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Influence of Participatory Management Practices on Sustainability of Water and Sanitation Projects in Musanze District, Rwanda Rural Areas: A Case Study of Musanze District

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Abstract: *This study examines the influence of participatory management practices on the sustainability of water and sanitation projects in Musanze District, Rwanda, with a particular focus on the Sustainable Rural Water Supply and Sanitation Project (SRWSSP). A mixed-methods approach was employed, utilizing both qualitative and quantitative techniques to gather data from 250 beneficiaries involved in various water projects. Using Yamane's formula, a sample size of 154 respondents was selected through stratified and simple random sampling to ensure proportional representation and minimize bias. Data analysis was performed using SPSS version 25, with Pearson correlation and regression analysis used to assess the impact of participatory management on project sustainability. The findings revealed a strong positive correlation (r = 0.789) between participatory management practices and the long-term sustainability of water and sanitation projects. Regression analysis further indicated that participatory management significantly predicts project sustainability, with a standardized beta coefficient of 0.412 and a p-value of 0.000. Despite these positive outcomes, challenges such as limited technical expertise and insufficient funding were identified as barriers to full sustainability. The study recommends that future project planners should incorporate cultural and geographical sensitivities more effectively into their planning processes. While community needs were largely considered, it may be beneficial to ensure that local cultural practices, geographical realities, and traditional knowledge are better understood and integrated. This will likely lead to greater acceptance and improve the adaptability and relevance of water projects to local contexts.*

Keywords: *Participatory Management Practices, Sustainability of Water and Sanitation Projects, participatory planning and Musanze District*

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1. Introduction

Access to clean water and sanitation remains a critical global challenge, with over 2 billion people lacking safely managed drinking water and more than 4 billion without adequate sanitation. These deficits are major contributors to waterborne illnesses, such as cholera and typhoid, which collectively cause an estimated 3.4 million deaths annually, especially in developing countries. The United Nations Sustainable

Development Goal 6 targets universal access to water and sanitation by 2030, recognizing water's integral role in health, agriculture, and economic growth. However, progress is hindered by geographic barriers, climate change, political instability, and financial limitations, particularly in rural communities where infrastructure is sparse and traditional, often unsafe, water sources prevail (WHO & UNICEF, 2020).

Africa faces some of the most acute water and sanitation shortages globally, with nearly 400 million people lacking clean water and over 700 million without basic sanitation (AfDB, 2020). The rural-urban divide is stark, and inadequate infrastructure in remote areas exacerbates disease outbreaks and entrenches poverty. Women and children often bear the burden of fetching water, sacrificing time for education and income-generating activities. Climate-related events such as droughts and floods further strain limited resources. Despite numerous international and regional interventions, including the African Union's 2025 Vision for Water and Sanitation, substantial investments and structural reforms are still required to bridge the gap in access.

In Eastern Africa, including countries like Kenya, Uganda, Tanzania, Ethiopia, and Rwanda, the situation is particularly critical, with around 40% lacking safe drinking water and nearly 60% without improved sanitation services (UNDP, 2021). Challenges such as high population growth, rapid urbanization, and ineffective water management systems exacerbate the crisis. Traditional water sources dominate rural regions but are often contaminated, leading to widespread disease. While countries in the region have launched national programs to address these issues, progress is slow due to underfunding, limited technical capacity, and inconsistent community engagement. A more sustainable approach requires empowering communities to take active roles in water and sanitation initiatives.

Rwanda has made commendable progress toward improving water and sanitation, with 85% of the population accessing clean drinking water by 2020 (Rwanda Water and Sanitation Sector Strategic Plan, 2021). However, rural areas remain underserved due to the nation's rugged terrain and costly infrastructure development. The government has initiated several programs, such as the Sustainable Rural Water Supply and Sanitation Project (SRWSSP), focusing on community involvement and private sector partnerships. Despite these efforts, challenges persist, including maintenance failures, inadequate funding, and limited local engagement in project planning and execution, which compromise the sustainability of these interventions.

Musanze District in northern Rwanda illustrates the complex challenges of rural WASH (Water, Sanitation, and Hygiene) service provision. Characterized by volcanic terrain and remote settlements, the district struggles with both infrastructure development and frequent disease outbreaks linked to poor water quality. Although the government has launched targeted programs to improve access, high construction costs and geographical obstacles slow progress. Community participation is essential for sustainable outcomes, yet in practice, engagement often falls short due to lack of training, poor communication, and minimal inclusion in decision-making processes. Addressing these shortcomings through capacity-building and inclusive governance is vital for the long-term success of rural water and sanitation projects (RBC, 2019).

1.1 Problem Statement

Access to clean water and adequate sanitation remains a pressing issue in rural Rwanda, particularly in Musanze District. Despite the government's continued efforts through programs like the Sustainable Rural Water Supply and Sanitation Project (SRWSSP), a large portion of the rural population still lacks reliable access to these essential services. According to the Rwanda Water and Sanitation Sector Strategic Plan (2021), approximately 72% of rural residents do not have access to safe drinking water and sanitation. This persistent gap contributes to high rates of waterborne diseases such as cholera and typhoid, disproportionately affecting women and children and undermining efforts toward health, education, and gender equity. While Rwanda has made commendable progress in urban areas, rural districts continue to lag behind due to geographical, economic, and systemic challenges.

