Factors Contributing to the Sustainability of Water Projects in Mufindi District, Tanzania

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https://dx.doi.org/10.4314/ajasss.v7i1.10

Abstract
This study investigates the key factors influencing the sustainability of rural water projects in Mufindi District, Tanzania, where challenges such as seasonal variability, groundwater limitations, and inadequate infrastructure persist despite national efforts to improve water access. Although water coverage in rural Tanzania has expanded significantly rising from 50% in 2002 to nearly 80% in 2024 many systems fail within a few years due to poor maintenance, weak governance, and limited community participation. The study stresses integrating social, economic, environmental, and technical aspects to enhance sustainability in rural water service delivery. Using quantitative research design and cross-sectional survey method, the study sampled 260 respondents, including household heads, project leaders, local government leaders and community water committee members. Data were collected through structured questionnaires measuring the influence of variables such as water accessibility (distance, affordability, water facilities), management practices (leadership, communication, maintenance systems), on sustainability of water projects. Statistical analysis using SPSS Version 26 included descriptive statistics and multiple linear regression, with Cronbach's alpha confirming high reliability (α > 0.70) of measurement instruments. Findings reveal that sustainability is significantly influenced by maintenance systems, community communication systems, water facilities, and proximity to water points, while affordability and leadership also play critical roles. The study identifies leadership and communication gaps in rural Tanzania, urging integrated, community-led governance for sustainable water management. The insights offer practical recommendations for policymakers, community, and water authorities to collectively design more inclusive, resilient, and sustainable water projects, tailored to the unique socio-economic and environmental conditions of rural districts like Mufindi.

Keywords: *Sustainability, Rural water facilities, Community participation and Water governance*

1.0 INTRODUCTION

Access to safe and sustainable water remains a major global challenge. As of 2024, over 4.4 billion people lack access to safely managed drinking water services (Greenwood, 2024). This crisis is driven by factors such as climate change, population growth, aging infrastructure, and inadequate governance. In Sub-Saharan Africa, more than 300 million people live without clean water access, with rural areas disproportionately affected by weak institutions, prolonged droughts, and failing infrastructure (Adaka & Mugambi, 2018; Shemer et al., 2023). East Africa, including Tanzania, faces these challenges acutely. Groundwater remains a key source in rural areas, yet sustainability is undermined by poor maintenance, lack of funding, and limited community ownership (Elisante & Muzuka, 2017). In regions like Iringa and Mufindi District, water scarcity is compounded by limited groundwater reserves, poor rainfall distribution, and inadequate piped systems (URT, 2013). Although programs have increased access, millions still lack safe water and sanitation (Projects & Besnier, 2021; Yap et al., 2023). Women and children bear the heaviest burden, often walking long distances to fetch water, limiting educational and economic opportunities.

Tanzania has implemented various policies and programs to address these issues, such as the National Water Policy (NAWAPO, 2002) and the Water Supply and Sanitation Act (2019). National strategies like the Sustainable Rural Water Supply and Sanitation Program (SRWSSP) have expanded rural water coverage from 50% in 2002 to nearly 80% by 2024 (MoW, 2025). However, improved access does not equate to sustainability. Many projects collapse due to weak financial planning, poor institutional capacity, and minimal community involvement (Muyambo et al., 2022; Scott et al., 2020).

Despite national and international investment in rural water access, sustainability remains elusive. In Tanzania, SRWSSP expanded coverage significantly, yet many systems fail within years due to poor maintenance, weak institutions, and limited local participation (Scott et al., 2020). In Mufindi District, water points such as boreholes and rainwater tanks are frequently abandoned due to low yield, mechanical failure, and vandalism (URT, 2013;)(Mpora et al., 2023). These issues waste public resources and disproportionately affect women and children, who must seek alternative, often unsafe sources. This situation reveals a persistent gap between infrastructure provision and long-term functionality, demanding a re-evaluation of sustainability frameworks in rural water projects.

There is growing interest in rural water project sustainability, but key gaps remain. Most existing studies emphasize national or regional trends, offering

limited insight into localized, community-level factors that influence long-term success (Oduor, 2019; Wehn et al., 2021). Mufindi District, with its distinct environmental and socio-economic challenges, is notably under-researched. While literature highlights the importance of maintenance, governance, and community involvement (Everard et al., 2024; George-williams et al., 2024), there is little integration of these aspects with location elements such as proximity, affordability, and facility type (Access et al., 2024) (Mpora et al., 2023). Furthermore, although leadership and communication are recognized as vital (Olohunfemi & Mansur, 2025)(Ahmed et al., 2021), their practical roles in rural Tanzanian contexts remain unclear.

Water sustainability is multidimensional, involving social, economic, technical, and environmental factors. Studies highlight that inclusive governance, community engagement, and technical competence are critical for long-term success (Oduor, 2019; Wehn et al., 2021). Yet localized research remains scarce. In Mufindi District, despite efforts to expand infrastructure, many water systems remain non-functional due to poor planning, vandalism, or environmental constraints (Mpora et al., 2023). This study fills the literature gap by examining how social, economic, technical, and location dimensions collectively influence the sustainability of rural water projects in Mufindi district aiming to inform more resilient and inclusive water management strategies.

