to the management of risks by defining risk responsibilities within the organization. ERM also includes designing and using risk artifacts to promote risk communication, and integrating risk information into strategic decision-making Klein & Reilley, 2021).

The ERM risk management framework of managing risk emphasizes that senior company executives and employees should actively be involved in the risk management process of analyzing and responding to a wide range of company risks (Hallowell, Molenaar, &Fortunato, 2013). This concept encourages all members of the organization to be involved in the management of risks and not only one or a few members. The ERM also highlights the importance of clear processes and policies for managing risks. According to Olson and Wu (2010), the theory also affirms that if organizations can embrace formal policies that define risk appetite, strategic goals, tolerance, and systematic processes then they can improve their risk management capacity of identifying, analyzing, and treating risks. The theory also stresses the creation of a risk management culture where all stakeholders are empowered and accountable to manage risks. Cormican (2015) suggested that ERM practices involve increased competitive advantage, stakeholder confidence and long-term viability of organizations.

Tabish and Jha (2012) define ERM as a strategic business discipline that supports the achievement of an organization's objectives by addressing the full spectrum of its risks and managing the combined impact of those risks as an interrelated portfolio. Historically, firms managed different kinds of risks separately. This fragmentation of risk management occurred because different functions within a corporation handled different parts of risk management e.g. finance often addressed risks associated with interest rate variations, insurance handled natural catastrophes and liability, and operations managed quality and safety risks (Sudhakar, 2012). Kinyua (2017) on the other hand defines ERM as the overall process of managing an organization's exposure to uncertainty with particular emphasis on identifying and managing the events that could potentially prevent the project from achieving its objective. ERM is an organizational concept that applies to all levels of the project.

Foreseen risks require disciplined risk management, the identification of potential risks that could affect the project followed by the planning of preventive measures to mitigate adverse events and multiple contingent courses of action that are then triggered by the events. The project manager must not only be able to troubleshoot but also function as a reactive consolidator of what has been achieved up to a certain stage in the project. All risks that may affect project performance must be constantly monitored and communicated to project stakeholders. Progress tracking demands monitoring not only of activities that have been completed but also of the uncompleted project activities. Flexible contingent actions, depending on outcomes of key influence parameters, should be anticipated in the decision tree (Zwikael & Ahn, 2011). This theory indicates that all risks emanate from uncertainties that a foreseen in the implementation of a project.

The ERM theory has become popular in project management techniques even though it was developed to manage company risks. In conducting ERM, the following are listed as some of the areas or aspects of the project that a project risk manager needs to look into namely: the

people, intellectual assets, brand values, business expertise and skills, the principle source of funds stream and the regulatory environment. Deshmukh (2018) explains that adopting the ERM philosophy in project management is a wise decision as it applies to industries that have very high rates of failure like the construction industry. These failures are a result of failure to identify, mitigate and control risk across the entire business making this theory relevant to this research. Proper management of the risks will determine how the managers will prevent the risks from occurring and improve the quality of a project enhancing its performance. This would also ensure the sustainability of the water projects. The theory hence supports the objective of quality control.

Change Management Theory

Change Management Theory was developed by Kurt Lewin in 1995. The theory of change is based on three phases of change including unfreezing, changing, and refreezing (Levasseur, 2001). The first phase is unfreezing which means creating the momentum for change. The phase aims at reducing forces that are aimed at maintaining the status quo and disrupting the present mindset. Normally presenting a provoking situation or challenge helps staff in seeing the importance of changing and looking for new resolutions. In this step, the top leadership of an organization must "preach the gospel" of the impending change and convince all the firm's employees that the change will be beneficial to all in the long run (Hendry, 1996). People must be given a reason to support the change or else the organization runs the risk of facing user resistance.

The second phase is the changing stage which entails understanding the necessity for change and finally changing the workforce's attitude. This involves establishing new values, traits, and attitudes, at times by organizational process and structure modifications and development methods. There might be confusion as staff changes from the conventional methods at the workplace to the new when the management must walk the change journey with their staff (Robbins and Judge, 2009). An important strategy is to keep the fire burning by introducing "quick wins" that will help the employees embrace the change for the benefit of the organization.

