

Rainwater Harvesting and Community Engagement: A Path to Sustainable Livelihoods in East Gonja District, Ghana

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ABSTRACT

Water, an indispensable element for life's inception and continuity, is confronted with significant challenges as a primary resource. This paper assessed the influence of community participation on sustainable rainwater harvesting tanks for improved livelihood within Presbyterian Agricultural Services -Mile 7 (PAS-Mile 7) in the East Gonja District of Ghana. This research employed a mixed-methods approach using a cross-sectional descriptive survey. A sample of 50 respondents was selected from five communities within the study area using simple random and purposive sampling techniques within the estimated population of 24,628. The paper revealed high community involvement in the planning and implementation phases, with a composite mean score of 4.73 and 4.64, respectively. However, participation in monitoring and evaluation was moderate, with a composite mean score of 3.26, highlighting a critical gap in the project's lifecycle. The findings again revealed that all communities within the study's catchment areas are prepared to support the project to ensure their sustainability. This paper recommends that PAS-North conduct workshops and training sessions in monitoring and evaluation where participation seems moderate or lower compared to other project phases to build the capacity and empower project participants. The paper concluded that comprehensive community involvement throughout all project phases is essential for achieving sustainable outcomes.

Keywords: Community engagement, Community participation, Harvesting tank, Rainwater, Sustainability,

INTRODUCTION

Water, covering two-thirds of the Earth's surface and constituting 75% of the human body, is crucial for sustaining life (Oduor, 2019). Despite its abundance, water is globally imperilled, particularly in rural areas where sustainable water supply is challenging due to limited community involvement, high costs, and inadequate infrastructure maintenance. This concern has sparked discussions among scholars and development partners about sustainable development. Goal six of the UN's Sustainable Development Goals (SDGs) aims to ensure the availability and sustainable management of water and sanitation for all (Oduor, 2019). In Sub-Saharan Africa, rural communities face severe challenges due to restricted access to potable water, impacting health and human development (Joint Monitoring Programme, 2017).

Water scarcity leads to significant health and human development issues, resulting in an estimated 1.6 million deaths annually due to diseases linked to inadequate potable water, poor sanitation, and hygiene issues (Oino et al., 2015). Water scarcity occurs when collective demands significantly affect supply or quality, making it challenging to meet all sectors' needs, including the environment. Factors contributing to water shortages include climate change-induced weather patterns like droughts or floods, increased pollution, human consumption, and overexploitation of water resources. These factors expose rural communities to considerable hardships, especially during dry periods (Oino et al., 2015).

Sustainability of water projects is intricately tied to the accessibility of improved water sources. Community participation is fundamental for ensuring the enduring viability of rural water supply initiatives. Scholars emphasize that integrating community participation within project life cycle management enhances resource utilization, meets community needs, and fosters sustainability (Oduor, 2019). Over the past three decades,

there has been a focus on community participation, highlighting its benefits in project efficiency and collective community strength (Marks et al., 2014).

The UN Secretary-General, in a report updating progress on Agenda 2030 for sustainable development, emphasized the critical role of local community participation in managing water resources (United Nations, 2017). Afrobarometer data collected across 34 African countries revealed that, on average, 44% of Africa's population lacks access to safe drinking water (Bentley et al., 2015). In Malawi, it was observed that half of the rural piped water systems aged between 3 to 26 years were poorly operating due to weak management and regulatory oversights (Oduor, 2019). Siaya County, largely rural, faces significant water shortages. With 89.2% of the population living in rural areas, higher than the national average, only 36% of its population uses improved water sources, and just 6.6% have access to piped water (Ornit, 2019). This situation underscores the urgent need for sustainable water projects and enhanced community participation.

Perkins and Zimmerman's empowerment theory (1995) explains how marginalized individuals gain control over their decisions, leading to favourable outcomes. Empowerment enables individuals to address critical issues collaboratively, achieving shared goals. Professionals working with communities should adopt an empowering approach, acting as facilitators and engaging with the community's culture and challenges. This theory highlights the importance of active, self-motivated community involvement for sustainability (Perkins & Zimmerman, 1995).