2.0 THEORETICAL LITERATURE REVIEW

This study is grounded in the sustainability theory, which promotes meeting current needs without compromising the ability of future generations to do the same, while preserving ecological integrity (Brundtland Report, 1987; (Muyambo et al., 2022). In rural water projects, this means ensuring long-term availability, quality, and equitable access to water resources. Achieving this requires balancing environmental protection, economic viability, and social inclusion. Stakeholder engagement especially involving local communities' fosters ownership and long-term support (UN, 2015). Environmentally, projects must minimize ecological disruption, conserve aquatic ecosystems, and promote responsible water use (UN, 2019). Economically, sustainable financing mechanisms like user fees and lifecycle cost planning are critical for continued operation (World Bank, 2021). Adaptive management, supported by continuous monitoring and feedback, ensures flexibility in response to changing conditions. This approach is particularly relevant for Mufindi District, Tanzania, where environmental stress, economic challenges, and social dynamics such as gender roles directly affect water project sustainability.

2.1 Empirical literature Review

Effective leadership is central to sustainable water governance. Democratic

leadership, as discussed by (Olohunfemi & Mansur, 2025), promotes transparency and accountability, essential for building community trust. (Steven Mzilangwe et al., 2025) emphasize inclusive stakeholder engagement, while (Journal et al., 2021) stress adaptive leadership that evolves with changing social and environmental conditions. However, institutional weaknesses often undermine these efforts. (Access et al., 2024) cite poor coordination as a major cause of project failure. For instance, the collapse of the Um Dafoug dam due to mismanagement highlights the consequences of ineffective governance(Ali, 2025). (Chidubem et al., 2024) to ensure sustainability, leadership must promote legal, social, and environmental integration through inclusive and enforceable governance frameworks.

Transparent communication supports sustainability by enhancing coordination and community trust.(Everard et al., 2024) argue that weak communication structures reduce engagement and oversight. Informal communication, as (Woldesenbet, 2020) observed, limits problem resolution and hinders responsiveness. The Deurali-Hupsekot project suffered from unresolved grievances due to a lack of formal systems. Conversely, inclusive platforms like community forums and digital tools improve service delivery (Kassanga & Lekule, 2021)(Kassanga & Lekule, 2021). Yet, communication must be embedded in broader governance reforms that address systemic barriers such as environmental stress and institutional fragmentation (Al-hamawi et al., 2025).

Maintenance is vital for long-term functionality. (Ali, 2025) link regular maintenance to sustained water service delivery. However, inadequate funding, lack of trained personnel, and fragmented governance often derail these efforts (George-williams et al., 2024). (Chinseu et al., 2022) emphasize that system scalability and coordination are often neglected, leading to premature breakdowns. Integrated solutions like preventive maintenance, local water committees, and public-private partnerships can enhance system resilience (Kativhu et al., 2022; Thomson, 2021) Ultimately, maintenance requires strategic investment, clear institutional roles, and community participation.

The technical and social sustainability of water facilities such as boreholes, rainwater tanks, and standpipes varies. Boreholes are widespread but frequently fail due to poor planning and mechanical issues. In Uganda, (Mpora et al., 2023) report over 100 non-functional boreholes. Rainwater harvesting, while promising, sees low adoption due to cost and lack of awareness. Only 4% of households in Mbarara use such systems. Standpipes often suffer from vandalism and leakage due to weak infrastructure and poor management. Studies also highlight geographic inequalities in facility distribution, which worsen access and undermine equity (Adeenze-kangah, 2022).

Distance is a critical sustainability factor. Long distances increase logistical and financial burdens and reduce usage (Access et al., 2024)(Mazancov, 2021). Poorly located facilities are prone to neglect and failure, while closer water points encourage maintenance and community ownership (Avidar, 2024; Opoku et al., 2024). Strategic placement of water sources is therefore essential to enhancing sustainability and user participation.

Affordability significantly influences water system usage and sustainability. High costs deter use and limit household contributions to maintenance (Khatri, 2025). In Tanzania, prices can reach 500 shillings per 20 liters during dry seasons, well above affordable levels (Ugulumu et al., 2025). Unaffordable systems often lead users to unsafe alternatives or system abandonment. Addressing affordability requires inclusive financial planning, subsidies, and -community engagement, especially involving women who manage household water needs (Avidar, 2024; Opoku et al., 2024)

3.0 METHODOLOGY

This study employed a quantitative research methodology using a cross-sectional survey design to examine the key factors influencing the sustainability of rural water facilities in Mufindi District, Tanzania. The cross-sectional approach allowed for data collection at a single point in time, facilitating analysis of relationships among variables such as accessibility, management systems, and sustainability outcomes. The study population included household heads, project leaders, local government leaders and community water committee members, selected due to their direct involvement with rural water services. A stratified random sampling method was used to ensure proportional representation across different wards and villages, and a total of 260 participants were chosen based on proximity to water sources and level of engagement in facility use or maintenance.