A critical issue impeding the sustainability of water projects in Musanze is the insufficient involvement of local communities in all stages of water and sanitation initiatives. Although community participation is

widely recognized as essential for the success and sustainability of such projects, many interventions still follow a top-down approach. External agencies often make key decisions without adequately consulting local communities, resulting in infrastructure that does not reflect the actual needs or usage patterns of the population. Studies by Leah et al. (2021) and Ochieng & Sakwa (2019) highlight that lack of involvement in planning, monitoring, and maintenance often leads to neglect, system failure, and a lack of local ownership. In Musanze, these issues are compounded by the district's challenging terrain and the reliance on unsafe water sources, making effective community engagement even more critical.

Although there is broad consensus in academic and development literature that community participation enhances project sustainability, there is limited empirical research that examines how different forms of community engagement such as involvement in planning, design, implementation, and maintenance—specifically affect project outcomes in rural Rwanda. This research gap limits the ability of policymakers and development practitioners to tailor approaches that foster meaningful participation and long-term impact. This study seeks to fill that gap by investigating the relationship between community engagement and the sustainability of water and sanitation projects in Musanze District. Understanding this connection is essential for designing effective, locally appropriate interventions that can overcome the persistent challenges facing rural water and sanitation services.

This study sought to achieve the following research objective:

i. To assess the Influence of Participatory planning on sustainability of Rural Water project.

2.1 Literature Review

This section reviews key concepts and practices relevant to the implementation and sustainability of rural water projects, with a particular focus on participatory approaches. The literature highlights how active community involvement contributes to improved project outcomes by fostering ownership, strengthening institutional capacity, and ensuring the cultural relevance of interventions. The review is organized into three main areas: participatory management practices, participatory planning, and project sustainability.

2.1.1 Participatory Management Practices

Participatory management is a collaborative approach that actively involves all stakeholders, particularly community members, in decision-making throughout the entire lifecycle of a project. In rural water initiatives, this approach typically unfolds across three key stages: participatory planning, implementation, and monitoring and evaluation (M&E). At each of these stages, the emphasis is on integrating local voices, insights, and cultural knowledge to ensure that the project is both relevant and effective. By engaging communities from the outset, participatory management helps identify local priorities, potential challenges, and context-specific solutions that might otherwise be overlooked. According to Reddy (2022), this inclusive process not only empowers community members but also increases transparency, strengthens trust, and enhances the social legitimacy of the project.

The ultimate goal of participatory management is to foster a strong sense of ownership, responsibility, and long-term commitment among local residents. When community members are involved in designing, building, and managing water systems, they are more likely to use them appropriately, maintain them diligently, and advocate for their continued improvement. This proactive engagement leads to improved functionality, reduced system failures, and greater sustainability over time. Additionally, when local knowledge and practices are respected and integrated into the technical design, the resulting systems are often more culturally appropriate, environmentally resilient, and cost-effective. Studies have consistently shown that projects developed through participatory approaches enjoy higher rates of success and community satisfaction compared to those implemented without such engagement (Reddy, 2022). In this way, participatory management serves not just as a project strategy, but as a foundational principle for ensuring the long-term viability of rural water infrastructure.

2.1.2 Participatory Planning

Participatory planning is the first and perhaps most critical stage in the participatory management process. It involves the early and active engagement of community members, local leaders, technical experts, and other stakeholders in identifying needs, setting priorities, and designing project interventions. This inclusive approach ensures that the planning process reflects the lived experiences, cultural norms, and aspirations of the community. In the context of rural water projects, participatory planning may include community meetings, focus group discussions, stakeholder mapping, and participatory rural appraisal (PRA) tools that facilitate open dialogue and consensus-building.

One of the primary benefits of participatory planning is its ability to create realistic and context-specific project designs that are more likely to be accepted and supported by the community. By encouraging local input from the beginning, the process fosters a sense of shared ownership and trust, which is essential for long-term sustainability. Moreover, involving community members in identifying key issues such as water access challenges, seasonal variability, and infrastructure limitations helps ensure that the project addresses actual needs rather than externally perceived ones. According to Kumar and Singh (2021), participatory planning not only enhances the relevance and responsiveness of rural water projects but also lays the foundation for successful implementation and community-led monitoring in later stages.

2.1.3 Project Sustainability

Project sustainability refers to the ability of a development initiative such as a rural water supply system to continue delivering benefits over the long term without external support (Fanny, 2020). In the context of rural water projects, sustainability encompasses several dimensions, including technical functionality, financial viability, environmental stewardship, institutional capacity, and social acceptance. Ensuring sustainability means designing systems that communities can manage, maintain, and finance independently once initial project support has ended.

A key factor influencing sustainability is the level of community involvement and ownership. Projects that incorporate participatory approaches tend to achieve higher levels of sustainability because they align more closely with local priorities, capacity, and cultural practices. Local knowledge contributes to the selection of appropriate technologies, ensures better site selection, and promotes behavioral changes essential for long-term use. Additionally, building local capacity through training and the establishment of water user committees or community-based management structures strengthens institutional frameworks that support ongoing operation and maintenance. According to Apiyo (2023), rural water projects that embed sustainability considerations from the outset such as life-cycle costing, environmental safeguards, and inclusive governance are far more resilient to challenges and capable of delivering lasting impacts.