The issue warranting this paper is the persistent water scarcity and inadequate access to sustainable water sources in rural areas, particularly in the Jantong Traditional Area in the Savannah Region of Ghana. This scarcity poses significant challenges to health, livelihoods, and overall human development. This paper aims to address the sustainability challenges of water projects by exploring the role of community participation in the Rainwater Harvesting for Livelihoods initiative in the East Gonja District. It seeks to understand how community involvement can enhance the planning, implementation, and monitoring of water projects, ensuring their long-term viability and improving local livelihoods.

LITERATURE REVIEW

Conceptual Review

Community participation is a dynamic process involving inclusive engagement in decision-making, planning, implementation, and evaluation. It is viewed not only as a democratic right but also as a strategic tool for effective and sustainable development. As Phologane (2014) and Shetunyenga (2023) argue, active participation helps tailor development initiatives to meet specific local needs and improves project outcomes. In the planning phase, participation ensures innovation and relevance (De Nisa, 2024), while in implementation, it fosters a sense of ownership crucial for sustainability.

Shetunyenga (2024) underscores the importance of involving communities in evaluations to promote transparency, accountability, and long-term success. Evaluation also promotes learning and capacity-building, making future development efforts more effective. Moreover, community participation is linked with good governance as it promotes transparency, equity, and social inclusion. However, Bosworth et al. (2018) caution that communities need adequate training and education to engage meaningfully in these processes, especially vulnerable groups. Without appropriate skills and guidance, participation may be symbolic rather than substantive.

Community participation must be intentional, inclusive, and continuous. According to Shetunyenga (2024), positioning communities as the primary actors and decision-makers enhances ownership, responsibility, and long-term commitment to projects. Raising awareness, building capacity, and enabling equitable engagement are essential to strengthening local governance and ensuring lasting impact.

Theoretical Review: Participatory Development Theory underpins the central idea that communities should actively engage in the processes that shape their development. It posits that local people must be involved in decision-making, planning, implementation, and evaluation to ensure effective and sustainable development.

Moallemi et al. (2020) and Islam (2014) assert that such participation makes public decisions more legitimate and reflective of community needs and values. Mansuri and Rao (2013) emphasize that participatory approaches contribute to poverty alleviation, effective service delivery, and stronger governance systems by placing communities at the center of development efforts.

Development Communication Theory supports the notion that communication is a catalyst for social transformation. In the context of community development, it facilitates dialogue, education, awareness, and shared understanding between stakeholders. Aga et al. (2018) highlight that communication enhances local capacity to manage projects and address community needs. Schwartz and Schejter (2024) add that participatory communication can empower individuals to shape their collective realities, reinforcing inclusivity and democratic governance.

Empowerment Theory aligns with both Participatory and Development Communication Theories. It posits that development must enhance individuals' and communities' ability to influence decisions that affect their lives. Empowerment entails increasing community members' control over resources and project processes. According to Obar et al. (2018), true empowerment requires active involvement in all project phases, thus planning, implementation, and evaluation to develop skills, foster ownership, and build confidence in addressing development challenges. Empowerment is also essential to reduce dependency on external actors and promote self-reliant communities.

Empirical Review

Empirical evidence consistently shows that sustained community participation leads to better development outcomes. Mahama and Badu-Nyarko (2014) observed that development projects rooted in local engagement, such as the Community and Social Development Project (CSDP) in Ghana, tend to have higher success and sustainability rates. In contrast, top-down approaches often fail due to a disconnect between project goals and community realities.

Mutua and Gakuu (2014) provide a compelling case from the Takete-Ide Community in Kogi State, Nigeria, where participatory development led to measurable community improvements. The initiative empowered residents, enhanced collective action, and ensured long-term maintenance of facilities. Similarly, Macdonald (2021) emphasizes that sustainability is enhanced when communities participate throughout all stages of development, from planning and implementation to monitoring and evaluation.

In Ghana, abandoned projects in rural communities are frequently linked to inadequate participation. This finding supports the argument that meaningful involvement fosters ownership, aligns development with local priorities, and reduces dependency on external support. Macdonald (2021) also stresses that while community engagement is vital, success often depends on enabling conditions such as supportive policies, institutional frameworks, and capacity-building initiatives.