Data were collected using structured questionnaires with both closed-ended and Likert-scale items, targeting access factors (e.g., distance, affordability), management aspects (e.g., leadership, communication, maintenance), and sustainability as the dependent variable. A pilot study ensured the instrument's clarity and reliability. Cronbach's alpha values for all constructs exceeded 0.70, indicating strong internal consistency. Descriptive statistics summarized the data, and multiple linear regression was used to assess the impact of independent variables on sustainability. Analysis was conducted using SPSS Version 26 at a 5% significance level. Ethical clearance and informed consent procedures ensured compliance with research ethics.

3.1 Reliability Assessment

A reliability assessment using Cronbach's alpha was conducted to evaluate the internal consistency of the scales measuring both independent and dependent variables in the study. The results demonstrated excellent reliability across all constructs. Within the accessibility domain, Water Facility (6 items) recorded a very high alpha of .983, while Distance to Water Point and Affordability (each with 3 items) had strong reliability scores of .925 and .859 respectively. These values indicate that the items consistently measure their intended aspects of accessibility.

Similarly, the management variables exhibited high internal consistency. Leadership (3 items) and Maintenance Systems (3 items) showed exceptional reliability with alpha values of .989 and .987 respectively, while Communication Systems (3 items) also met the reliability standard with an alpha of .846. The dependent variable, Sustainability (9 items), demonstrated excellent internal consistency with a Cronbach's alpha of .977. These findings confirm that all scales used in the study are reliable and suitable for further statistical analysis.

4.0 FINDINGS AND DISCUSSION

The findings reveal a strong and statistically significant relationship between the selected predictors and the sustainability of water facilities. The model explained 94.8% of the variance in sustainability scores, which is exceptionally high.

Table 1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.973[a]	.948	.946	3.31779	.948	762.890	6	253	.000

This suggests that the combined effect of accessibility and management-related variables plays a crucial role in determining the long-term viability and performance of water systems in the study area. The model's significance ($F = 762.89$, $p < .005$) further confirms that the predictors, when taken together, offer a reliable explanation of sustainability outcomes.

Table 1: Regression Analysis Findings

Sn	Model	Un-standardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	Water Facility	1.235	.120	.556	10.298	.000	.999	1.471
2	Distance to Water point	.856	.186	.196	4.603	.000	.490	1.222
3	Affordability	.198	.135	.033	1.468	.143	-.067	.463
4	Leadership	.281	.185	.063	1.521	.130	-.083	.646
5	Communication Systems	.367	.165	.050	2.222	.027	.042	.692
6	Maintenance Systems	.585	.173	.120	3.385	.001	.245	.926

a. Dependent Variable: Sustainability

Among the predictors, accessibility to water facilities emerged as the most influential factor, with a strong positive effect on sustainability ($B = 1.235$, $p < .001$). This means that communities with better physical access to water sources either through proximity or ease of use are more likely to maintain those systems over time. Similarly, accessibility distance ($B = 0.856$, $p < .001$) was also a significant predictor, reinforcing the idea that shorter distances to water sources contribute to better sustainability. These findings highlight the importance of geographic and infrastructural considerations in water service planning. The more accessible a water point is, the more likely it is to be valued, protected, and sustained by its users.

In terms of management variables, communication systems ($B = 0.367$, $p = .027$) and maintenance systems ($B = 0.585$, $p = .001$) were both significant predictors. This suggests that structured communication channels and regular maintenance procedures are essential for sustaining water facilities. Good communication likely facilitates the timely sharing of information regarding breakdowns, fee collections, and user responsibilities. Likewise, effective maintenance systems ensure that problems are addressed before they escalate, preserving the functionality of the infrastructure. These findings underline the importance of not just the physical components of water systems but also the organizational structures that support their continued operation.

On the other hand, affordability ($B = 0.198$, $p = .143$) and leadership ($B = 0.281$, $p = .130$) did not have statistically significant effects in the regression model, despite showing positive correlations with sustainability. This may be due to overlapping effects with other predictors or the possibility that their influence is more indirect. For instance, strong leadership may influence sustainability

through its impact on communication or maintenance systems rather than directly. Likewise, affordability may not vary widely among respondents or may be mitigated by community coping strategies. These findings can inform policy and programmatic efforts aimed at improving the sustainability of water services, especially in rural or under-resourced settings.

4.1 Accessibility

4.1.1 Water facilities

The presence and condition of water infrastructure significantly influence sustainability. A strong majority strongly agreed that the water projects had essential facilities such as water pumps powered by sustainable energy (173 responses), storage and distribution tanks (134), and water points (119). Agreement levels across these indicators reflect a community that largely acknowledges the presence of key infrastructure.