2.2 Theoretical Review

This section presents the theoretical foundations that underpin the study, focusing on frameworks that explain the importance of community involvement and long-term impact in development initiatives. Theoretical perspectives guide the analysis and interpretation of how rural water and sanitation projects can achieve sustainability and effectiveness through local engagement. Two key theories—Participatory Development Theory and Sustainability Theory are reviewed for their relevance in understanding the dynamics of rural water management in Musanze District, Rwanda. These theories provide critical insights into how active community participation and long-term planning contribute to the success and continuity of development interventions in resource-constrained environments

2.2.1 Participatory Development Theory

Participatory Development Theory emerged as a response to the limitations of traditional top-down development approaches, emphasizing the active involvement of communities in decision-making processes that affect their lives. While Vohland and Barry (2009) contributed significantly to this field, the foundational ideas can be traced back to earlier scholars such as Slocum et al. (1995), who

highlighted the importance of community participation in development. These early works laid the groundwork for understanding how inclusive planning can lead to more effective and sustainable development outcomes.

At its core, Participatory Development Theory posits that development projects are more likely to succeed when they are designed and implemented with the active participation of the communities they aim to serve. This involvement ensures that projects align with local needs, values, and contexts, fostering a sense of ownership and accountability among community members. Research by Mgulo and Kazer (2022) underscores the significance of community participation in enhancing the sustainability of rural water projects in Tanzania. Their study found that effective community engagement in all stages of project implementation from design to monitoring was crucial for the long-term success of these initiatives.

The relevance of Participatory Development Theory to this study lies in its emphasis on community engagement as a critical factor for the success and sustainability of development projects. By adopting this theoretical framework, the study aims to explore how active community involvement influences the planning and implementation of rural water projects, particularly in the context of Rwanda. Understanding the dynamics of participation can provide valuable insights into designing more effective and contextually appropriate interventions that empower communities and ensure the long-term viability of development efforts.

2.2.2 Sustainability Theory

Sustainability Theory was popularized by the World Commission on Environment and Development (WCED), also known as the Brundtland Commission, which was established by the United Nations in 1983 and chaired by former Norwegian Prime Minister Gro Harlem Brundtland. The foundational definition of sustainability was articulated in the commission's 1987 report titled *Our Common Future*. The report defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). This definition laid the groundwork for understanding development through three interconnected dimensions: economic viability, environmental protection, and social equity.

Sustainability Theory emphasizes a holistic and long-term approach to development. It advocates for the responsible use of natural resources, the equitable distribution of benefits, and inclusive decision-making processes that empower communities. In the context of water and sanitation, the theory suggests that infrastructure and services must be designed not only for short-term effectiveness but also for long-term resilience and adaptability. This includes systems that are environmentally sound, economically maintainable, and socially accepted by the communities they serve. Projects that fail to address these three pillars often collapse or become ineffective once external funding or support is withdrawn.

A critical component of Sustainability Theory is community participation, which is considered essential for ensuring the longevity and effectiveness of development projects. Scholars such as Pretty (2023) have emphasized that when communities are actively engaged in the planning, implementation, and maintenance of water and sanitation systems, there is increased ownership, accountability, and proper management of resources. This is particularly relevant in rural areas like Musanze District, where geographic isolation and financial constraints challenge centralized service delivery. By applying the principles of Sustainability Theory, this study seeks to examine how meaningful community engagement contributes to the sustained functionality of rural water and sanitation projects, ensuring they continue to deliver benefits beyond the lifespan of external support.

Sustainability Theory is highly relevant to this study because it provides a conceptual framework for evaluating the long-term effectiveness of rural water and sanitation projects in Musanze District, Rwanda. The theory's emphasis on environmental, social, and economic sustainability directly aligns with the core challenges faced in the region, such as infrastructure breakdown, poor community ownership, and limited maintenance capacity. By focusing on the role of community participation, a key component of

sustainability theory the study can assess how involving local stakeholders in planning, implementation, and maintenance enhances the durability and relevance of water systems. Understanding these dynamics is essential for identifying practical strategies that ensure water and sanitation projects remain functional and beneficial well beyond their initial implementation.

2.3 Empirical Literature

Empirical literature plays a crucial role in understanding the practical application of participatory planning in development projects. Studies across various regions highlight the positive impact of community involvement on the sustainability of water and sanitation initiatives, though challenges persist, particularly in ensuring genuine and ongoing engagement. This section reviews key empirical findings from global, regional, and national contexts to shed light on the role of participatory planning in enhancing project outcomes and addressing existing gaps.

2.4.1 Participatory Planning and Project Sustainability

Globally, participatory planning is widely recognized as a crucial element in enhancing the sustainability of development projects.. Research consistently shows that when communities are actively involved in the planning, implementation, and monitoring of development initiatives, they are more likely to meet local needs, foster ownership, and increase the overall effectiveness of the project. For instance, a study by Laah et al. (2021) in Ghana demonstrated that projects involving community participation achieved better outcomes in terms of maintenance and local relevance. Their research highlighted that when local communities are consulted and empowered, water systems are better maintained and less likely to fall into disrepair after project completion. However, a significant gap remains, particularly in terms of integrating community input early in the planning process. Many projects still fail to fully align with local needs because community feedback is either solicited too late in the process or is not considered seriously by project designers. This gap leads to projects that fail to meet the community's expectations, which, in turn, affect their sustainability. Therefore, a more thorough and timely integration of community feedback is necessary to ensure that projects are genuinely responsive to local realities.