In conclusion, the literature demonstrates that community participation is fundamental to sustainable development. Theoretical perspectives, particularly Empowerment Theory, Participatory Development Theory, and Development Communication Theory, offer a robust foundation for understanding the role of participation in shaping community outcomes. Conceptually, participation spans all project stages and must be inclusive and empowering. Empirical studies from Ghana, Nigeria, and beyond affirm that participatory approaches lead to improved sustainability, governance, and community well-being. Therefore, ensuring community empowerment through skills development, inclusive communication, and shared decision-making is essential for achieving long-term, people-centered development.

Brief Description of Rainwater Harvesting Tanks Project Study Area

The project seeks to increase access to potable water in the Jantong Traditional Area of the East Gonja District of the Savannah Region of Ghana. The objective of the project was to improve access to clean drinking water for 623 families in the Jantong Traditional Area through the construction of 20 rain harvesting units (each unit comprising 6m long gutters and 30,000-litre capacity rain harvesting tank) for 8 communities. Six rainwater

harvesting tanks of 30,000L capacity each were constructed in Vagyili (1 tank), Sakpalua (1 tank) and Buhija (4 tanks). These communities can be located on the beneficiary communities' map, as seen in Figure 1.



Figure 1: Communities for Rainwater Harvest Project

Source: Author's Construct

METHODOLOGY

Research Design

The study employed a mixed-methods approach, integrating qualitative data from interviews and observations with five purposively selected experts, analyzed thematically, and quantitative data from structured questionnaires administered to 50 randomly selected respondents across the five purposively chosen communities. The study utilized a multi-stage sampling technique, combining purposive selection and simple random sampling. This technique ensured fair representation and minimized bias. Quantitative data was analyzed using SPSS.

Target Population

This study focused on the Jantong Traditional Area in the East Gonja District of the Savannah Region, which has a total population of 39,404 (Ghana Statistical Service, 2021). Five out of eight communities were purposively selected based on accessibility and relevance. As exact population data for each community was unavailable, the population of the selected communities was estimated at 24,628, assuming an even distribution. Participants included a programme manager, field officers, and household heads, chosen because they are key decision-makers in their homes.

Sample Size and Sampling Technique

The research employed simple random sampling for a community-based survey within the five selected communities. Following Nichols (2000), who suggests a sample size of 50 -100 for larger studies, the researcher chose 50 participants, including household heads and community members over 18, with 10 respondents from each community. In-depth interviews were conducted with a purposively selected programme manager, two field officers, and two opinion leaders chosen for their extensive knowledge of community development projects.

Table 1: Number of Respondents Interviewed

Number of Respondents	Interview
Program Manager	1
Field officers	2
Opinion leaders	2
Total	5

Source: Fieldwork, 2024

Sources of Data Collection

The paper aimed to achieve its objective by collecting primary and secondary data through mixed-method research. Information was gathered using questionnaires, interviews, and observations. Questionnaires were physically administered, and both structured and semi-structured face-to-face interviews were conducted to collect qualitative and quantitative data.

Data Analysis

Qualitative data was gathered through interviews and observations, which were carefully documented in field notebooks and digital recordings. This data was transcribed, compiled, and analyzed using thematic analysis to identify patterns. Quantitative data was obtained through closed-ended questions, with responses recorded by the interviewer. This data was refined, coded, and input into SPSS software version 24. The analysis included descriptive statistics such as frequency, mean, standard deviation, t-test, and percentages, with the results presented in tables.

RESULTS AND DISCUSSION

Distribution of Respondents by Gender

Results show that 31(62%) of respondents were male and 19 (38%) were female, as depicted in Figure 1. This gender distribution is attributed to men traditionally heading households in the selected communities. Project implementers likely targeted more men than women, aligning with cultural norms where men are viewed as the heads of households.