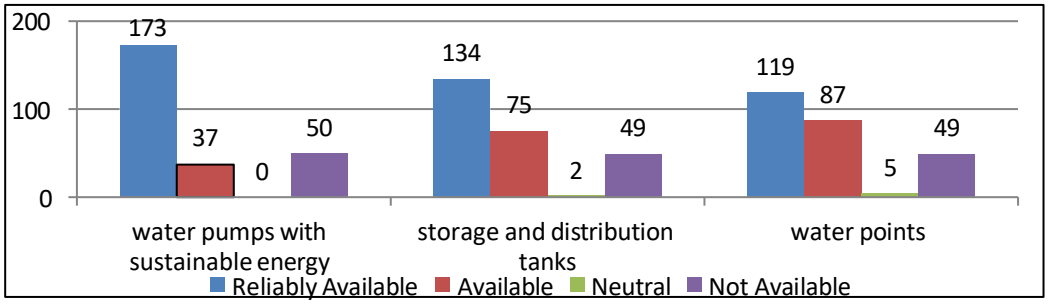

Figure 1: Water facility availability in the study area

There was high indication of availability of key infrastructure where: 173 respondents strongly pointed-out water pumps with sustainable energy as available, 134 pointing storage tanks, and 119 pointing water points. However, 18.5% indicated storage tanks to being difficult to access, and 18.5% with dissatisfied access to water points.

In terms of access to these facilities, 41.2% found storage and distribution tanks easy to access, and 36.9% found them very easy. However, 18.5% still found access difficult, suggesting room for improvement in design or location. Similarly, 33.8% were very satisfied and 43.5% satisfied with water point access, while 18.5% were dissatisfied, echoing a consistent minority that faces infrastructure-related challenges.

The presence of essential infrastructure aligns with positive community perceptions of facility availability. As (Mpora et al., 2023) report, many boreholes and water points fail due to technical breakdowns and poor

maintenance. The positive responses here suggest stronger infrastructure performance, though the minority expressing dissatisfaction highlights ongoing distribution or design issues. The literature further emphasizes the importance of robust and equitable infrastructure. (Ali, 2025) and (Adeenze-kangah, 2022) caution that even when infrastructure exists, poor location distribution leads to disparities in access. Additionally, the satisfaction gap in facility accessibility suggests potential social or environmental barriers possibly terrain, congestion, or vandalism, as noted by (Mpora et al., 2023).

From a sustainability perspective, this reinforces the need for continual investment in inclusive, durable infrastructure, regular assessment of functionality, and community engagement in planning. It also highlights the value of hybrid systems (e.g., rainwater harvesting), as proposed by (Chukwu, 2015).

4.1.2 Distance

Distance to water sources plays a critical role in water access and project sustainability. The majority of respondents (58.1%) reported living within 100–400 meters of a water source, which is considered a favourable distance. Only 0.4% indicated living over 1 kilometre away, while 18.5% were within 100 meters. However, 23.1% were unsure, suggesting potential gaps in awareness or variability in water source placement.

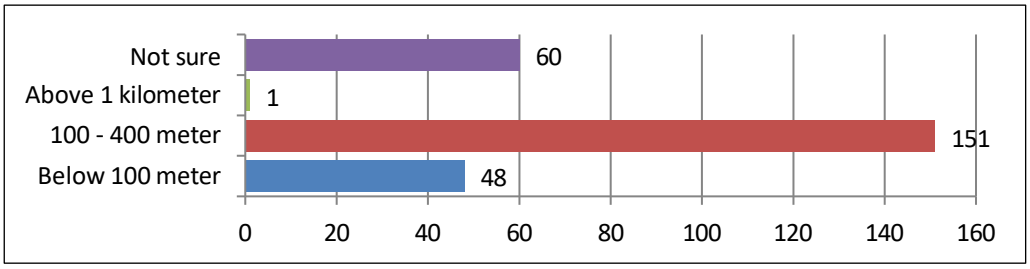

Figure 0: Distance of community member's accessibility of water services

Most respondents (58.1%) reported living 100–400 meters from a water source, and 61.2% accessed water within 5–10 minutes. Furthermore, 79.3% agreed or strongly agreed that water access was generally convenient in terms of distance and time.

The favourable proximity of water sources supports the literature emphasizing the importance of strategic location planning. According to (Access et al., 2024) and (Al-hamawi et al., 2025), closer distances reduce system strain and maintenance costs while enhancing user satisfaction and system longevity.

(Access et al., 2024) and (Mazancov, 2021) add that longer distances discourage user engagement and ownership, which are crucial for sustainability.

The data confirms these insights, suggesting that the majority of community members enjoy reasonable access. However, the 18.5% who reported challenges signal the presence of location inequalities. This aligns with (Opoku et al., 2024), who argue that sustainability hinges on aligning infrastructure layout with population needs. To enhance sustainability, water projects must continue prioritizing equitable placement and consider mobile or decentralized systems in harder-to-reach areas.

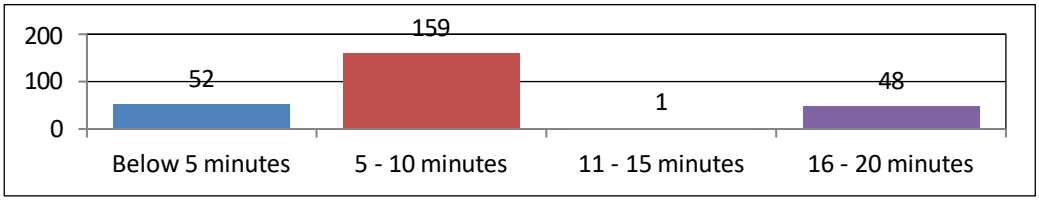

Figure 1: Time spent by the community members for accessing water services to the availability of water project

Overall, 41.2% of respondents strongly agreed and 38.1% agreed that the time and distance to access water are acceptable. However, 18.5% disagreed, suggesting there are still some gaps in coverage.