In developed countries, participatory planning is often embedded into the institutional framework for development projects. For example, in the United States, the National Environmental Policy Act (NEPA) mandates public participation in planning for infrastructure projects, including those related to water and sanitation. Studies such as those conducted by Stewart et al. (2019) in the United Kingdom found that involving communities in water management projects, through consultations and public hearings, significantly enhanced the sustainability of these systems. These participatory mechanisms, when implemented effectively, help ensure that the projects are designed to fit local needs and are more easily adopted by the public. However, a gap persists in the ability to fully represent marginalized groups, such as low-income communities and minorities, whose needs are often overlooked in the consultation process. In these regions, while participatory processes are in place, tokenism and superficial engagement are common, where community involvement is sought, but their input does not significantly influence decision-making or project design. Therefore, a more genuine form of engagement, where the voices of marginalized groups are authentically considered, is necessary for improving the sustainability of these projects.

In Africa, participatory planning has become a cornerstone of development projects aimed at improving water and sanitation services. In countries like Kenya and Uganda, community-managed water systems have shown that when local communities are engaged in decision-making, the sustainability of water projects improves significantly. A study by Mgulo and Kazer (2022) in Tanzania found that involving communities in both the design and management of rural water projects led to higher levels of maintenance and fewer system breakdowns. Despite these positive outcomes, research in other African countries, including a study by Ochieng & Sakwa (2019) in Kenya, identifies several gaps. These include inadequate technical training for community members, insufficient funding, and a lack of long-term engagement beyond the project’s initial phases. In many cases, local communities are involved in the planning but are not adequately

trained to maintain systems or troubleshoot issues as they arise. Additionally, external support often wanes after the project is completed, leaving communities without the resources or expertise needed to sustain the project. This gap highlights the need for ongoing capacity-building initiatives and resource allocation to ensure that communities can manage water and sanitation projects independently in the long run.

In East Africa, participatory planning is becoming increasingly important in the design and implementation of water and sanitation projects, as countries strive to meet the demands of rapidly growing populations and improve public health outcomes. Studies conducted in countries like Kenya, Uganda, and Tanzania demonstrate that community involvement in water projects can lead to improved outcomes in terms of sustainability and maintenance. For instance, a study by the UNDP (2021) highlighted that community involvement in rural water projects in Tanzania contributed to a 30% reduction in waterborne diseases in the targeted areas. However, challenges remain, particularly in regions with difficult terrain, such as Musanze District in Rwanda. A study by the Rwanda Biomedical Center (2019) indicated that despite efforts to engage communities, many rural water and sanitation systems in East Africa continue to fail due to poor management and lack of technical expertise. Furthermore, the study found that while local communities were consulted during the planning stages, their involvement was often limited to surface-level engagement, leaving them with minimal responsibility in the ongoing management and maintenance of the systems. This gap underscores the importance of not just engaging communities at the outset of a project but ensuring their active involvement throughout the project's lifecycle, including maintenance and monitoring phases, which are critical for long-term sustainability.

In Rwanda, participatory planning is increasingly viewed as key to improving the sustainability of water and sanitation projects, especially in rural areas like Musanze District. The government's Sustainable Rural Water Supply and Sanitation Project (SRWSSP), launched in 2016, emphasizes community participation in planning, implementation, and maintenance of water systems. According to the Rwanda Water and Sanitation Sector Strategic Plan (2021), involving local communities in the development of water systems has led to better alignment with local needs and increased ownership of the projects. A study conducted by the Rwanda Biomedical Center (2019) found that communities in rural districts where participatory planning was used had better water system functionality and lower rates of system breakdowns. However, despite these successes, the research pointed out significant gaps in terms of ensuring continuous community involvement and providing ongoing technical and financial support. Many rural water systems in Musanze still face challenges such as inadequate maintenance and reliance on external assistance. This gap illustrates the need for a more integrated approach that ensures communities not only participate in the initial planning stages but are also supported through training and resources for long-term management and maintenance. Addressing these gaps is essential for improving the sustainability and effectiveness of rural water and sanitation projects in Rwanda.

3. Methodology

This section outlines the research methodology used to investigate the influence of participatory management practices on the sustainability of water and sanitation projects in Musanze District, Rwanda. The study aimed to explore the relationship between community engagement and the long-term success of water projects, specifically within the Sustainable Rural Water Supply and Sanitation Project (SRWSSP). The following subsections describe the research design, target population, sampling techniques, and data collection methods used to gather insights on the project's impact and sustainability

3.1 Research Design

This study adopted a descriptive research design, utilizing both qualitative and quantitative methods to explore the influence of participatory management practices on the sustainability of water and sanitation projects in Musanze District, Rwanda, with a particular focus on the Sustainable Rural Water Supply and Sanitation Project (SRWSSP). A descriptive design was chosen to offer a clear and detailed account of the relationship between community engagement (independent variable) and project sustainability (dependent variable). By

combining both qualitative and quantitative data, the research captures numerical patterns and trends, as well as in-depth insights from community members' personal experiences and perspectives. This dual approach provided a comprehensive understanding of how community engagement impacts the long-term sustainability of water projects in rural Rwanda.

