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DETERMINANTS OF SUSTAINABILITY OF WATER SUPPLY PROJECTS IN MACHAKOS COUNTY, KENYA

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ABSTRACT

Water supply projects are essential for the socio-economic development of communities, particularly in rural areas where access to clean and reliable water sources is often a significant challenge. In Machakos County, Kenya, the sustainability of water supply projects had become a pressing issue due to the increasing demand for reliable water sources and the escalating environmental and social factors that impact water availability. This study aimed to investigate the key determinants of sustainability in water supply projects, focusing on two critical factors: project funding, and financial management skills. The study adopted a descriptive survey design and targeted a population of key stakeholders who were directly involved in the management and implementation of water supply projects, including project managers, community members, and village elders. A sample size of 171 respondents was selected from a total population of 300 using stratified random sampling, which ensured that all essential groups within the community were adequately represented. Primary data were collected through structured questionnaires, which addressed both demographic details and specific variables related to the sustainability of the water supply projects. The study identified that effective financial management and adequate project funding were vital components in ensuring the sustainability of water supply projects. The research showed that reliable financial resources were necessary for the smooth operation, maintenance, and expansion of water systems. Moreover, strong financial management skills, including budgeting, resource allocation, and monitoring, were essential in ensuring the optimal use of funds and the reduction of financial mismanagement. The study recommended financial management practices be improved to ensure the efficiency of project funds. Lastly, the study recommended that the sources of funding for water supply projects be diversified to guarantee continued financial support and to reduce reliance on single funding sources. The research provided valuable insights and practical recommendations for policymakers, project managers, and stakeholders, aiming to improve the sustainability of water supply projects in Machakos County and similar regions. The study concluded that financial management, and funding are crucial to project sustainability, the success of water supply projects also depends on the continuous adaptation and inclusion of other socio-economic and environmental factors that impact water resource management.

Key Words: Determinants of Sustainability, Water Supply Projects, Project Funding, Financial Management Skills

Background of the study

Water is vital to all life plant, animal, and human and as such, it is crucial to maintaining life itself. For this reason, water sources should be safeguarded to guarantee that people will always have access to water. Sustainability, in the words of scholar Abrams (2018), is about a project's ability to continue providing the same advantages to its owners and beneficiaries. It is predicated on the project's ability to fulfil the same purpose as when it was first introduced, as specified in the plans, and with a product of the same or higher quality. In order to ensure project sustainability, Nakagami, Kubota, and Setiawan (2016) demonstrated that it is necessary to have resources to cover upkeep and repair expenses as well as skilled and qualified service providers who can plan and execute high-quality water projects. Kwena (2015) observed that project beneficiaries' sense of ownership rises when the community is involved in planning and execution, which is beneficial for the sustainability of commissioned initiatives. All stakeholders must be included by the project planners and teams carrying out the plans at every stage until they are finished and commissioned (Kwena, 2015). In addition to fostering long-term economic growth, efficient management of water resources also lowers poverty and enhances security and health. Long-term access to better water sources leads to better health outcomes, a decline in poverty in local areas, and more economic success. It is evident that a variety of factors influence the potential duration of these sorts of efforts. Water delivery programmes have received significant financial support from rich nations, international organizations, and other well-intentioned groups, all with the goal of guaranteeing universal access to clean water. All of this effort might be in nothing, though, if the initiatives fall short of expectations shortly after they are implemented. To ensure the long-term viability of these improved water distribution systems, appropriate management is necessary. Sustainability may be compromised by a lack of management expertise, and the continuation of water supply projects is further threatened by ineffective top-level management support and bad leadership.

Policies and a legal framework must be established in order to guarantee the effective and long-lasting leadership of water supply projects. Establishing effective systems for sustained rural water distribution programmes requires stakeholder collaboration. It is crucial to assess the social and economic effects of the water distribution system, according to a 1999 UNICEF report. According to Elmendorf (1984), resolving engagement concerns is consistent with the objectives of the Beijing Declaration of 1995. Because they have to walk a considerable distance and use a lot of energy to obtain water, women are disproportionately affected by the scarcity of water supplies in areas like Machakos County, where the terrain is difficult and the water sources are few.