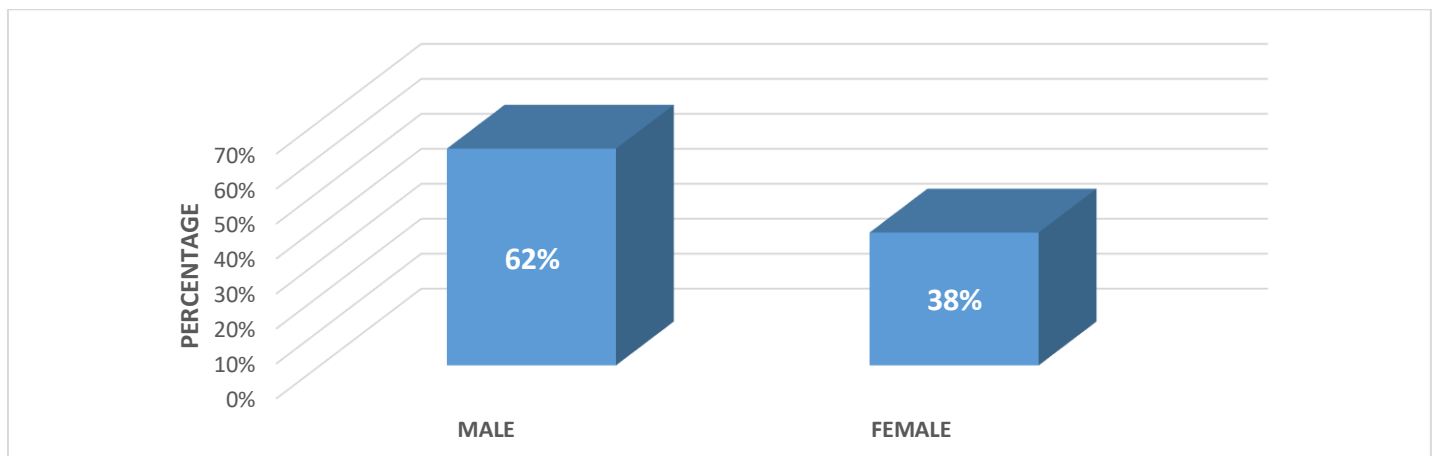


Figure 1: Gender distribution of respondents

Source: Fieldwork, 2024

Educational Background of Respondents

The level of education influences a person's attitude, perception, and understanding of social issues, affecting their participation in development projects (Hassan et al., 2019). The highest frequency of respondents, 43 (86%), had no formal education, while 3 (6%) and 4 (8%) had Junior High School and Senior High School education, respectively. Higher education levels correlate with better understanding and dissemination of project information within the community. Education is crucial for social, economic, and political inclusion (National Human Development Report (NHDR), 2001). Therefore, the implementing organization should enhance educational efforts about the project to ensure community acceptance and active contribution. Figure 2 shows the gender and educational level of respondents.