Refreezing is the final stage of Lewin's change model and it involves crystallizing and the adaptation of ownership of the new processes or how things are done by all the employees (Schein, 1988). At this point, the firm could go back to the previous manner of doing things except if the changes are strengthened by freezing. In addition, the leadership must play a key role at this stage or else all the benefits that had been intended when initiating the change process might not be achieved. The majority of change agents are in the management team, who are then responsible for ensuring that the functional system is in line with all personnel (Hughes, 2007). The three-step approach explicates the relevance of effectively implementing a change by eliminating present conditions, then movement modification, making norms absolute, and altering behaviors. As a result, whenever stakeholders, particularly workers, are kept informed of planned changes regularly, they are more likely to embrace and apply them efficiently.

According to Weiss (1995), the theory of change explains the process of change within interventions and shows the linkages between the intervention activities and long-term outcomes (Vogel, 2012). The theory of change states all the assumptions and requirements needed to facilitate change acknowledging the role of context in influencing the process (Connell & Kubisch, 1998). While the theory of change uses diagrams to show how project tasks interact in a non-linear fashion, logic models and logical frameworks are more rigid and linear in showing the relationship between inputs, processes, outputs and outcomes of project tasks (De Silva, Breuer, Lee, et al., 2014).

During the implementation of a project, it should be noted that the theory of change keeps on changing and should be monitored throughout the process. Theory of change should be developed in conjunction with all project stakeholders to avoid project conflicts during the change process. Theory of change is currently used in quite several projects including construction, public health, and logistic industries both in the public and private sectors (Maini,

Hotchkiss & Borghi, 2017). The theory of change is important as it helps the project program and other factors in contributing to outcomes (Mayne, 2008).

Evaluation usually takes place at three stages of a project namely mid-term review, end of program review and afterward review. Midterm review checks the contribution of the project to the intended change in line with the theory of change while end of program review, also known as summative evaluations would study if lessons learned can be up-scaled or transferred to other domains of practice. Theory of change checks how the project is evolving during the design, planning and monitoring stages, to provide input for the evaluation process (Mackinnon & Amott, 2006).

The theory of change helps project managers to predict, manage and where necessary avoid some of the project management risks during the implementation of public projects. The theory of change will help the project managers during the implementation process to track the intermediate outcomes and define the path to achieving the desired change, which will enable them to articulate the interrelatedness between different stages in the process (Dhillon & Vaca, 2018). The theory supports the objective of quality improvement since effective implementation of project changes will help to continuously improve project quality.

Conceptual Framework

According to Kothari and Garg (2014), a conceptual framework represents a hypothetical model which identifies the relationship between dependent and independent variables. The conceptual framework is presented in Figure 2.1.