Each household in a rural area without access to clean water sources spends over three hours a day getting water (UNICEF, 1999). The health of the community is also at risk because, according to Admassu et al. (2002), women occasionally choose to collect water from open springs, rivers, and other nearby sources in order to save time. From these sources, they obtain water for free without having to worry about the quality of the water or its potential effects. Girls have a better probability of attending school and having more time for study at home when they spend less time getting water. According to UNICEF (2020), around 40 billion hours are lost annually in Africa getting water from sources.

Overall, the aforementioned elements community management, stakeholder participation, project funding, and stakeholder management have an impact on the sustainability of water supply worldwide, particularly in Kenya and, more especially, in Machakos County, where there is a surplus of water demand and a high rate of project failure.

Statement of the problem

Lack of sustainability in projects is a major challenge that deny rural population the opportunity to drive benefits from community projects (Muhatia &Wainaina, 2024). According to the Ending Drought Emergencies Common Programme Framework, EDE (2015) an estimated 70-80% of Kenya's landscape is affected by drought. Although the Kenyan government and its development partners have invested heavily in water supply projects, many of these initiatives have failed to achieve long-term sustainability.In spite of efforts to increase access to water, many rural water supply projects have either stoped operating or are not operating optimally (Nyakwaka, 2019). A study by Lilian and Mutiso (2019) found that approximately 67% of water projects in Kenyan counties become non-functional within five years of implementation. Mbavu, Nyanchaga and Oonge(2021) found that 26.92% of water projects have failed due to lack of community involvement. Lack of community involvement in community projects reduced project sustainability by more than 69% (Lennon, 2019).On success rate of water supply projects Mamburi (2014) noted that operational failure rates from Africa projects range from 30% to 60%. While several water supply interventions have been implemented in Machakos county, their sustainability has been undermined by poor management, limited community involvement, and environmental constraints (Mwangangi, 2016). This scenario is replicated in Machakos where some water supply projects have failed in under five years of their launch, others have fallen beyond rehabilitation (Nzomo,2022).

To address the chronic water challenges in Machakos County, it is essential to investigate the key drivers of sustainability of water supply projects. Understanding these factors will enable stakeholders to implement more effective, inclusive, and resilient strategies that ensure long-term access to clean and reliable water. This study, therefore, sought to identify and analyze the critical factors affecting the sustainability of water supply projects in Machakos County.

Objectives of the Study

General Objective

The study sought to establish determinants of sustainability of water supply projects in Machakos County, Kenya.

Specific Objectives

i. To determine how project funding determines the sustainability of water supply projects in Machakos County.
ii. To examine how financial management skills determines the sustainability of water supply projects in Machakos County.

LITERATURE REVIEW

Theoretical framework

Technology Adoption Theory

Technology Adoption Theory, proposed by Rogers (2003), suggested that the adoption and success of new technologies were influenced by several factors, including their perceived relative advantage, compatibility with existing practices, complexity, trialability, and observability. According to Rogers, individuals or communities went through stages of decision-making knowledge, persuasion, decision, implementation, and confirmation before adopting new technology. These stages impacted whether the technology would be successfully implemented and maintained.

Technology Adoption Theory provided a framework for understanding how the choice of technology affected the sustainability of water supply projects in Machakos County. Rogers

(2003) posited that technologies that were perceived to offer clear advantages such as cost-effectiveness, environmental friendliness, and low maintenance were more likely to be adopted by communities. In the context of water supply projects, technologies like solar-powered water pumps, efficient boreholes, or modern filtration systems offered these advantages, contributing to the long-term sustainability of water systems. The theory suggested that when these technologies were compatible with local needs and practices, they were more likely to be adopted and maintained, ensuring that the projects continued to meet the community's needs.

The Project Management Competency Theory

Crawford (2005) asserts that the three essential components of project management competency are technical, contextual, and behavioral abilities. Planning, scheduling, risk management and the use of project management software for scope, time, cost, and quality management are all examples of technical abilities. Understanding corporate cultures, policies, and external elements like the economy, the environment, and the law are all part of contextual skills. Project managers may negotiate rules, foresee and reduce risks, and match projects to strategic objectives with the help of these competencies. The emphasis of behavioral competences is on interpersonal abilities such as effective communication, negotiation, emotional intelligence, and leadership. These skills are essential for promoting cooperation between project teams and stakeholders while skillfully managing expectations

Integrating these competencies is paramount for achieving successful project outcomes and delivering sustained value to stakeholders (Project Management Institute, 2017). For instance, contextual competences ensure compliance with strict environmental norms and laws, while technical talents ensure the development of high-quality infrastructure in infrastructure projects like water supply systems. Meanwhile, the inclusion of local populations, the development of trust, and the encouragement of project ideas are all made possible by behavioral competences, which in turn improve the overall success of projects as well as their long-term Institute.