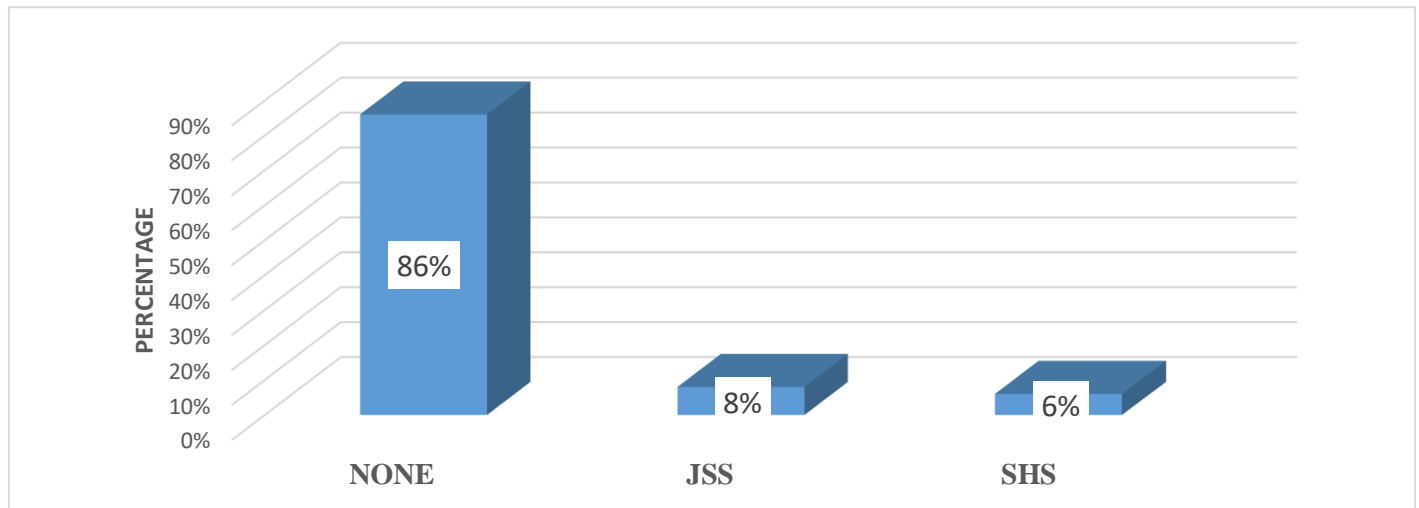


Figure 2: Educational level of respondents

Source: Fieldwork, 2024

Respondents Occupation

Figure 3 indicates that respondents mentioned six different occupations, with some having more than one. The majority, 43 (86%), were farmers. Additionally, 4 (8%) were involved in business, and 3 (6%) were unemployed. The rest included business people, the unemployed, and a student.

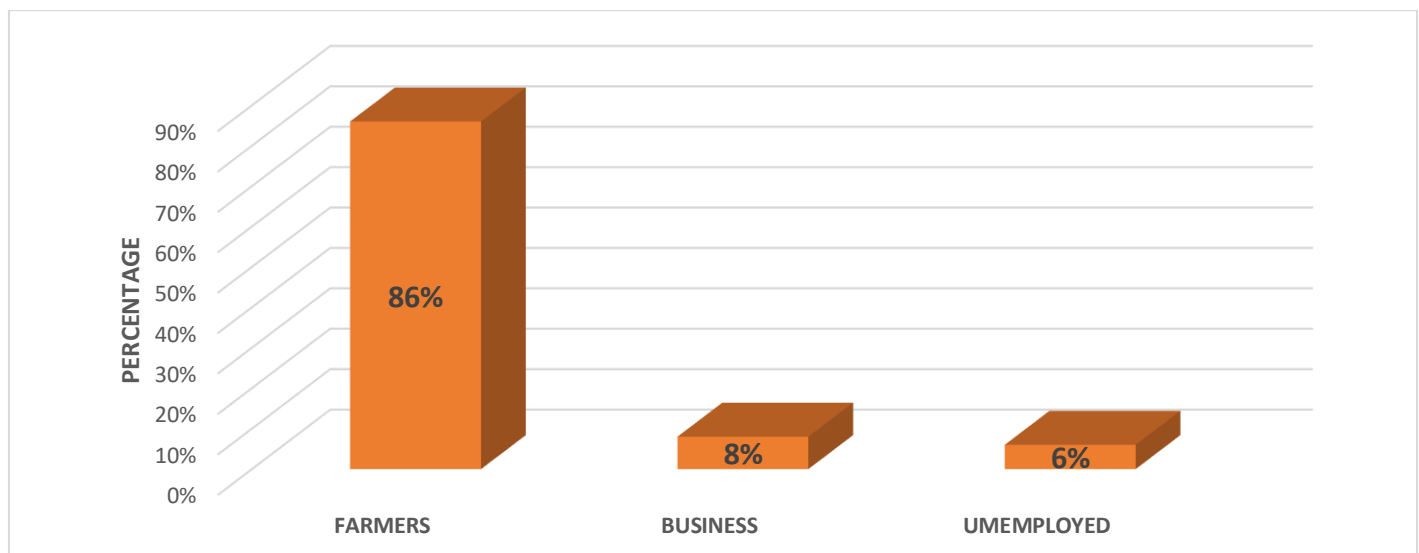


Figure 3: Occupation of respondents

Source: Fieldwork, 2024

Age of Respondents

Respondents were divided into age groups: 25 - 40 years (54%), 40 - 60 years (36%), and 18 - 25 years (10%) (Figure 4). This aligns with Miseda (2014), who found the 25-40 age group predominant due to their high activity levels, technological adeptness, and quick learning abilities.