3.2 Study Area and Target Population

The target population for this study consisted of 250 beneficiaries involved in various water projects within Musanze District, Rwanda. These beneficiaries were part of the SRWSSP, which focuses on improving access to clean water and sanitation services. Musanze District was selected due to its active involvement in the SRWSSP and the notable engagement of local communities in the implementation, monitoring, and maintenance of water projects. The district was chosen for its significant community involvement, making its residents ideal participants for this study.

3.3 Sample Size and Sampling Technique

A sample size of 154 respondents was determined using Yamane's (1967) formula for sample size calculation. The formula used was:

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

- N was the sample size
- N was the population size (250 in this case)
- e was the margin of error (set at 0.05 for 95% confidence)

Using this formula, the sample size was calculated as:

$$n = \frac{250}{1+250(0.05)^2} = 154$$

Thus, the study targeted a sample of 154 respondents for data collection.

The identification of the sample was accomplished using stratified sampling, which was justified due to the homogeneity of the population. Specifically, the population consisted mainly of a single ethnic group, which made stratified sampling an appropriate method for ensuring that different segments of the population were proportionately represented. Stratified sampling allowed for more accurate estimations and provided an equitable opportunity for all projects to be selected. Once the strata were identified, simple random sampling was applied to select the individual community members who would participate in the study. This ensured that each beneficiary had an equal chance of being included in the study, thus reducing bias and ensuring the reliability of the findings.

3.4 Data Collection Methods

Data was collected through a combination of structured questionnaires, interviews, observations, and document analysis. Structured questionnaires were used to gather quantitative data from the beneficiaries, allowing for consistency and comparability across responses. Interviews provided a more nuanced understanding of the community members' experiences and perspectives regarding water projects. Observations were conducted to assess the practical implementation and functioning of the water systems, while document analysis was used to examine project reports and records to cross-reference and validate the primary data collected.

3.5 Data Processing and Analysis

Data processing involved several stages, including cleaning, coding, entry, and storage. Data cleaning was performed to identify and correct errors or inconsistencies in the collected data, ensuring accuracy. Once cleaned, qualitative data from interviews was coded into numerical format for statistical analysis. The cleaned and coded data was then entered into a database for secure storage and future reference.

For data analysis, descriptive statistics, correlation analysis, and regression analysis were employed. Descriptive statistics were used to summarize key features of the data, such as the mean, frequency, and median, providing an overview of the patterns and trends. Correlation analysis measured the strength and direction of the relationship between community engagement and project sustainability. Regression

analysis, specifically linear regression, examined the influence of community engagement on project sustainability. Statistical tests, such as t-tests and ANOVA, were used to assess the significance of the observed relationships, allowing for comparisons between projects with varying levels of community engagement.

3.6 Ethical Considerations

Ethical considerations were central to the study's design and execution to ensure the integrity and respect of participants. Informed consent was obtained from all respondents, ensuring they understood the study's purpose and their right to withdraw at any time without consequences. Privacy and confidentiality were maintained throughout, with personal identifiers removed from the data to protect participants' anonymity. The study adhered to ethical guidelines, ensuring no harm was caused to participants or their communities. All collected data was securely stored and used exclusively for the purposes of this study, maintaining transparency and respect for participants' contributions.

4. Results and Discussion

4.1. Findings

This section presents the analysis and interpretation of the findings of the study in relation to the research question**.**

4.1.2 Descriptive statistics of Participatory planning on project sustainability

This section presents the descriptive statistics related to participatory planning and its influence on project sustainability. Participatory planning is a critical factor in determining the effectiveness and long-term success of development projects, as it ensures that the communities' needs and preferences are incorporated into the planning process. Descriptive statistics such as mean, standard deviation, and frequency distributions were used to assess the respondents' views on the level of participatory planning involved in the water projects. Respondents were asked to rate their agreement with various statements regarding the participatory planning process using a scale of 1 to 5, where 5 represented "strongly agree," 4 indicated "agree," 3 was "neutral," 2 signified "disagree," and 1 stood for "strongly disagree." The findings, as shown in Table 1, provide insights into the level of community involvement in the planning phase and its perceived impact on the sustainability of the projects.

Table 1: Level of agreement of financial knowledge on investment decisions

Statements	N	Mean	Std. Deviation
The community was actively involved in the planning of the water project.	154	4.34	1.093
Community needs and preferences were considered during the planning phase	154	4.29	1.095
There were clear communication channels between the project team and the community during planning	154	4.23	1.113
The planning process of water projects addressed the cultural and geographical needs of the community	154	4.2	1.122
The community felt ownership of the planning process.	154	4.14	1.18
Valid N (listwise)	154		

Source: Field data, 2025

Table 1 presents the respondents' views on the role of participatory planning in the sustainability of rural water projects, based on five key statements. Overall, the data reveals that respondents strongly agreed that participatory planning significantly contributed to the success of the projects. The highest mean score of 4.34 was recorded for the statement "The community was actively involved in the planning of the water project," suggesting that the community's involvement in the planning process was seen as a key factor for the project's success. The low standard deviation of 1.093 indicates that the majority of respondents shared this positive perspective, with minimal variation in their responses. This highlights the consensus that participatory planning was an integral part of the project's development.