Conceptual framework

Mugenda and Mugenda (2014) a conceptual framework comprises of variables operationalized by the researcher to achieve set goals. A variable is a measure that takes different values depending on the input, Mugenda and Mugenda (2014). Conceptual framework creates a link between independent variable and dependent variable. The following framework shows the link between determinants and sustainability of water supply projects. The independent variables are project funding and financial management skills while the dependent variable is sustainability of water supply projects.

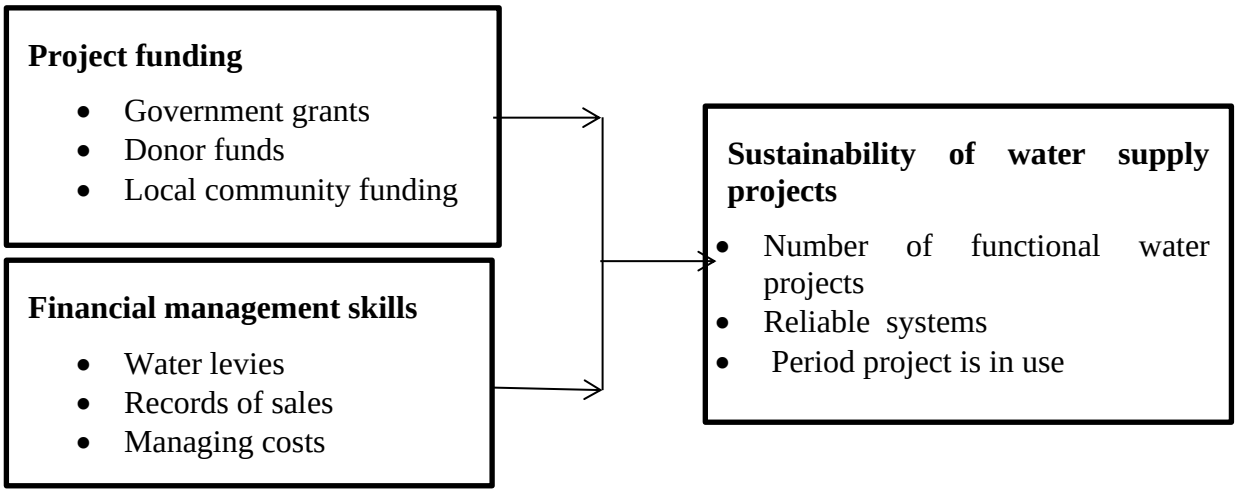

Figure 2.1 Conceptual framework

Project funding

In Harold Kerzner's 2017 book "Project Management: A Systems Approach to Planning, Scheduling, and Controlling," he defines project finance as the distribution and deployment of monetary resources necessary to accomplish a project's particular objectives. Kerzner emphasizes that successful project finance entails careful planning and financial supervision throughout the project's lifespan, in addition to obtaining initial money. This strategy increases the chance of project success and sustainability by ensuring that resources are effectively managed, distributed where needed and modified when circumstances change. He contends that careful financial management is essential to coordinating expenses with project milestones and adjusting for potential unanticipated obstacles.

Financial management skills

In their groundbreaking book "Financial Management: Theory & Practice," Eugene F. Brigham and Michael C. Ehrhardt describe financial management skills as essential proficiencies for prudent financial decision-making, efficient investment management, and guaranteeing financial stability within an enterprise (Brigham & Ehrhardt, 2013). They contend that these competencies constitute the basis of financial planning and control, encompassing the aptitude to efficiently manage budgets, project future financial outcomes, and carry out comprehensive investment research. Forecasting is the process of projecting future financial patterns to inform strategic decision-making, whereas budgeting is the distribution of financial resources in a way that advances organizational objectives. The goal of investment analysis, on the other hand, is to assess possible investments to make sure they support the organization's expansion and overall financial health.

Sustainability of water supply projects

Project sustainability is the degree to which a water supply project functions for a long period of time while benefiting the end users, Habtamu (2012). Determinants of sustainability depends on both pre and post implementation factors, Gebrehiwot (2015). Factors in pre-implementation stage comprise of community involvement, existing population, technology choice and community training. Post-implementation factors are community satisfaction, financial and institutional management and willingness of supporting to sustain the project.