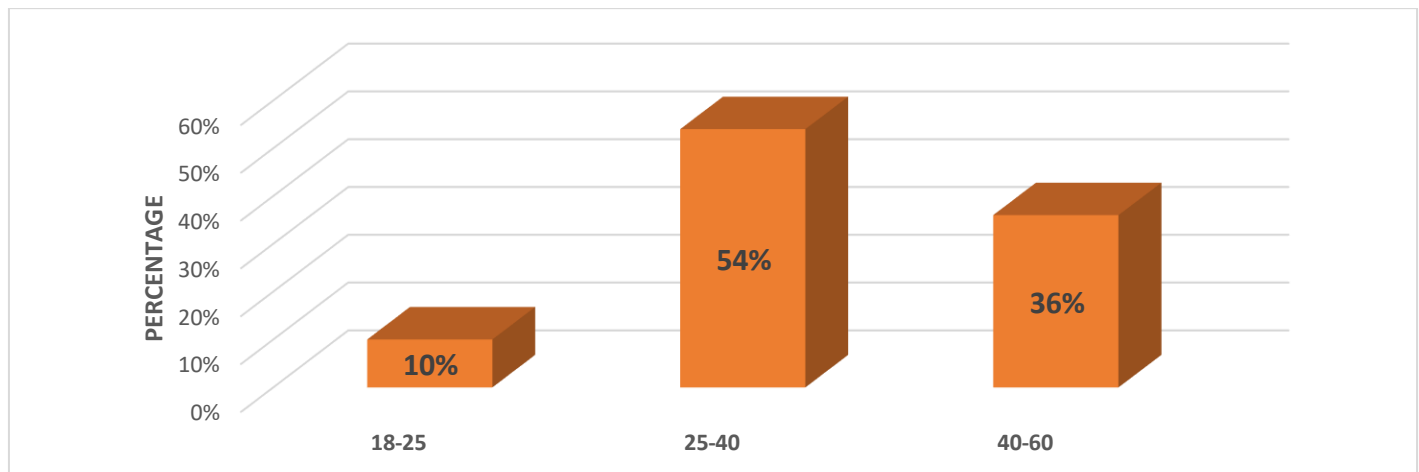


Figure 4: Age of Respondents and Occupation

Source: Fieldwork, 2024

In terms of planning the warehousing facility, the survey results revealed that none of the respondents selected the options 'Not at all' or 'Little extent' for any of the survey items. According to Table 2, the statement 'I participated in labour provision' had a mean score of 4.74 (SD=0.52; $t=7.11$), indicating a very great extent of participation in the project among the respondents. The program manager noted that:

“Contributing resources foster a sense of communal ownership of the project. The community's contributions may take the form of fetching water, cooking for the workers, and households working in turns while the project is being planned. In the Buhija community, the chief fueled his tractor to fetch water for the construction. A setting like that and community backing would make the sustainability of a project easier” (Mile 7 Programme manager).

The respondents showed a high level of involvement in the project, as reflected by an average score of 4.70 (SD = 0.51; $t = 6.86$) for the statement 'I was involved in the determination of the labour type required.' Similarly, the statement 'I was involved in tank siting decision making' had a mean score of 4.76 (SD = 0.52; $t = .52$), indicating significant participation in project planning. The composite mean of 4.73 confirms that participants were greatly involved in the planning process. The p-value indicates a significant relationship between the extent of participation and planning, suggesting that the agreement level among the sample is representative of the population. These findings support Zimmerman's (2000) assertion that empowerment and effective communication promote participation and group decision-making, thereby improving community quality of life.

Again, in the implementation of the warehousing facility, the mean score of 4.54 (SD = 0.61; $t = 3.80$) for the statement 'I participated in the election of committee members' suggests that the respondents, in general, participated to a very great extent in the project. In addition, one of the field officers remarked that:

“All the five communities elected dedicated members to form the WASH committees to facilitate the management of the water systems in each community” (field officer)

The average score of 4.66 (SD = 0.69; $t = 4.62$) for the statement 'I participated in deciding on women's inclusion in the management committee' shows a very great extent of participation among respondents. This finding contrasts with the study by Nguyen et al. (2019), which found women's engagement to be counterproductive due to their lack of vocal participation in meetings. The survey revealed that 16 members

were elected to the WASH committee, including 10 women and 6 men from each community, contradicting Leder's (2017) findings that women had fewer opportunities to participate in projects compared to men. Additionally, the statement 'I participated in training on how to maintain rainwater tanks' had a mean score of 4.72 (SD = 0.54; $t = 76.72$), indicating significant involvement in project planning. A WASH committee member stated:

“We were trained on how to manage the facilities by ensuring a clean environment around the tanks and dams, especially around fetching points. We were again trained on how to maintain the tanks and treat water from the dug-outs. The training was done by the North-East Gonja District Water and Sanitation Team (DWST)”.