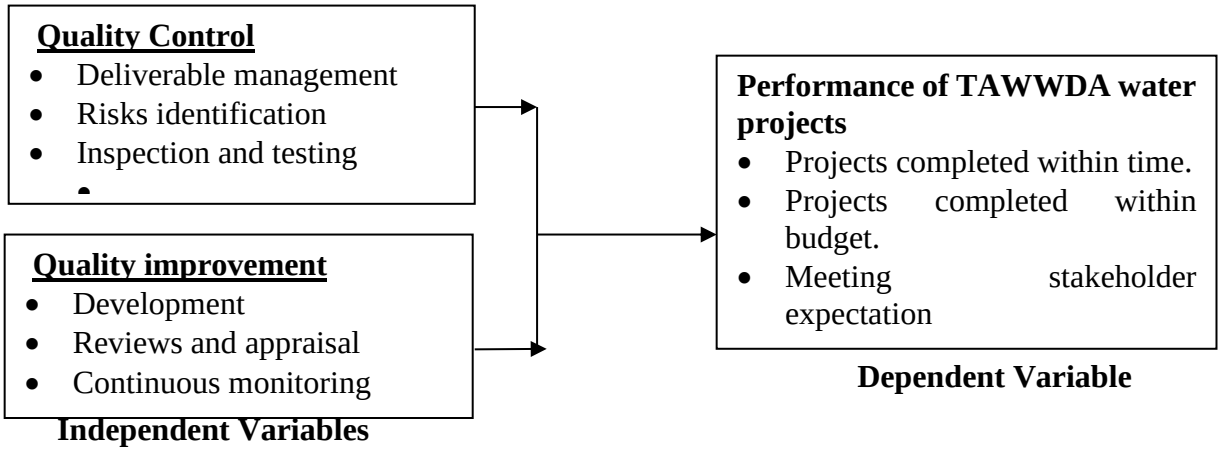

Figure 2.1: Conceptual Framework

Quality Control

The Project Management Body of Knowledge (PMBOK) refers to quality control as the technical aspect of quality management. Project team members who have specific technical expertise on the various aspects of the project play an active role in quality control. They set up the technical processes and procedures that ensure that each step of the project provides a quality output from design and development through implementation and maintenance. Each step's output must conform to the overall quality standards and quality plans, thus ensuring that quality is achieved (Giao, & Trang, 2021).

Quality control is the part of quality management that ensures products and services comply with requirements. It is a work method that facilitates the measurement of the quality characteristics of a unit, compares them to established standards, and analyzes the difference between the results obtained and the desired results to make decisions that will correct any differences. One way of controlling quality is based on the inspection or verification of finished products. The aim is to filter the products before they reach the client so that products that do not comply with requirements are discarded or repaired (Abeysinghe, 2022).

Quality Control is performed mainly during the Monitoring and Controlling phase of the project. This helps the Project Manager to have a clear understanding of current progress, the

quality of activities performed and their respective value addition to the overall project. It also aids managers in taking timely action if any parameter or variable is out of the project trajectory. Thus, proves to be a critical factor for taking timely corrective actions which in turn impact overall project progress (McCown Gordon, 2021). Quality control ensures that the work done must be of required quality and durability. This can be achieved by inspecting the source of supply of material up to the finished production. Major items of control before and during construction are verifications of soil characteristics, drawings and designs, structural safety, durability, checking the quality of materials, specifications, testing of materials and inspection of equipment (Jewell & Flanagan, 2019).

Quality Improvement

Quality improvement is the process of constantly analyzing and refining project management strategies to enhance efficiency, minimize errors, and maximize productivity (Khan et al., 2019). Quality improvement encourages ongoing evaluation and refinement of project management practices. It is also a powerful tool for engineering project delivery, enabling teams to enhance efficiency, productivity, and quality. By constantly evaluating and improving processes, a project manager can identify and eliminate inefficiencies and bottlenecks, which can save time and resources and improve overall productivity (Lerche & Neve, 2020).

Quality improvement can lead to better quality outcomes by identifying and addressing issues and errors early on in the project lifecycle. It also enables trust and confidence building with stakeholders which can lead to better relationships and more successful projects in the future. Quality improvement helps teams stay adaptable and resilient by encouraging them to stay flexible and open to change, even in the face of unexpected challenges. By regularly evaluating and fine-tuning processes, engineering teams can identify and address potential quality issues early on, reducing the likelihood of costly mistakes and rework. The quality improvement approach emphasizes efforts to eliminate waste and to reduce variability optimizing the so-called 'value-added time' as part of the total project delivery time (Tiara, 2023).

Implementing effective change management in projects can result in cost and time savings and quality improvement. However, if changes are not properly managed, it can lead to cost overruns and failure to meet the client's satisfaction (Yap & Skitmore, 2019). Change is an inevitable part of any project, and managing change can be a challenging task, especially if it is not well-planned and executed, the success of a project often depends on how well change is managed (Chin, 2019). When changes occur, for whatever reason, a tight change control process can help to keep the project on track. Once the changes are made, there is almost always an accompanying increase in the budget and/or extension of the schedule. However, on some projects, even a high number of changes and a severe amount of scope increase have been added to the project without any schedule extension given to perform the same work. All changes must be assessed in the dimensions of the budget plan, the resource plan, and the project schedule (Mesa, 2020).