Kanyanya, (2014) found out that sustainability of water project is key desire for government, non-governmental organizations and community at large since sustained projects serves the target beneficiaries for long period of time.

A study by Pauline (2015) reveled that the most important factor that contributes to water project sustainability is genuine involvement of target beneficiaries as equal partners and active participants because their experience and their inputs contribute to success of the project. It is of great importance to involve the target community regarding decisions on projects planning, implementation, execution and closure stages, Pauline (2015).

Empirical review

Project Funding and Sustainability of Water supply

Siborurema, Shukla, and Mbera (2015) investigated how project finance affected Rwandan project performance. The focus of the investigation was the construction projects in the Gatsibo district along the Bukomane-Gikoma route. Since it is necessary to estimate project expenses, design, and Rwandan financing policies, project finance is an important topic. The project implementation team and the planning and financing team were the two distinct groups that provided the data, and they used questionnaires and interviews as their two tools. Following research, the findings showed that the project's technical design and cost projections are obstacles to Rwandan project financing rules and regulations, which negatively affects projezct

execution and timeliness. The study's shortcoming stems from the fact that it was conducted in Rwanda and inside the construction sector, leading to contextual gaps.

Gachuka and Warren (2016) examined fundraising, budgeting, distribution, allocation, and control of money in their study on the impact of fund management on project success in Rwanda. The research technique for the study involved gathering both qualitative and quantitative data utilizing a descriptive and correlation design. The preferred tool for gathering study data was a questionnaire, which was then used to analyze the data using correlations and descriptive means to highlight the relationships between the variables. The analysis showed that all of the study variables were positive and that there was a positive correlation between the independent variable of managing finances and the dependent variable of project performance. The study's contextual gap was caused by the fact that it was conducted in Rwanda.

Dinnie and Holstead's (2018) study examined the impact of public financing sources on the continuation of community-based initiatives in Scotland. According to the report, there has been a focus on institutional and regulatory reforms, such as obtaining public money for projects, since there is a growing interest in maintaining community-based initiatives that have an influence on the community. Interviews with community-based initiative groups and public funding agencies were used to gather data for this study, which examined the opportunities and difficulties associated with receiving public financing. The results show that community-based initiatives with expertise in arguing for their objectives, methods, and technical support may obtain significant public money for their programs.

Increased accountability, expectations for openness and transparency in the use of funds in community-based initiatives that make programs more sustainable are brought about by public financing sources. The study came to the conclusion that public funding is necessary for community-based initiatives to manage their operations; the funds come with requirements for accountability and open procedures, which increase the sustainability of the initiatives' projects and programs over time. Because the study was conducted in Scotland, there are methodological and contextual limitations because it is not apparent who is sponsoring these projects and community-based activities.

In a 2013 research, Rao looked at the financing sources and their impact on financial sustainability for the Kenyan water industry. The study's main goal was to evaluate how financing sources affect the organizations in Kenya's water industry that are financially sustainable. According to the data gathered for the study and the ration analysis that followed, there is a significant and favorable association between these water organizations' internal funding creation and financial viability. The results of the regression analysis demonstrate the favorable relationships that exist between financial sustainability and government grants, reserves, donor financing, and internal funding sources. Grants and debts from external sources are used to supplement the domestically produced finances, which are derived from fees levied to residential and commercial water consumers by privately held water corporations and water vendors. The study is constrained by a theoretical gap since, in contrast to the current study, it depends on financial theories to describe the intricate notions of finance.

Financial management skills and sustainability of water projects

The topic of water projects' sustainability is becoming more and more important, particularly in areas were low water quality and shortage present serious difficulties. To guarantee that these initiatives can continue to operate and provide advantages in the long run, financial management is essential. The impact of different financial management techniques on the long-term viability of water projects is investigated in this literature review, with particular attention paid to financing sources, budgetary control, financial planning, transparency, stakeholder involvement, and risk management.

The viability of water projects is contingent upon the implementation of efficient finance systems. A robust financial foundation is provided by a variety of financing sources, including government grants, foreign aid, and private sector investments. This helps reduce the risks that come with depending too heavily on one source of funding. According to Schwartz (2017), continuous government backing is crucial for rural water projects in Sub-Saharan Africa to be operationally sustainable. In the meanwhile, Kayaga and Smout (2018) talk on the function of foreign aid, pointing out that although it might be important in the early stages of a project, relying too much on outside donors can become problematic if financing priorities change.