In addition, the statement "Community needs and preferences were considered during the planning phase" received a mean score of 4.29, further emphasizing that the planning process was perceived to be responsive to local needs. The low standard deviation of 1.095 suggests that respondents generally agreed that community input was prioritized, leading to a planning process that aligned well with local expectations. Similarly, the statement "There were clear communication channels between the project team and the community during planning" scored a mean of 4.23, indicating that respondents felt communication was effective throughout the planning phase. Although the standard deviation was slightly higher at 1.113, the result still suggests that the majority of respondents had a positive view of the communication channels, though a few individuals may have had differing opinions.

However, the data also reveals some areas where there was slightly more variation in responses. For example, the statement "The planning process of water projects addressed the cultural and geographical needs of the community" had a mean score of 4.20, indicating agreement that these factors were considered, but the standard deviation of 1.122 suggests that not all respondents felt the planning fully addressed these needs. Additionally, the statement "The community felt ownership of the planning process" had the lowest mean score of 4.14, although it still reflected general agreement that the community had a sense of ownership. The relatively higher standard deviation of 1.18 for this statement indicates that there was greater variability in how respondents perceived their level of ownership in the planning process, with some feeling more involved than others. Despite these variations, the overall results point to a generally positive view of participatory planning, with most respondents acknowledging the community's role in shaping the projects and contributing to their sustainability.

4.1.3 Test for Normality

In this section, the test for normality was conducted to assess whether the data collected for the study follows a normal distribution. The assumption of normality is crucial for the application of various

parametric tests, such as correlation and regression analysis, as these tests rely on the data being normally distributed. To evaluate normality, both graphical and statistical methods were used.

The graphical method involved the use of histograms and Q-Q (quantile-quantile) plots, which visually depict how the data points align with a normal distribution. A bell-shaped curve in the histogram and the alignment of points along the diagonal in the Q-Q plot would suggest that the data is normally distributed. For the statistical method, the Shapiro-Wilk test was employed. This test specifically evaluates the null hypothesis that the data is normally distributed. A p-value greater than 0.05 indicates that the data does not significantly deviate from normality, suggesting it follows a normal distribution**.**

Table 2: Test of Normality

Gender		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Age	Male	.084	84	.200*	.978	84	.160
	Female	.060	70	.200*	.984	70	.529

SSource: Field data 2025

The results of the normality test for the variable "Age" across gender categories using both the Kolmogorov-Smirnov and Shapiro-Wilk tests indicate that the data are normally distributed. For male respondents, the Shapiro-Wilk test produced a statistic of 0.978 with a significance level (p-value) of 0.160, while the Kolmogorov-Smirnov test gave a statistic of 0.084 with a p-value of 0.200. Similarly, for female respondents, the Shapiro-Wilk statistic was 0.984 with a p-value of 0.529, and the Kolmogorov-Smirnov statistic was 0.060 with a p-value of 0.200. Since all p-values are greater than 0.05, the null hypothesis that the data are normally distributed is not rejected. Therefore, the assumption of normality is satisfied for both male and female respondents' age data.

4.1.4 Correlation Analysis

The findings of the correlations between the independent variables and the dependent variables are summarized and presented in Table 3

Table 3: Correlation between independent variable and dependent variable

		Participatory Planning	**Project sustainability**
Participatory Planning	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	154	
Project sustainability	Pearson Correlation	.789**	1
	Sig. (2-tailed)	.000	
	N	154	154

Source: Field data, 2025

Table 2 presents the correlation between the independent variable, participatory planning, and the dependent variable, project sustainability. The Pearson correlation coefficient between participatory planning and project sustainability is 0.789, which indicates a strong positive relationship between the two variables. This suggests that as participatory planning increases, the sustainability of the water projects also tends to improve. The correlation is statistically significant, as indicated by a p-value of 0.000, which is less than the 0.05 threshold for significance. The findings underscore the importance of participatory planning in enhancing the long-term success and sustainability of water projects, emphasizing that greater community involvement in the planning process is strongly associated with more sustainable project outcomes.

4.1.4 Regression Analysis

A multiple regression analysis was conducted to examine the influence of participatory planning on the sustainability of rural water projects. This analysis aimed to predict the dependent variable—project sustainability based on the independent variable, participatory planning. Table 3 shows the model summary of the results.

Table 3. Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.814[a]	.662	.661	.109

a. Predictors: Participatory planning

b. Dependent variable: Project sustainability

As shown in Table 3, the model yielded an R value of 0.814, indicating a strong positive correlation between participatory planning and project sustainability. The R Square value of 0.662 suggests that approximately 66.2% of the variance in project sustainability can be explained by participatory planning. This high value indicates that participatory planning is a substantial predictor of sustainability in rural water projects. The Adjusted R Square, which corrects for the number of predictors in the model, remained nearly identical at 0.661, confirming the robustness of the model. The standard error of the estimate was 0.109, which reflects a relatively low level of dispersion around the regression line, suggesting a good fit of the model to the observed data. These results imply that the more communities are involved in the planning phase of water projects, the more likely those projects are to be sustainable. Therefore, strengthening participatory planning processes can significantly enhance the long-term success and resilience of rural water and sanitation initiatives.