Empirical Review

Quality Control

Smith (2023) studied the impact of quality control on organizational performance. Results showed that quality control contributes to organizational performance by optimizing operational efficiency. Through the identification and elimination of inefficiencies, organizations can streamline their processes, reduce waste, and enhance productivity. This results in cost savings, improved resource allocation, and increased profitability. Furthermore, quality control fosters a culture of quality improvement, encouraging employees to identify opportunities for innovation and enhancement, leading to higher levels of employee engagement and organizational agility.

Yu and Wang (2019) studied the effect of quality defect management on construction projects in China. The results indicated that the use of precast components with quality defects, poor operations by construction workers, and ineffective quality inspection and testing during onsite

assembly and construction were the major factors affecting quality defect control. Additionally, contractors have the highest level of impact on the occurrence of quality defects. Rehman (2017) investigated the risk management strategies adopted by construction firms in Pakistan. The study adopted a descriptive approach. Questionnaires were used to collect data. Findings established that management of risks reduces the chances of failure in construction projects. The study recommended that contractors should invest more in getting accurate and reliable information for better cost estimation and future forecasting.

Agbeko (2019) explored quality control practices in building construction project management in Ghana. The researcher used a convenience sampling technique and questionnaires were used to collect data. Results showed that factors that hinder the implementation of quality control practices during the execution of construction projects were: lack of management commitment to quality improvement, workers' lack of information and knowledge on the importance of quality, uncertainties of workers about management's goals and also, struggle in calculating the efficiency of quality control. Quality control significantly affect project performance.

Otaalo and Asinza (2020) investigated the effect of risk management practices on road construction project performance in Kenya. The study adopted a descriptive survey design. The target population was 554,622 and simple random sampling was used to select respondents. The study questionnaires and observation schedules. Findings revealed that the project team is involved during the risk analysis since it enables in analysis of future events and the impact they have on the project. Through the various techniques in risk analysis, the project team is aware of the entire risk management process of the project. Kinyua (2015) conducted a study to establish the effects of risk management strategies on the project performance of small and medium information communication technology (ICT) enterprises in Nairobi, Kenya. A descriptive research design was adopted. The target population was 48 ICT SMEs in Nairobi, Kenya. Primary data was collected using a questionnaire. Findings revealed that an effective risk management practice encourages ICT enterprises to identify and quantify risks and to consider risk containment and risk reduction policies. The study also established that there existed a positive relationship between risk management strategies affecting project performance and ICT project performance for SMEs in Kenya.

Quality Improvement and Project Performance

Nora (2023) conducted a study on change management in Finland. The study was conducted in large multinational companies in Finland. The primary research methodology was qualitative research with semi-structured interviews. The results indicated that the project change nature includes planned top-down changes considered an emotional topic for end-users. While most drivers are positive towards the change, there are concerns and areas for improvement highlighting the importance of managing behaviors and ensuring that end-users feel supported during the change process. Study findings emphasize the importance of communication, coordination, and collaboration among stakeholders as well as the need for effective change planning and management.

del Solar Serrano, del Río Merino and Villoria Sáez (2020) studied utilization of quality improvement in building constructions in Spain. The results showed that the implementation of quality improvement helped to reduce project costs by half. The costs were related to defects caused during the ceramic tiling execution. Taniguchi and Onosato (2018) studied effects of quality improvement on success of information projects in Japan. The results indicated that quality improvement was effective in achieving project success in terms of meeting project time, cost and quality.

Aleksi (2019) studied change management in construction projects. Data was collected through qualitative interviews. This study found many of the currently recognized critical success factors in information systems change management to be relevant and revealed some additional critical success factors and areas of interest in change management. In addition, utilization of change management models in information systems change management was noticed to be non-standard, with many organizations using ad hoc methods to manage a change

endeavor. Change management was found to be a crucial part of organizations' sustaining and refining activities in an ever-changing world.