Short travel distances and minimal time spent fetching water are strong indicators of good access and significantly contribute to the sustainability of water projects. They reduce labour burden, especially on women and children, and encourage regular use. Nonetheless, efforts should continue to expand access to underserved areas to ensure inclusivity.

4.1.3 Affordability

The affordability of water services is a significant determinant of sustainability. Regarding the affordability of user fees, a majority of respondents either strongly agreed (21.9%) or agreed (44.6%) that the fees were affordable. However, a notable 21.2% disagreed, and 11.9% remained neutral. This indicates that while most community members find water services reasonably priced, a substantial minority experiences affordability challenge.

Table 2: Affordability

No.		Strong agree		Agree		Neutral		Disagree		Strong disagree		Total
		f	%	f	%	f	%	f	%	f	%	
1	Water service fees are affordable	57	21.9	116	44.6	31	11.9	55	21.2	1	0.4	260
2	Water services connection fees are affordable	1	0.4	61	23.5	109	41.9	81	31.2	8	3.1	260
3	Overall Water Supply Services are affordability	8	3.1	79	30.4	98	37.7	74	28.5	1	0.4	260

The data reveals a subtle perception of affordability in water services. While 66.5% of respondents (strongly agree and agree) found user fees affordable, only 23.9% found connection fees affordable. Additionally, overall affordability drew a more divided response, with 33.5% finding it affordable and 28.9% finding it unaffordable, while 37.7% remained neutral.

Affordability remains a foundational pillar of sustainability in water projects, especially in low-income settings. According to (Ugulumu et al., 2025), when fees exceed community affordability, the result is decreased usage, reduced revenue for maintenance, and eventual system failure. This is evident in the data, where significant neutrality and disagreement reflect financial constraints or inconsistent pricing models. The findings align with (Opoku et al., 2024) and (Avidar, 2024), who highlight that affordability challenges often stem from poor financial planning and weak governance structures.

The relatively high percentage of respondent's neutral response on overall affordability may indicate a lack of transparency or variability in costs. Therefore, addressing affordability requires not only pricing reforms but also community engagement in setting tariffs, subsidization for vulnerable groups, and improved financial governance. Consistent with the theory of sustainability, economic viability through cost-effective financing mechanisms is essential for long-term resilience.

4.2 Management Systems

4.2.1 Leadership Systems

Leadership emerged as strength in sustaining water services. A significant 40.4% strongly agreed and an equal number agreed that the organizational structure

ensured effective service delivery. Similar agreement levels were seen in assessments of water project leaders and association committees, with around 40% each strongly agreeing and agreeing.

Table 4: Leadership Systems

Sn				1 Strong agree	2 Agree	3 Neutral	4 Disagree	5 Strong disagree	Total
3	Leadership system in sustainability of water projects	Organization structure in ensuring the effectiveness of water services accessibility to the community	f	105	105	2	48	0	260
			%	40.4	40.4	0.8	18.5	0	100
		Water project leaders in ensuring the effectiveness of water services accessibility to the community	f	104	106	2	48	0	260
			%	40	40.8	0.8	18.5	0	100
		Water association committee with committee members ensure the effectiveness of water services accessibility to the community		99	103	10	48	0	260
				38.1	39.6	3.8	18.5	0	100

Leadership scored highly in all metrics. About 80% of respondents agreed or strongly agreed that organizational structures and leadership committees were effective in ensuring service accessibility.

These findings support the extensive literature on the central role of leadership in sustainable water management.(Bazaanah, 2019) argue that democratic and participatory leadership fosters accountability and trust both of which appear present here. (Journal et al., 2021) and (George-williams et al., 2024) further emphasize that effective leadership enhances stakeholder engagement, integrates adaptive strategies, and supports long-term planning.

While 18.5% of respondents disagreed, this could reflect localized dissatisfaction or exclusion from decision-making processes. It aligns with (Access et al., 2024), who note that coordination failures and lack of managerial support often hinder sustainability, even where leadership structures exist.

The positive perceptions indicate a strong foundation for long-term water

governance. However, leaders must continue to facilitate inclusive participation, support capacity building, and coordinate with external institutions to overcome systemic constraints.

Conclusively, the integration of community data with literature underscores that affordability, proximity, infrastructure quality, maintenance practices, communication systems, and leadership structures are all critical to the sustainability of water projects. The data suggests that while accessibility and leadership are strong, communication systems represent a significant weakness. These findings affirm the importance of the sustainability theory, which advocates for a balance of environmental, economic, and social dimensions. Sustainable water systems require more than infrastructure they require inclusive governance, adaptive leadership, ongoing investment, and community stewardship. Addressing weak points such as affordability and communication will be key to ensuring water project longevity in Mufindi and similar regions.