Table 4. Summary of ANOVA results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	195.860	3	65.287	2279.815	.000[b]
	Residual	4.296	150	.029		
	Total	200.156	153			

a. Dependent Variable: project sustainability

b. Predictors: (Constant), Participatory Planning

Table 4 presents the ANOVA summary results, which evaluate the overall significance of the regression model used to predict project sustainability based on participatory planning. The analysis reveals that the regression model is statistically significant, with an F-value of 2279.815 and a p-value of .000, which is well below the 0.05 threshold. This indicates that participatory planning, as an independent variable, significantly contributes to explaining the variance in project sustainability. The model explains a substantial proportion of the total variation, as reflected by the regression sum of squares (195.860) compared to the residual sum of squares (4.296). These results confirm the model's strong predictive power and the critical importance of participatory planning in enhancing the sustainability of rural water projects.

Table 5. Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.096	.060		1.619	.000
	Participatory planning	.599	.058	.562	10.397	.000

a. Dependent Variable: Project Sustainability

Table 5 presents the regression coefficients that assess the influence of participatory planning on project sustainability. The unstandardized coefficient (B) of 0.599 indicates that a one-unit increase in participatory planning is associated with a 0.599 unit increase in project sustainability, suggesting a strong positive relationship between the two variables. The standardized beta coefficient of 0.562 further confirms the strength of this relationship. The t-value of 10.397 and the p-value of 0.000 indicate that the relationship is statistically significant at the 0.05 level. Additionally, the constant value of 0.096 with a standard error of 0.060 also reaches significance, though to a lesser extent. Overall, the findings demonstrate that participatory planning significantly contributes to the sustainability of rural water projects, underscoring the critical role of community involvement in enhancing long-term project outcomes.

4.2 Discussions of Findings

The study explored the influence of participatory planning on the sustainability of rural water projects, using descriptive, correlation, and regression analyses to draw meaningful conclusions. The descriptive analysis revealed that participants generally held a positive perception of the participatory planning process. Most respondents reported that their communities were actively involved, with their needs and preferences considered, and that communication between project implementers and the community was clear. This is consistent with the growing body of literature that emphasizes the benefits of community engagement in rural water projects. However, while the majority of respondents agreed that local cultural and geographical factors were considered, there were variations in perceptions of community ownership. This suggests that while participatory efforts were visible in some areas, the depth of engagement varied across project sites. Some communities felt more empowered and involved than others, which indicates that the participatory process was not always as inclusive or thorough as it could have been. This finding resonates with Shirazi (2021), who noted that inclusivity in participatory processes is critical to ensuring that all community members feel a sense of ownership and responsibility for the projects. When all members, including marginalized groups, are engaged, it enhances the likelihood of long-term project sustainability.

Correlation analysis further reinforced these findings by revealing a strong positive relationship between participatory planning and project sustainability. This implies that as the level of community engagement in planning increases, the likelihood of project success and longevity also improves. The significance of this relationship confirms the hypothesis that projects which actively involve the community in their design and decision-making phases tend to be more resilient. A study by Mullei (2019) in Kenya supported this conclusion, finding that participatory planning significantly influenced the sustainability of water projects in rural areas, as it led to greater local commitment to maintaining the projects post-implementation. Additionally, the findings from a similar study by Patel and Thomas (2018) in rural India suggest that participatory planning can mitigate project failure by fostering a sense of ownership among community members, which in turn leads to greater care and long-term viability.

The results of the regression analysis showed that participatory planning was a strong predictor of project sustainability. This means that the extent to which communities were involved in the planning phase significantly influenced how well the projects endured over time. The analysis also demonstrated that participatory planning alone accounted for a substantial portion of the variance in sustainability outcomes, highlighting its critical role in determining whether water infrastructure remains functional and beneficial beyond initial implementation. This

finding is consistent with the study by Mansuri and Rao (2013), which concluded that community-driven initiatives, including participatory planning, contributed to long-term sustainability by aligning the projects with local priorities and ensuring that resources were managed effectively. The regression results also align with Participatory Development Theory and Sustainability Theory, which emphasize that involving stakeholders in every step of the development process leads to more context-appropriate and durable outcomes.

Finally, an important observation from the study is the variation in responses related to cultural and geographical considerations in the planning process. While most respondents felt that these factors were adequately addressed, a portion of the respondents expressed concerns that their unique local contexts were not sufficiently incorporated into the planning process. This observation supports previous research by Sultana and Brikke (2020), which noted that ignoring cultural and geographical specifics in rural water projects could lead to poor community buy-in and reduced sustainability. Addressing these factors more thoroughly in future projects could significantly enhance their effectiveness, ensuring that the interventions are not only technically feasible but also culturally relevant and accepted by local communities.

5. Conclusion and Recommendations

5.1 Conclusion

In conclusion, this study demonstrates that participatory planning plays a crucial role in the sustainability of rural water projects. The findings highlight that active community involvement, effective communication, and consideration of local needs and preferences significantly contribute to the long-term success of these projects. The positive correlation and regression results further emphasize that the more communities are engaged in the planning process, the more likely the projects are to be sustainable. While most projects showed strong community participation, some areas, such as ownership and cultural sensitivity, require further attention. Therefore, fostering deeper inclusivity and empowering communities throughout the planning and implementation stages will enhance the sustainability and effectiveness of rural water projects in the future.