In order to avoid resource misallocation and guarantee that money is spent effectively, budgetary management and financial monitoring are crucial. Reliable financial systems and frequent audits are essential elements of efficient budgeting management. According to Marin (2016), Latin American water utilities' financial sustainability has greatly improved since implementing integrated financial management systems. According to the World Bank (2019), regular financial audits provide accountability and transparency, both of which are essential for preserving stakeholder trust and obtaining continued support.

Water projects require long-term financial planning and risk management in order to be sustainable. In order to handle potential financial risks and project future financing demands, financial forecasting and risk management techniques are helpful. Nyarko (2019) discovered that water projects had a higher chance of long-term sustainability when they had thorough financial strategies. Furthermore, Whittington(2018) stress the significance of risk management frameworks in guaranteeing water projects' resilience against financial risks and other variations in the economy.

Another important component that has a significant impact on the sustainability of water projects is financial management transparency. Trust is increased among investors, contributors, and recipients by transparent financial processes. According to Lee and Schwab (2020), initiatives with great financial openness had better success obtaining ongoing financing and backing from the community. By making sure that all financial transactions are visible to the public, transparency helps ward against corruption and poor financial management.

Stakeholder participation is crucial to the legitimacy and long-term viability of water projects and is directly related to financial transparency. Project ownership and responsibility are increased when local communities and other stakeholders are included in financial decision-making processes. Harvey and Reed (2017) provided evidence that improved maintenance and sustainability of water infrastructure resulted from community members' involvement in financial planning and administration. Results are more effective and long-lasting when the requirements and preferences of the recipients are taken into account, which is ensured by this participatory method.

More people are realizing that public-private partnerships, or PPPs, are a viable strategy for managing and funding water projects. PPPs provide creative solutions to challenging problems in water management as well as extra funds and experience in financial management. According to Buse and Walt (2020), public-private partnerships (PPPs) may bolster public sector efforts by using the efficiency and resources of the private sector to improve the financial sustainability of water projects.

In conclusion, a number of financial management factors have a significant impact on the sustainability of water projects. Important elements include strong budgetary control, risk management, active stakeholder participation, thorough financial planning, and effective financing methods. Future studies should concentrate on creating integrated financial management frameworks that are suited to the unique requirements of various water projects in order to make sure they can remain functional in the face of shifting financial conditions.

RESEARCH METHODOLOGY

This study used a descriptive research design. The descriptive design, as noted by Creswell and Creswell (2017), was ideal for delving deep to answer questions on the 'why, what, when, and how' of an element. Therefore, the design was ideal for obtaining in-depth data on the subject and collecting data from a large population, allowing for the generalization of the findings. The target population of the study comprised of 300 water projects initiated in machakos county.The unit of observation comprised of project managers, community members, and village elders of the 300 projects who played a vital role in ensuring the success and sustainability of these initiatives. Project managers provided technical and managerial insights, offering a professional perspective on the operational challenges and resource allocation necessary for sustainability. Community members, as direct beneficiaries, contributed by highlighting the accessibility, reliability, and impact of the projects on their daily lives. Village elders and community leaders served as intermediaries, mobilizing community participation, resolving conflicts, and fostering a sense of ownership that was crucial for the longevity of these projects.

For this study, the population was stratified according to groupings of the respondents as project managers, community members, and village elders as the beneficiaries of the water project. The stratified sampling technique was used to group the respondents according to project managers, community members, and village elders. The population for the present study was determined to consist of a sample size of 171 individuals. The study stipulated a confidence level of 95% along with a margin of error of 5%. To ascertain the appropriate sample size from the population, the researcher employed the Yamane (1967) formula,

The data questionnaire contained closed-ended questions since Mugenda (2014) found that for the purpose of obtaining quantitative data, the researcher needed to use both close and open-ended questions developed to generate information on key variables of interest in the study. Both qualitative and quantitative analysis was done on the data that was gathered. Descriptive statistics were used to analyze quantitative data, and the Statistical Package for Social Sciences (SPSS) was used to report the results as frequencies and percentages. In order to analyze qualitative data, it was first arranged and coded into themes or topics, and then the relationships between the themes or topics were determined. Recommendations were written based on the findings.