Milimu (2016) investigated the influences of change management practices on the performance of Pinnacle Projects Ltd, Kenya. Interviews were administered to the managing director, finance manager, human resource manager, IT manager, marketing director, chief engineer and chief project manager at Pinnacle Projects Ltd. Results showed that Pinnacle has adopted several strategic change management practices to improve its performance. Some of the strategic changes that the company had implemented included involving the team in the change process, change of culture, reduction in cost, improving partnership with government, adoption of modern technology, and training and provision of incentives to employees. The observations showed that effective strategic change management practices had a significant influence on organizational performance. Nganga and Nyaga (2022) studied effect of quality improvement practices on performance of large manufacturing companies in Kenya. The study was conducted on 190 Nairobi Bottlers Limited. The sample size was 57 respondents. Data was collected using questionnaires. Results showed that quality improvement practices have an impact on performance of manufacturing organizations.

RESEARCH METHODOLOGY

The study used a descriptive survey research design. The study focused on water projects implemented by TAWWDA in four counties in Kenya (Kitui, Makueni, Machakos and Kajiado). According to TAWWDA (2023), there are 23 water projects completed in the past five years (2018-2022). The water projects are spread out in 4 counties as shown in Appendix IV. The unit of analysis was 23 water projects. The target population was 300 respondents comprising 23 TAWWDA project managers and 277 project steering committee members. The study used Yamane's (1967) formula to calculate the sample of 171. The researcher used stratified random sampling to select project managers and the project steering committee.

Primary data was used in the study and it was collected using questionnaires. Ader (2008) defined data analysis as a process of editing, cleaning, transforming and modeling data to highlight useful information, suggestions and conclusions. Inferential and descriptive statistics will be used for analysis. Descriptive analysis includes variability measurements such as percentage, frequency, and mean. Inferential statistics included hypothesis testing with parametric tests that assume normally distributed data as well as non-parametric tests that do not. Correlation regression was used to test the relationship between the study variables. All the tests' significance levels will be at a 95% confidence level.

RESEARCH FINDINGS AND DISCUSSIONS

The study sampled 171 respondents and 18 were used for piloting. The questionnaires were administered to the 153 respondents from the selected study sample and 128 questionnaires were successfully answered. The response rate was 83.7% which was excellent for analysis as recommended by Mugenda and Mugenda (2018) the response rate of 50% is acceptable for further analysis, 60% and above is good while that of 70% and above is excellent.

Descriptive Analysis

In this section, the study presents findings on Likert scale questions where respondents were asked to indicate their level of agreement with various statements that relate with the relationship between project quality management practices and performance of Tanathi Water Works Development Agency water projects. They used a 5-point Likert scale where 1-strongly disagree, 2-disagree, 3-moderate, 4-agree, 5-strongly agree. The means and standard deviations were used to interpret the findings where a mean value of 1-1.80 was strongly disagree, 1.81-2.60 disagree, 2.61-3.20 neutral, 3.21-4.20 agree and 4.21-5.00 strongly agree. Standard deviation greater than 2 was considered large meaning responses were widely spread out and not tightly clustered around the mean. The participants had different interpretations of the questions being asked.

Quality Control

The first objective sought to assess the relationship between quality control and performance of Tanathi Water Works Development Agency water projects, Kenya. Respondents were asked to tick on the extent to which they agree/disagree with statements related to quality control. Findings are presented in Table 1.

Table 1: Quality Control

Key: SD=Strongly disagree, D=Disagree, NS=Not Sure, A=Agree, SA= Strongly agree, M=Mean, Std.==Standard Deviation.

Statements	SD %	D %	N %	A %	SA %	MN	Std.
Project deliverables are verified often	6.3	13.0	11.9	10.0	58.8	4.07	1.454
There are set procedures to control quality	13.3	6.0	18.1	11.5	51.1	3.91	1.542
There are regular site visits to monitor project progress	16.4	7.0	3.2	15.6	57.8	3.86	1.429
The agency has a quality management team	14.8	6.3	1.6	32.8	44.5	4.23	1.283
Project managers ensure that main subcontractors/sub-suppliers meet specified requirements	7.1	9.4	2.3	15.6	65.6	4.52	1.065
Anticipated risks are identified and risks mitigated on time	71.9	9.4	1.6	10.1	71.9	1.71	1.305
Complaints are addressed promptly and rectified on time	44.5	34.4	3.9	4.7	44.5	2.06	1.344
Average						**3.48**	**1.346**