5.2 Recommendations

Based on the study findings, the following recommendations are made:

1. It is essential that stakeholders enhance community ownership and empowerment by involving the community more actively in the decision-making, project management, and post-implementation stages. Efforts should be made to build the capacity of the community, equipping them with the skills and knowledge necessary to manage and sustain water projects independently.

2. Future project planners should incorporate cultural and geographical sensitivities more effectively into their planning processes. While community needs were largely considered, it may be beneficial to ensure that local cultural practices, geographical realities, and traditional knowledge are better understood and integrated. This will likely lead to greater acceptance and improve the adaptability and relevance of water projects to local contexts.

3. Project implementers should strengthen communication channels to foster trust and transparency. It would be beneficial to establish clear and open communication strategies, including regular feedback loops and consultation meetings. Such measures would ensure that the community's concerns and suggestions are continuously addressed throughout the project lifecycle, contributing to the long-term sustainability of the projects.

References

AfDB. (2020). *African water and sanitation: The challenge of providing access to safe water and sanitation in Africa*. African Development Bank.

Apiyo, M. (2023). Sustainability in rural water projects: Approaches for enhancing long-

term impact. *Journal of Rural Development, 14*(2), 45-60.

Fanny, D. (2020). Project sustainability and community participation in rural development initiatives. *International Journal of Development Studies, 12*(4), 202-218.

Kumar, A., & Singh, P. (2021). Participatory planning for rural water projects: Community involvement and project success. *Rural Development Perspectives, 19*(3), 128-142.

Laah, S., et al. (2021). Community participation and water project sustainability in Ghana. *Journal of Development Studies, 16*(3), 78-92.

Leah, W., et al. (2021). The role of community participation in rural water projects: A case study in Rwanda. *Journal of Rural Development, 15*(2), 101-115.

Mgulo, A., & Kazer, R. (2022). The role of community engagement in water project sustainability: A case study of Tanzania. *International Journal of Water and Environmental Management, 10*(1), 67-84.

Mansuri, G., & Rao, V. (2013). Localizing development: Does participation work?. *The World Bank Research Observer, 28*(2), 182-210.

Mullei, P. (2019). The role of participatory planning in ensuring the sustainability of rural water projects: Evidence from Kenya. *Journal of Rural Development, 35*(2), 200-215.

Ochieng, D., & Sakwa, M. (2019). Challenges of community participation in water and sanitation projects: A case study of Kenya. *International Journal of Development Studies, 20*(4), 58-72.

Ochieng, M., & Sakwa, G. (2019). Challenges and opportunities in community engagement in water projects in Kenya. *African Journal of Rural Development, 5*(2), 112-127.

Patel, A., & Thomas, G. (2018). Participatory planning for sustainable water infrastructure: Insights from rural India. *Water Resources Management Journal, 32*(8), 1575-1591.

Pretty, J. (2023). The role of participatory approaches in achieving sustainability in rural development. *Environmental Sustainability Journal, 7*(3), 119-134.

RBC. (2019). *Rwanda Biomedical Centre report on water, sanitation, and hygiene in Musanze district*. Rwanda Biomedical Centre.

RBC. (2019). *Challenges in rural water and sanitation systems in East Africa: A case study of Musanze district, Rwanda*. Rwanda Biomedical Center Report, 21(1), 34-49.

Reddy, G. (2022). Community participation and sustainability in rural water supply projects: Lessons from India. *Journal of Rural Infrastructure, 8*(2), 85-99.

Rwanda Water and Sanitation Sector Strategic Plan. (2021). *National strategy for water and sanitation in Rwanda*. Government of Rwanda.

Shirazi, S. (2021). Inclusive participatory planning for sustainable development projects: A case study in Tanzania. *International Journal of Development Studies, 19*(3), 120-134.

Slocum, R., et al. (1995). Power and participation: Development and local governance in the global South. *Development and Change, 26*(1), 45-60.

Stewart, A., et al. (2019). Public participation in water management: The impact on project sustainability in the UK. *Water Policy and Management, 21*(4), 195-210.

Sultana, F., & Brikke, F. (2020). Integrating cultural and geographical context in rural water projects: Enhancing community buy-in for long-term sustainability. *Water International, 45*(7), 897-910.

UNDP. (2021). *Water and sanitation challenges in Eastern Africa*. United Nations Development Programme.

UNDP. (2021). *Community involvement in rural water projects: Case studies from East Africa*. United Nations Development Programme Report, 18(3), 100-120.

WHO & UNICEF. (2020). *Progress on household drinking water, sanitation, and hygiene 2000-2020: Five years into the SDGs*. World Health Organization & United Nations Children's Fund.

WCED. (1987). *Our common future*. World Commission on Environment and Development, Oxford University Press.

Vohland, K., & Barry, T. (2009). Community-based development and sustainability: Theoretical and empirical insights. *Journal of Participatory Development, 14*(2), 143-158.

Yamane, T. (1967). *Statistics: An introductory analysis* (2nd ed.). Harper and Row.