With a composite mean of 4.64, it can be inferred that the participants were extensively involved in the implementation process to a very great extent. The p-value in Table 2 below confirms a significant relationship between the extent of participation in implementation.

Table 2: Extent of Community Participation in Planning, Implementation and Monitoring and Evaluation of Rainwater Harvesting Tank Project by PAS-Mile 7

Participation Aspect	Statement	Mean	SD	t-test	p-value
Planning	I participated in labour provision	4.74	0.52	7.11	0
	I was involved in the determination of the labour type required	4.7	0.51	6.86	0
	I was involved in tank-sitting decision-making	4.76	0.52	7.52	0.001
	Composite Mean	4.73	0.52		
Implementation	I participated in the election of committee members	4.54	0.61	3.8	0
	I participated in deciding on women's inclusion in the management committee	4.66	0.69	4.62	0
	I participated in training on how to maintain rainwater tanks	4.72	0.54	6.72	0
	Composite Mean	4.64	0.61		
Monitoring & Evaluation	I participated in project monitoring	3.36	1.16	-5.19	0
	I was involved in reporting leakages to the committee	3.22	1.13	-6.19	0
	I attended M&E meetings by the WASH committee	3.2	1.21	-5.89	0
	Composite Mean	3.26	1.17		

Scale: Not at all (NA)=1, Little Extent (LE) = 2, Moderate Extent (ME) =3, Great Extent (GE) =4, and Very Great Extent (VE) =5

Source: Fieldwork, 2024

In addition, in terms of monitoring and evaluation, the mean score of 3.36 (SD = 1.16; $t = -5.19$) for the statement " I participated in project monitoring " suggests that, overall, the respondents participated to a

moderate extent in the project. From the survey, a respondent from one household where a tank is sited remarked that:

‘The community members participated in the monitoring of the project for example in case there is a breakdown; the community members then alert the WASH committee for immediate attention’

Similarly, the average score of 3.22(SD = 1.13; $t = -6.19$) for the statement " I was involved in reporting leakages to the committee " indicates a moderate extent of respondent involvement. However, one respondent interviewed disclosed that there were delays in repairing the broken systems.

“The community participates in the monitoring of the rainwater harvesting tanks, for example in case there are underground cracks and leakages; the community members alert the WASH committee leader. However, breakages and leaks from rainwater harvesting tanks took longer time to be repaired, thus contributing to wastage and consequently affecting the sustainability of the water project.”

When analysing the respondents' agreement scores for the statement " I attended o M&E meetings by WASH committee," we found a mean score of 3.20 (SD = 1.21; $t = -5.89$), underscoring a moderate extent to which participants were engaged in project monitoring and evaluation. The composite means of 3.26 also reinforces the notion that participants were, to a moderate extent, involved in planning. The p-value in the table above indicates a noteworthy relationship between the level of participation and monitoring and evaluation. Additionally, the p-value suggests that the agreement level of the sample does not significantly deviate from the population.

RECOMMENDATIONS

As such, it is recommended that PAS-North expands training and engagement opportunities in M&E to empower communities with essential skills in sustainable project management. This commitment to community-led water management aligns with global sustainability goals and is critical for reducing the vulnerability of rural areas to water scarcity, ultimately contributing to improved health, economic stability, and social cohesion within these communities.

CONCLUSION

This paper illustrates the critical role that active community participation plays in the planning, implementation, and partial monitoring of rainwater harvesting projects for sustainable livelihoods. Evidence suggests that when communities are deeply involved in decision-making, project siting, and resource mobilization, there is a strong foundation for the sustainability of these initiatives. However, the study also highlights a notable gap in monitoring and evaluation (M&E) participation, indicating that sustainability could be further strengthened by greater community involvement in M&E processes. The statistical significance observed in the relationship between community participation and successful project outcomes underscores the importance of community-driven approaches. This approach not only fosters a sense of ownership but also enhances the project's adaptability to local needs and strengthens the participant's commitment to the long-term viability of water resources.

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