N=128

Findings show that project deliverables are verified often as agreed by 79.7% of the respondents. The statement was supported by the mean (M = 4.07, std dev = 1.454). There are set procedures to control quality was agreed by 62.6%. The statement was supported by the mean (M = 3.91, std dev = 1.542). There are regular site visits to monitor project progress was agreed by 57.8%. The statement was supported by the mean (M = 3.86, std dev = 1.429). The agency has a quality management team was strongly agreed by 44.5% of the respondents. This statement was supported by the mean (M = 4.23, std dev = 1.283). Project managers ensure that main subcontractors/sub-suppliers meet specified requirements was strongly agreed by 65.6% through the mean (M = 4.52, std dev = 1.065). Anticipated risks are identified and risks are mitigated on time was disagreed by 81.3 % of the respondents. The statement was supported by the mean (M = 1.71, std dev = 1.305). The complaints are neither promptly addressed nor rectified on time was disagreed by 44.5% of the respondents. The statement was supported by the mean (M = 2.06, std dev = 1.344). The average for the variable for quality control is 3.48 which translates to agree and the standard deviation 1.346 which is less than 2 indicate that on the average the respondents had less variations from their responses.

Findings imply that the project managers control the quality of projects. This is achieved through appointing a quality management team that is responsible for ensuring that the projects implemented are of good quality. The project manager also ensures that the suppliers and subcontractors meet the specified requirements. In addition, there are constant visits to project sites to monitor the progress of the projects under implementation. However, the risks are not mitigated on time and they may spread causing project delays and the risk may also cause more harm to the projects under implementation. There is also delay in addressing complaints and rectification of any faults identified in the projects. Findings are in agreement with Agbeko (2019) that factors that lack of management commitment to quality improvement, workers' lack of information and knowledge on the importance of quality, uncertainties of workers about

management's goals hinder the implementation of quality control practices during the execution of construction projects.

Quality Improvement

The second objective sought to examine the relationship between quality improvement and performance of Tanathi Water Works Development Agency water projects, Kenya. Respondents were asked to tick on the extent to which they agree/disagree with statements related to quality improvement. Findings are presented in Table 2.

Table 2: Quality Improvement

Key: SD=Strongly disagree, D=Disagree, NS=Not Sure, A=Agree, SA= Strongly agree, M=Mean, Std.=Standard Deviation.

Statements	**SD** %	**D** %	**N** %	**A** %	**SA** %	**MN**	**Std.**
The board has a flexible manual to accommodate changes	7.0	18.0	1.6	16.4	57.0	3.98	1.397
The management defines the responsibilities and authorities of different functional departments	13.2	5.5	18.0	5.5	57.8	3.89	1.475
The management plans for board members benchmarking to other water projects in the counties of operations	14.8	3.1	5.5	18.8	57.8	4.02	1.453
The management draws up quality system procedures by professionals from different departments	13.1	5.5	6.3	18.8	56.3	3.99	1.434
The management integrates existing work documents into work instructions	18.7	9.4	3.1	5.5	63.3	3.85	1.651
The board improves the quality system documents continuously	60.2	11.7	3.1	18.8	6.2	1.99	1.400
The board modifies quality system documents through quality audits and management review	3.9	24.2	6.3	39.8	25.8	3.59	1.220
Average						**3.61**	**1.433**

N=128

Findings show that the 73.4% agreed that the board has a flexible manual to accommodate changes. This statement was supported by the mean (M= 3.98, std dev = 1.397). The management defines the responsibilities and authorities of different functional departments as strongly agreed by 57.8%. The statement was supported by the mean (M = 3.89, std dev = 1.475). The management plans for board members benchmarking to other water projects in the counties of operations as strongly agreed by 57.8%. The statement was supported by the mean (M = 4.02, std dev = 1.453). The management draws up quality system procedures by professionals from different departments as strongly agreed by 56.3%. The statement was supported by the mean (M = 3.99, std dev = 1.434). The management integrates existing work documents into work instructions as strongly agreed by 63.3%. The statement was supported by the mean (M = 3.85, std dev = 1.651). The board improves the quality system documents continuously was strongly disagreed by 60.2%. The statement was supported by the mean (M = 1.99, std dev = 1.400). The board modifies quality system documents through quality audits and management review as agreed by 65.6%. The statement was supported by the mean (M = 3.59, std dev = 1.220). The average for the variable for quality improvement is 3.61 which translates to agree and the standard deviation 1.433 which is less than 2 indicate that on the average the respondents had less variations from their responses.