4.2.2 Communication Systems

Communication within water projects showed weaker performance. Only 2.7% strongly agreed and 3.1% agreed that communication systems were in place, whereas a significant 73.1% were neutral, and 20.8% disagreed. Similarly, the effectiveness of information sharing methods was affirmed by just 6.5%, while 61.5% remained neutral and 31.5% disagreed.

Table 5: Communication Systems

Sn				1	2	3	4	5	
				Strong agree	Agree	Neutral	Disagree	Strong disagree	Total
2	Communication systems of water projects	Availability of communication systems in the available water project	f	7	8	190	54	1	260
			%	2.7	3.1	73.1	20.8	0.4	100
		Effectiveness of means of sharing information in the available water project	f	7	10	160	82	1	260
			%	2.7	3.8	61.5	31.5	0.4	100
		Community meeting serve the means of sharing information about the available project	f	18	155	28	58	1	260
			%	6.9	59.6	10.8	22.3	0.4	100

Only 5.8% of respondents positively rated the availability of communication systems. A staggering 73.1% were neutral on their presence, and 31.5% disagreed

on their effectiveness. However, community meetings were seen more favourably, with 59.6% agreeing they are used for information-sharing.

This finding illustrates a critical weakness in sustainability infrastructure. As (Everard et al., 2024) and (Woldesenbet, 2020) argue, poor communication undermines transparency, accountability, and stakeholder involvement. (Bhattarai et al., 2025) emphasize that in the absence of timely updates such as about tariffs or supply interruptions trust deteriorates, weakening user cooperation and oversight.

Though community meetings provide a platform for engagement, they may be insufficient as standalone communication tools. The findings suggest the need for diversified, culturally sensitive channels such as local radio, mobile alerts, and notice boards as proposed by (Raimi et al., 2022). The limited perception of communication systems highlights institutional fragmentation, reinforcing (Al-hamawi et al., 2025) call for integrated governance frameworks.
Addressing communication gaps is essential not only for accountability but also for fostering adaptive, resilient management practices over time.

4.2.3 Maintenance Systems

Maintenance is crucial for long-term functionality of water projects. The availability of a maintenance system was strongly affirmed by 25.4% and agreed by 52.3% of respondents. Likewise, regular maintenance received 23.1% strong agreement and 54.2% agreement. The availability of sufficient storage and distribution facilities also showed similar positive responses.

Table 6: Maintenance Systems

Sn				1	2	3	4	5	
				Strong agree	Agree	Neutral	Disagree	Strong disagree	Total
1	Maintenance systems of water projects	Availability of maintenance system in the available water project	f	66	136	10	48	0	260
			%	25.4	52.3	3.8	18.5	0	100
		Regular maintenance of water facilities in the available water project	f	60	141	11	48	0	260
			%	23.1	54.2	4.2	18.5	0	100
		Enough water storage and distribution facilities of available water project	f	58	141	13	48	0	260
			%	22.3	54.2	5	18.5	0	100

Respondents strongly affirmed the presence and regularity of maintenance systems, with over 75% agreeing or strongly agreeing that systems exist, maintenance is performed regularly, and storage facilities are sufficient.

These findings align well with sustainability best practices in the literature. (Kativhu et al., 2022) and (Kativhu et al., 2022) emphasize that consistent preventive maintenance is critical to system longevity. Similarly, (Everard et al., 2024) and (George-williams et al., 2024) stress that aging infrastructure without oversight rapidly deteriorates, leading to system failure and user frustration.

The community's perception of adequate maintenance suggests an effective operational model. However, sustainability also demands adaptability to growing population demands and environmental pressures, as pointed out by (Chinseu et al., 2022). Preventive maintenance must be complemented by financial planning, local capacity building, and integration of Water Point Committees or public-private partnerships (Thomson, 2021).

Thus, while the data shows strong performance in maintenance, ongoing investment in institutional capacity and infrastructure upgrades is necessary to ensure long-term functionality.

5.0 CONCLUSION

The findings of this study demonstrate that both physical accessibility and management systems significantly influence the sustainability of rural water facilities in Mufindi District. Among the accessibility factors, proximity to water sources and the presence of functional water infrastructure had the most substantial positive impact on sustainability. Management-related elements, particularly effective communication and maintenance systems, also emerged as crucial determinants of long-term service viability. Although leadership and affordability showed positive trends, they did not reach statistical significance in the regression model, suggesting their influence may be indirect or context-dependent. Overall, the study confirms that sustainable rural water service delivery requires integrated efforts that combine physical infrastructure with robust institutional and community-based governance.

5.1 Recommendations

The government should prioritize the location planning and equitable distribution of rural water infrastructure to minimize walking distances and reduce the abandonment of water points. It should also invest in capacity building for local leaders and technicians to enhance leadership quality and technical competence in water governance. Furthermore, the government should strengthen policy

enforcement mechanisms to support preventive maintenance and ensure accountability at all levels.

Water authorities must develop and implement structured maintenance schedules and ensure consistent availability of spare parts and trained personnel. Additionally, they should establish transparent and inclusive communication channels, such as community meetings and digital alerts, to inform users about service changes, breakdowns, or tariff adjustments. Integrating local knowledge into decision-making and involving water users in planning and monitoring will also help improve service reliability and sustainability.