RESEARCH FINDINGS AND DISCUSSIONS

From a sample size of 171 respondents was selected. Out of this, 17 respondents were allocated for the pilot study, leaving 154 respondents for the main study. From the main study sample, 128 successfully completed and returned the questionnaires, resulting in a response rate of 83.1%. According to Mugenda and Mugenda (2018), a response rate of 50% is acceptable, 60% and above is good, while 70% and above is excellent. Since the obtained response rate exceeded 70%, it is considered excellent for analysis. This high response rate enhances the validity, reliability, and generalizability of the study findings regarding the sustainability of water supply projects in Machakos County.

Descriptive Analysis

The findings from the Likert scale questions, where respondents were asked to indicate their level of agreement with various statements related to the sustainability of water projects in Machakos County. The 5-point Likert scale was used, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The means and standard deviations were used to interpret the data. The interpretation of the mean values was as follows: a mean value of 1-1.80 indicated strong disagreement, 1.81-2.60 indicated disagreement, 2.61-3.20

indicated neutrality, 3.21-4.20 indicated agreement, and 4.21-5.00 indicated strong agreement. Additionally, a standard deviation greater than 2 was considered large, suggesting that responses were widely spread out, indicating that participants had varying interpretations of the questions asked.

Project Funding

The first objective of the study was to examine how project funding drives sustainability of water supply projects in Machakos County. Respondents were asked to indicate their level of agreement or disagreement with statements related to project funding and its impact on the success and sustainability of water supply projects. The findings, as presented in Table 4.6.0

Table 1: Project Funding

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 (%)	M	Std.
Adequate funding is critical for project execution	4.8	6.3	8.1	34.5	46.3	4.17	1.10
Timely release of funds ensures project sustainability	6.1	5.9	9.2	36.4	42.4	4.09	1.12
Sufficient funding is provided to complete projects within budget	5.3	4.5	10.1	38.7	41.4	4.12	1.08
The availability of funding influences project success	6.2	7.4	9.8	32.2	44.4	4.13	1.14
Delays in funding negatively impact project timelines	11.3	14.2	10.0	32.1	32.4	3.91	1.31
Funding for project maintenance is available post-implementation	7.5	8.1	12.3	34.1	38.0	4.02	1.20
Average						**4.08**	**1.12**

The analysis of project funding in relation to the sustainability of water supply projects in Machakos County highlights a strong agreement among respondents on the importance of sufficient and timely funding. The statement "adequate funding is critical for project execution" received a high mean score of 4.17, supported by 46.3% of respondents strongly agreeing and 34.5% agreeing. Similarly, the statement "timely release of funds ensures project sustainability" received strong support, with a mean score of 4.09, reflecting agreement from 42.4% of respondents who strongly agreed and 36.4% who agreed. Additionally, "sufficient funding is provided to complete projects within budget" was also met with agreement (mean = 4.12), emphasizing the importance of adequate funding in ensuring projects are completed within budgetary limits.

However, delays in funding were viewed as problematic, with 32.4% strongly agreeing and 32.1% agreeing that such delays negatively impact project timelines, yielding a lower mean score of 3.91. Despite these concerns, funding for project maintenance post-implementation received strong support (mean = 4.02), suggesting that once projects are operational, funding is allocated appropriately for ongoing maintenance. Overall, the average mean score for project funding was 4.08, which indicates general agreement among respondents on the crucial role of funding in ensuring the sustainability of water supply projects, with a standard deviation of

1.12 showing moderate variation in the responses.The findings agree with Nzomo (2022) that project funding with elements like fundraising, donor funding, CDF funds and proper budgeting led to sustainability of water projects.

Financial Management Skills

The second objective sought to examine the relationship between financial management skills and the sustainability of water supply projects in Machakos County. Respondents were asked to indicate the extent to which they agree or disagree with statements related to financial management practices. Findings are presented in Table 2.