The findings imply that the water projects' designs are flexible to accommodate changes that may help to improve the quality of water projects. The quality system procedures are drawn

by professionals who guide on how to improve the quality of water projects. Quality audits are conducted to improve project quality and the board also benchmarks to gain more insights on how to effectively implement and operate water projects. There is also no role duplication since the roles of every department is assigned different roles in the projects hence perfection of the project tasks. Results are in consistent with del Solar Serrano, del Río Merino and Villoria Sáez (2020) that the implementation of quality improvement help to reduce project costs by half.

Project Performance

Respondents were asked to tick on the extent to which they agree/disagree with statements related to performance of Tanathi Water Works Development Agency water projects, Kenya. Findings are presented in Table 3.

Table 3: Project Performance

Key: SD=Strongly disagree, D=Disagree, NS=Not Sure, A=Agree, SA= Strongly agree, M=Mean, Std.==Standard Deviation.

Statements	**SD** %	**D** %	**N** %	**A** %	**SA** %	MN	Std.
Projects completed within time.	68.8	9.4	3.8	1.6	16.4	2.13	1.506
Projects completed within budget	66.4	1.6	7.0	12.5	12.5	2.03	1.542
Projects completed within quality requirements	8.6	13.3	16.4	39.8	21.9	3.69	1.421
Stakeholder expectations are met	17.2	3.2	11.7	15.6	52.3	3.83	1.517
Average						**2.60**	**1.496**

N=128

Findings show that the projects are completed within time was strongly disagreed by 68.8 % of the respondents. The statement was supported by the mean (M = 2.13, std dev = 1.506). Projects are completed within budget was strongly disagreed by 66.4% of the respondents. The statement was supported by the mean (M = 2.03, std dev = 1.542). The projects are completed within quality requirements was agreed by 61.7%. The mean supported the statement (M = 3.69, std dev = 1.421). Stakeholders' expectations are met was agreed by 67.9%. The statement was supported by the mean (M = 3.83, std dev = 1.517). The average for the variable for quality improvement is 2.60 which translates to disagree and the standard deviation of 1.496 which is less than 2 indicates that on average the respondents had less variations from their responses.

Findings provide evidence that there are performance challenges in implementation of Tanathi Water Works Development Agency water projects. Findings support of Mbavu, Nyanchaga, and Oonge, (2021) that 66.7% of water projects in Kitui County have failed due to poor Engineering design coupled with non-adherence to proper quality construction material standards, 26.92% due to lack of detailed site investigations and lack of community involvement in preliminary data collections or total ignorance of the community.

Correlation Analysis

Correlation analysis was conducted to establish the strength of the relationship between the independent and dependent variables. The significance level for a significant relationship was <=0.05. Pearson correlation coefficient was used and ranges between zero and one, where the strength of association increase with increase in the value of the correlation coefficients (Gujarat & Porter, 2016). Correlation results are presented in Table 4.

Table 4: Coefficient of Correlation

Variables		Project performance	Quality Control	Quality Improvement
Project performance	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	128		
Quality Control	Pearson Correlation	.805**	1	
	Sig. (2-tailed)	.000		
	N	128	128	
Quality Improvement	Pearson Correlation	.539**	.121	1
	Sig. (2-tailed)	.000	.173	
	N	128	128	128

**. Correlation is significant at the 0.05 level (2-tailed).

Quality control has a positive strong significant correlation with performance of TAWWDA projects (r = .805, sig = .000). This implies that an increase in quality control in TAWWDA could lead to an increase in project performance. Findings concur with Kinyua (2015) a positive relationship between risk management strategies affecting project performance and ICT project performance for SMEs in Kenya.