Local communities should take an active role in safeguarding water infrastructure through the formation and support of Water Point Committees. Community members must engage in routine monitoring, contribute to minor repairs, and participate in training on water resource management. Enhancing community ownership and fostering a shared sense of responsibility will strengthen sustainability, reduce misuse, and improve the longevity of water systems.

By working collaboratively, these stakeholders can create a sustainable and resilient rural water supply system that meets present needs without compromising future access.

REFFERENCES

Access, O., Yasmin, R., Ullah, S., Afzal, A., & Javed, M. (2024). *Impacts of Community Participation on Sustainability of Rural Water Supply Sytems : A Study from District Lahore , Pakistan*. *5*(2), 85–97. https://doi.org/10.55737/qjss.679534402

Adaka, V., & Mugambi, M. (2018). *Factors Influencing Sustainability Of Community Managed Rural Water Supply Projects In Pastoralist Areas Of Kenya . A Case Of Merti Sub County , Isiolo County Factors Influencing Sustainability Of Community Managed Rural Water Supply Projects In Pastoralist Areas Of Kenya . A Case Of Merti Sub County , Isiolo County*. *3*(1), 16–40.

Adeenze-kangah, H. A. (2022). *Maintenance of rural water supply facilities in the Builsa North District of the Upper East Region of Ghana*. *14*(1), 101–121.

Ahmed, M. F., Mokhtar, M. Bin, Lim, C. K., Wong, A., Hooi, K., & Lee, K. E. (2021). *Leadership Roles for Sustainable Development : The Case of a Malaysian Green Hotel*. 1–26.

Al-hamawi, H., Davies, P. A., & Mayouf, M. (2025). *Sustainability of Water , Sanitation , and Hygiene (WASH) in Post-Emergency Contexts : A*

Conceptual Framework. 1–20.

Ali, H. O. (2025). *Advancing integrated water resources management approaches for the sustainability of small dams in arid and semi-arid regions : A case study of the Um Dafoug dam in South Darfur State , Sudan*. *17*(1), 1–16. https://doi.org/10.5897/IJWREE2024.1082

Avidar, O. (2024). A holistic framework for evaluating and planning sustainable rural drinking water projects in sub-Saharan Africa. *Journal of Rural Studies*, *107*(December 2022), 103243. https://doi.org/10.1016/j.jrurstud.2024.103243

Bazaanah, P. (2019). *Review of Social Sciences Sustainability of Rural Communities Drinking Water Systems and Local Development Projects in the Bole , West and*. *04*(01), 16–36.

Bhattarai, S. K., Devkota, P., Joshi, G. K., & Neupane, U. (2025). *Assessing User Committees ' Effectiveness in Infrastructure Projects : A Case of Palungtar Municipality , Nepal Using Exploratory Factor Analysis*. *4*(1), 132–143.

Chidubem, E., Anthony, N., Nwamaka, D., & Chidimma, L. (2024). *Seasonal Variation and Antibiotic Susceptibility Patterns of Bacteriological Parameters in Groundwater Sources in Oyi LGA , Anambra State , Nigeria*. *24*(5), 40–55.

Chinseu, E. L., Dougill, A. J., Stringer, L. C., Chinseu, E. L., Dougill, A. J., Stringer, L. C., & Dougill, A. J. (2022). *Strengthening Conservation Agriculture innovation systems in sub-Saharan Africa : lessons from a stakeholder analysis sub-Saharan Africa : lessons from a stakeholder analysis*. https://doi.org/10.1080/14735903.2021.1911511

Chukwu, K. E. (2015). Water Supply Management Policy in Nigeria : Challenges in the Wetland Area of Niger Delta. *11*(26), 303–323.

Elisante, E., & Muzuka, A. N. N. (2017). Occurrence of nitrate in Tanzanian groundwater aquifers : A review. *Applied Water Science*, 71–87. https://doi.org/10.1007/s13201-015-0269-z

Everard, M., Rajput, J., Rane, N. L., Salem, A., & Elbeltagi, A. (2024). *Protecting ancient water harvesting technologies in India : strategies for climate adaptation and sustainable development with global lessons*. *August*. https://doi.org/10.3389/frwa.2024.1441365

George-williams, H. E. M., Hunt, D. V. L., & Rogers, C. D. F. (2024). *Sustainable Water Infrastructure : Visions and Options for Sub-Saharan Africa*.

Greenwood, E. E. (2024). *Effect of using safely managed drinking water services on child diarrhoea*.