Table 2: Financial Management Skills

Statements	SD (%)	D (%)	N (%)	A (%)	SA (%)	M	Std.
Proper budgeting ensures the success of water supply projects	4.8	7.4	10.5	33.8	43.5	4.09	1.14
Financial record-keeping is essential for monitoring project performance	3.1	5.9	8.7	31.2	51.1	4.27	1.06
Project managers have the financial management skills to monitor project budgets	2.8	4.5	12.4	38.7	41.5	4.16	1.08
Financial management training is provided to project staff regularly	5.9	8.2	14.1	33.4	38.4	4.00	1.19
Timely financial reporting contributes to the success of water supply projects	7.4	6.5	9.2	32.4	44.5	4.06	1.10
Poor financial management negatively affects the sustainability of water projects	6.2	5.3	11.8	34.2	42.5	4.08	1.13

The analysis of financial management skills in relation to the sustainability of water supply projects in Machakos County indicates a strong agreement with the significance of sound financial management practices. A high percentage of respondents (43.5%) strongly agreed and 33.8% agreed with the statement that "proper budgeting ensures the success of water supply projects," yielding a mean score of 4.09. Additionally, financial record-keeping was also viewed as essential for monitoring project performance, with 51.1% strongly agreeing and 31.2% agreeing, resulting in a high mean score of 4.27. Similarly, project managers' financial management skills were considered vital for the successful monitoring of budgets (mean = 4.16).

Furthermore, financial management training was reported to be regularly provided to project staff (mean = 4.00), which demonstrates an emphasis on continuous improvement in financial competency. The importance of timely financial reporting was similarly agreed upon, with a mean score of 4.06. However, a slight concern was raised regarding the negative impact of poor financial management on project sustainability, with 42.5% strongly agreeing and 34.2% agreeing that financial mismanagement affects the long-term viability of projects (mean = 4.08). Overall, the average mean score of 4.11 indicates a generally positive view of the role of financial management skills in the sustainability of water supply projects, with a standard deviation of 1.12 indicating moderate variation in the responses.The findings agree with Nzomo (2022) that financial management skills of water committee members led to improved sustenance of water supply projects.

Sustainability of Water Supply Projects

Respondents were asked to indicate the extent to which they agreed or disagreed with statements related to the sustainability of the water supply projects. Findings are presented in Table 3.

Table 3: Sustainability of Water Supply Projects

Statements	SD (%)	D (%)	NS (%)	A (%)	SA (%)	M	Std.
The water supply system is well-maintained and functional.	3.8	4.1	6.3	29.9	55.9	4.33	1.07
There is consistent access to safe drinking water.	4.3	3.9	7.2	28.9	55.7	4.31	1.05
The water project has improved public health in the community.	4.1	5.6	6.9	30.2	53.2	4.28	1.08
The water supply system is sustainable and resilient to changes.	3.5	5.2	8.4	31.1	51.8	4.30	1.06

The findings show that respondents have a positive view of the sustainability and functionality of the water supply projects. The highest agreement was seen with the statement "The water supply system is well-maintained and functional," with 55**.**9% of respondents strongly agreeing, and a mean score of 4.33. This suggests that the community perceives the water supply system as functioning effectively.

All four statements related to the sustainability and impact of the water projects received strong support. On average, respondents rated the sustainability of the water supply systems highly, with mean scores ranging from 4.28 to 4.33. These results imply that the community feels the water supply system is a critical asset, providing consistent access to safe drinking water, improving public health, and remaining resilient to changes. The low standard deviations (ranging from 1.05 to 1.08) indicate a consensus among respondents, suggesting a strong belief in the sustainability of the water supply projects.Findings suggest there is a challenge with sustainability of water supply projects which concurs with Dahal (2024) that sustainability is one of the major issues for water supply and sanitation projects.

Correlation Analysis

Correlation analysis was conducted to examine the strength and direction of the relationships between the independent variables and the dependent variable. The Pearson correlation coefficient was used to measure the strength of these relationships, with values ranging from 0 to 1. A value closer to 1 indicates a stronger positive relationship, while a value closer to 0 suggests a weaker or no relationship. The significance level was set at ≤ 0.05, meaning any correlation coefficient greater than or equal to 0.05 is considered statistically significant. Table 4 presents the results of the correlation analysis between each independent variable and the sustainability of water supply projects.

Table 4: Coefficient of Correlation

Variables		Project Funding	Financial Management Skills
Sustainability of Water Supply Projects	Pearson Correlation	-	-
	Sig. (2-tailed)	-	-
	N	128	128
Project Funding	Pearson Correlation	0.51	1
	Sig. (2-tailed)	0.000	-
	N	128	128
Financial Management Skills	Pearson Correlation	0.56	1
	Sig. (2-tailed)	0.000	-
	N	128	128

Project Funding emerges as one of the most important factors, with a strong positive correlation (r = 0.74) with sustainability. Adequate and timely funding ensures that projects have the necessary resources for proper implementation, maintenance, and scaling. The significant relationship between project funding and sustainability underscores the importance of financial backing in ensuring that water supply projects are not only completed but also maintained effectively over time. This findings agree with Nzomo(2017) that high accountability, demands for transparency and openness in using funds in community based initiatives make its projects more sustainable.