Quality improvement has a positive strong significant correlation with performance of TAWWDA projects (r = .539, sig = .000). This implies that an increase in quality improvement in TAWWDA could lead to an increase in project performance. Findings concur with Milimu (2016) that effective strategic change management practices have a significant influence on project performance.

Regression Analysis

Table 5: Regression Coefficients

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
Constant/Y Intercept	2.853	.351		8.128	**.000**
Quality control	.684	.051	.610	13.412	**.000**
Quality improvement	.474	.056	.315	8.464	**.000**

Quality control shows a statistically significant positive coefficient (β = .684, sig = .000), indicating that improvements in quality control practices result to higher project performance in Tanathi Water Works Development Agency. Quality control has the highest effect on project performance at 61% (std Beta = .610). The finding shows that quality control is essential in enhancing project performance. The findings are in support of Smith (2023) that quality control contributes to organizational performance by optimizing operational efficiency. Through the identification and elimination of inefficiencies, organizations can streamline their processes, reduce waste, and enhance productivity. Kinyua (2015) also found that there exists a positive relationship between risk management and ICT project performance for SMEs in Kenya.

Quality improvement shows a statistically significant positive coefficient (β = .474, sig = .000), indicating that improvements in quality improvement practices result to higher project performance in Tanathi Water Works Development Agency. Quality improvement has the second highest effect on project performance at 31.5% (std Beta = .315). The finding shows that quality improvement enhances project performance. The findings are in agreement with Nganga and Nyaga (2022) that quality improvement practices have an impact on performance of manufacturing organizations.

The model was fitted as shown below.

$Y = \beta 0 + \beta 1X1 + \beta 2X2$……(i)

Where: Y = Performance of TAWWDA water projects

X_1 = Quality Control (QC)

X_2 = Quality Improvement (QI)

$Y = 2.85 + .684X1 + .474X2$……(ii)

Conclusion

Quality control has a positive strong significant correlation with performance of TAWWDA projects. Quality control has the highest effect on project performance. Quality control involves confirming that everything is operating as it was agreed upon during the quality planning stage. Quality control is the process of physically inspecting and testing what was laid out in the planning stage to make sure it is obtainable. The project managers control the quality of the water projects through contracting suppliers/ contractors that meet specified requirements. The project managers and supervisors do not just depend on the reports from the project team, rather, they visit the project sites to check the progress of the projects. This helps them to identify risks/defects that may compromise project quality. The project manager confirms that all the standards put into place are met and that any errors that need to be rectified are identified.

Quality improvement has a positive strong significant correlation with performance of TAWWDA projects. Quality improvement has the second-highest effect on project performance. To improve project quality, the project managers ensure that the project designs are flexible to accommodate project changes. The work documents are integrated into work instructions which ensure that the project team follows the project plan and projects implemented as outlined in the quality plans. There is also benchmarking in other completed projects to learn how to effectively manage water projects. The project managers are however lenient in identifying and mitigating risks. There is also a delay in responding to complaints from stakeholders or project team members.

Recommendations

Regarding quality control, the quality control process should include a system for dealing with risks as they are. If a risk is detected, decisions on how to mitigate should be made within the shortest time possible. During project implementation, any material that doesn't meet the required standards should be removed from the site to avoid contamination of the quality materials. The project managers should also ensure that the site workers and project team are competent to avoid human errors which may lead to reworking project designs, replacing materials, and waste of time and financial resources.

The study highlights that quality improvement predicts project outcomes. The agency should create a flexible project plan in all aspects of the project to ensure that changes are accommodated to improve project outcomes. For effective continual improvement in project management, there should be data analysis, audit results and training of staff. This will reduce errors and mistakes in project delivery. The project managers should also ensure effective communication among departments and stakeholders for proper coordination of project changes.

Areas for Further Study

The study was limited to TAWWDA water projects, Kenya. Similar studies should be conducted in other water agencies that are members of WASREB in Kenya to establish the effect of project quality management practices and Performance of other water agencies. Furthermore, different resource methodologies would help ascertain the current findings. This will help give insight into the key variables that will significantly enhance the overall performance of water projects.

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