Journal, A. I., Eaton, W. M., Brasier, K. J., Burbach, M. E., Whitmer, W., Engle, E. W., Burnham, M., Quimby, B., Kumar, A., Whitley, H., Delozier, J., Fowler, L. B., Wutich, A., Bausch, J. C., Beresford, M., Hinrichs, C. C.,

Burkhart-kriesel, C., Preisendanz, H. E., Williams, C., … Watson, J. (2021). A Conceptual Framework for Social , Behavioral , and Environmental Change through Stakeholder Engagement in Water Resource Management A Conceptual Framework for Social , Behavioral , and Environmental Change through Stakeholder Engagement in Water Resource Management. *Society & Natural Resources*, *34*(8), 1111–1132. https://doi.org/10.1080/08941920.2021.1936717

Kassanga, E., & Lekule, C. (2021). *East African Journal of Education Studies Effectiveness of Non- Governmental Organisations ' Activities in Basic Education in Supporting School Dropped Out Girls in Shinyanga Region , Tanzania*. *3*(1), 14–25. https://doi.org/10.37284/eajes.3.1.269.IEEE

Kativhu, T., Madzivanyika, T. T., Nunu, W. N., & Macherera, M. (2022). *Sustainability of water facilities under community based management in Zimbabwe*. *71*(1), 19–30. https://doi.org/10.2166/aqua.2021.089

Khatri, B. K. (2025). *(A Case Study of Dharachaur Drinking Water and Sanitation User Committee) Impactful Activities of User Committee*. *7*(1), 14–22.

Mazancov, J. (2021). *Barriers to Water Access in Rural Communities : Examining the Factors Influencing Water Source Choice.*

Mpora, V., Turyamureba, R., & Mpairwe, A. (2023). *Community Participation and Sustainability of Community Based Water Projects in Mbarara City North Division*. *10*, 32–56.

Muyambo, F., Belle, J., & Sebastian, Y. (2022). *Climate-Change-Induced Weather Events and Implications for Urban Water Resource Management in the Free State Province of South Africa*. *2019.*

Oduor, J. O. (2019). *Influence of Community Participation in Project Life Cycle Management on Sustainability of Rural Piped Water Supply Projects- a Case of Alego Sub-county, Siaya County, Kenya*.

Olohunfemi, K. O., & Mansur, W. (2025). *SUSTAINABILITY ANALYSIS OF COMMUNITY- BASED RURAL WATER SUPPLY INITIATIVES IN KWARA STATE , NIGERIA*. *12*(10), 34–61.

Opoku, O. A., Sampson, L. E., & Aboagye, R. O. (2024). *Access and Sustainability of Water Point Sources in Sekyere Kumawu District*. 59–74.

Projects, S. H., & Besnier, J. R. (2021). *The correlation between poverty , water quality , community health , and education in Guatemala and Tanzania*.

Raimi, O. M., Ezekwe, C. I., Bowale, A., & Samson, T. K. (2022). *Hydrogeochemical and Multivariate Statistical Techniques to Trace the Sources of Ground Water Contaminants and Affecting Factors of Groundwater Pollution in an Oil and Gas Producing Wetland in Rivers State , Nigeria*. *6*, 166–202. https://doi.org/10.4236/ojogas.2022.73010

Scott, C. A., Zilio, M. I., Harmon, T., Teran, A. Z., Caravantes, R. D., Hoyos, N.,

Perillo, G. M. E., Meza, F., Varady, R. G., Neto, A. R., Velez, M. I., Martín, F., Piccolo, M. C., Mussetta, P., Montenegro, S., Rusak, J. A., & Pineda, N. (2020). Jo ur l P re of. *Environmental Development*, 100606. https://doi.org/10.1016/j.envdev.2020.100606

Shemer, H., Wald, S., & Semiat, R. (2023). *Challenges and Solutions for Global Water Scarcity*.

Steven Mzilangwe, E., González-Rojo, E., Lindkvist, M., Goicolea, I., Kaaya, S., & Kyungu Nkulu Kalengayi, F. (2025). Sexual Violence Against University Students in Sub-Saharan Africa: A Scoping Review. In *Trauma, Violence, and Abuse*. SAGE Publications Ltd. https://doi.org/10.1177/15248380251320980

Thomson, P. (2021). *Remote monitoring of rural water systems : A pathway to improved performance and sustainability ? November 2020*, 1–14. https://doi.org/10.1002/wat2.1502

UUnited Nations (2015). Transforming our world: the 2030 Agenda for Sustainable Development.

United Nations (2019). Progress on household drinking water, sanitation and hygiene.gulumu, E., Macha, L., & Fuime, S. (2025). *No Title*. *26*(1).

United Republic of Tanzania, (2013). Iringa Rural District council socio-economic profile 2013.

World Bank (2021). Financing for water supply, sanitation and hygiene to wards a sustainable future

Wehn, U., Vallejo, B., Seijger, C., Tlhagale, M., Amorsi, N., Kossi, S., Genthe, B., Marie, J., & Onema, K. (2021). Strengthening the knowledge base to face the impacts of climate change on water resources in Africa : A social innovation perspective. *Environmental Science and Policy*, *116*, 292–300. https://doi.org/10.1016/j.envsci.2020.09.026

Woldesenbet, W. G. (2020). Analyzing multi - stakeholder collaborative governance practices in urban water projects in Addis Ababa City : procedures , priorities , and structures. *Applied Water Science*, *10*(1), 1–19. https://doi.org/10.1007/s13201-019-1137-z

Yap, C., Mcfarlane, C., Ndezi, T., Makoba, F. D., & Yap, C. (2023). *Sanitation challenges in Dar es Salaam : the potential of Simplified Sewerage Systems*. *35*(1), 12–29. https://doi.org/10.1177/09562478221146722