Financial Management Skills also show a strong positive correlation (r = 0.72) with sustainability, suggesting that effective financial oversight and management play a critical role in the success of water supply projects. Proper financial management ensures that funds are used efficiently, helping to avoid cost overruns and enabling the continuation of project activities beyond the initial phases. This agree with the findings of Senelwa(2018) that a functional water project depends on operational management, financial management and capacity of the committee to run the project.

Regression Analysis

A regression analysis was conducted to determine how the Sustainability of Water Supply Projects in Machakos County. The analysis helps to establish the extent to which these independent variables predict variations in project sustainability.

Model Fitting

In this analysis, multiple linear regression was used to investigate how various independent variables influence the sustainability of water supply projects in Machakos County. Unstandardized coefficients measured the impact of each independent variable on project sustainability, while Beta (standardized coefficients) helped determine the strength of the relationship between the predictors and the dependent variable. A p-value of less than 0.05 indicated the statistical significance of each variable. The findings help identify which factors most strongly contribute to the sustainability of water supply projects in the region. Results are shown in Table 5

Table 5: Regression Coefficients

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	
Constant/Y Intercept	2.853	0.351		8.136
Project fund	0.420	0.053	0.375	7.943
Financial management skills	0.305	0.058	0.281	5.258

Moreover, financial aspects, such as project funding (β = 0.420, sig = .000) and financial management skills (β = 0.305, sig = .000), have a considerable impact on the sustainability of the water supply systems. The high coefficient for project fund underscores the importance of securing sufficient financial resources to meet operational needs and maintain infrastructure. Financial management skills, reflected by the positive coefficient, emphasize the critical need for effective budgeting and cost control practices to ensure the optimal use of resources.

Sustainability of Water Supply Projects = 2.853 + 0.420 Project fund + 0.305 Financial management skills

Conclusion

Project funding emerged as one of the most critical determinants of sustainability. The study concludes that adequate, timely, and well-managed financial resources are essential for project success from planning to implementation and post-construction maintenance. Delays or inefficiencies in funding allocation can negatively impact timelines and project quality. Therefore, ensuring effective disbursement and financial oversight is necessary to avoid disruptions and to enhance long-term project viability.

Financial management skills are essential for the sustainability of water projects, as they ensure that adequate resources are allocated for the ongoing maintenance and development of these projects. The study concludes that effective financial management, including accurate budgeting, cost control, and proper allocation of funds, is key to ensuring that water projects remain operational over time. Nevertheless, issues such as poor tracking of project finances, the lack of contingency funds, and delays in decision-making can jeopardize the financial stability of these projects. Strengthening financial management practices can significantly enhance the sustainability of water projects in the long term.

Recommendations

In project funding, it is recommended that adequate and timely financial resources be secured and disbursed in alignment with project timelines. Project managers should establish structured financial plans with clear milestones and contingency reserves to handle unforeseen costs. Enhancing financial transparency through regular audits and stakeholder reporting will also improve accountability. Strengthening the budgeting process and ensuring that funding is allocated for both implementation and post-project maintenance will help safeguard long-term sustainability. Furthermore, engaging donors, government bodies, and private partners in co-funding arrangements could improve funding consistency.

In the area of financial management, it is essential that project managers ensure financial flexibility in the budgeting process. Resources should be allocated to accommodate unexpected costs, and there should be mechanisms in place to address any financial challenges promptly.

To prevent budget shortfalls during the execution phase, timely decision-making processes must be implemented. The agency should also consider financial management workshops for the project team to strengthen their ability to manage project funds efficiently and mitigate any risks associated with financial constraints.

Areas for Further Study

Future studies could investigate how technology selection impacts the long-term sustainability of water projects across different regions, considering the influence of local conditions on technological performance. Research into how government policies, regulations, and financial elements shape the adoption of technology could offer deeper insights into improving sustainability in water projects. Furthermore, examining cost-benefit evaluations would help refine practices for making optimal technology choices, enhancing the overall effectiveness of water project

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