

The Performance of Small-Town Water Systems in the Upper West Region of Ghana

Patrick Aaniamenga Bowan

Department of Civil Engineering,
Dr. Hilla Limann Technical University, Wa, Upper West Region, Ghana

Adams Duma Amin

Community Water and Sanitation Agency,
Wa East District, Funsu Water System, Upper West Region, Ghana

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Abstract

Small-town water systems are supply systems designed mainly for residents in rural or peri-urban areas in many developing countries. This study investigated the performance of small-town water systems in the Upper West Region (UWR) of Ghana, focusing on functionality, management practices, and sustainability issues. It used an exploratory research design and combined both qualitative and quantitative methods, including surveys and interviews with water users, system operators, and officials from the Community Water and Sanitation Agency (CWSA). Results showed that although most small-town water systems were operational, they functioned below optimal levels, with overall coverage remaining under 3% across all selected districts. Major technical problems included frequent pump failures (46%), pipe leakages (22%), and unreliable power supply (16%). More than half of the system operators lacked sufficient training, and community involvement in water management was rare, as control was predominantly centralised within the CWSA. The study recommends adopting solar-powered mechanised water systems to minimise power-related disruptions, along with a comprehensive approach to water system management that encompasses technical efficiency, financial accountability, strong institutional collaboration, and inclusive community ownership to ensure sustainability and the optimal performance of

small-town water systems in the UWR and similar systems in other developing countries.

Keywords: Water Systems, Systems Performance, Water Supply, Pump Failure, Pipe Leakages, Systems Functionality

Introduction

Access to clean and reliable drinking water is a fundamental human right and a vital part of improving life and promoting sustainability. Unfortunately, over two billion people worldwide still face challenges in accessing safe drinking water, particularly in rural regions of sub-Saharan Africa (Matchawe et al., 2022; Nyika & Dinka, 2023). According to the World Health Organisation (WHO) and United Nations Children’s Fund (UNICEF) Joint Monitoring Programme (JMP) for Water Supply, Sanitation and Hygiene 2023 update, 27% of the global population (2.2 billion people) lacked “safely managed drinking water,” 43% of the global population (3.5 billion people) lacked “safely managed sanitation,” and 25% of the global population (2.0 billion people) did not have access to a handwashing facility with soap and water at home.

Consequently, small town water systems, which are water supply setups mainly designed for people living in rural areas or small towns near cities (peri-urban areas), are used to supply water in many developing countries. Small towns are settlements that are large and dense enough to benefit from the economies of scale offered by piped systems, but too small and dispersed to be managed efficiently by a conventional urban water utility (Yap et al., 2023). They require formal management arrangements, a legal basis for ownership and management, and the capacity to expand to meet growing water demand (Pointet, 2022). Typically, small towns have populations between 5,000 and 50,000, although they can be larger or smaller (Vilcea et al., 2024). Common types of small water systems include hand-pumped boreholes, which allow people to manually extract underground water, rainwater harvesting systems that collect and store rainwater for later use, small piped-water networks serving a single village or area, and solar-powered boreholes that utilise sunlight to pump water from underground. These systems are particularly useful because they are simple to operate and perform well even in remote areas with limited resources.

Measuring the performance of small water systems involves evaluating both technical and non-technical factors. Therefore, one of the most important indicators is functionality, which indicates whether the water system is active at the time of inspection (Zulkifli et al., 2022). A functional system guarantees that pumps, taps, and other infrastructure are in proper working order and that water flows without long interruptions. Another key measure of small water

system performance is the service level provided to users, including the amount of water available per person each day, the distance to the water source, and the overall reliability of supply (Odjegba et al., 2023). A higher service level means people can access sufficient water near their homes and depend on the system to operate consistently, without frequent breakdowns.

Water quality is also a vital performance indicator, focusing on whether the water supplied is safe for human consumption (Perveen & Amar-Ul-Haque, 2023). This is typically assessed through laboratory testing for microbiological contaminants, such as *Escherichia coli*, and chemical pollutants, including arsenic, fluoride, and nitrates, as maintaining good water quality is essential for safeguarding public health and preventing waterborne diseases. The sustainability of a small water system is another important aspect of performance measurement. Sustainability refers to the system's ability to continue functioning effectively over time, considering financial, technical, and institutional factors (Farghali et al., 2023; Martínez-Peláez et al., 2023). Financial sustainability depends on the availability of adequate funds for maintenance and repairs, while technical sustainability relates to the availability of spare parts and skilled technicians, and institutional sustainability requires a competent management structure to oversee operations. Alongside these core indicators, other measures commonly used to evaluate small water system performance include community satisfaction, the ability to recover operational costs through user fees, and the speed at which faults are repaired (Sukma & Leelasantitham, 2022; Zhang et al., 2024). These metrics offer a broader understanding of how well the system meets user needs and how efficiently it is managed.

Despite these established benchmarks, many small water systems fail to meet even basic performance standards. A study in Ghana found that numerous systems suffer from frequent technical breakdowns, delayed repairs, and inadequate maintenance regimes, which undermine both reliability and long-term sustainability (Mantey et al., 2024). These challenges highlight the need for stronger management practices, better funding mechanisms, and improved maintenance strategies to ensure consistent service delivery. Small-town water systems in Ghana, primarily managed by the CWSA, provide piped water to rural and peri-urban communities, with over 500 small-town piped schemes in operation as of 2021. These systems often utilise groundwater, using boreholes powered by solar or electric pumps, managed by local Water and Sanitation Management Teams (WSMTs). The Upper West Region (UWR) was the first region to commence the CWSA reform programme by incrementally participating in the management of Small Towns Piped Water Supply Systems (STPWSSs). The region piloted its reform programme on Lawra, Nandom, Tumu, Jirapa and Gwollu Water Systems in July 2017. Following the success of the pilot programme, the region scaled up

its direct management to cover eleven (11) additional STPWSSs, namely, Kpong, Busa, Manwe, Goripie, Wechiau, Kaleo, Nadowli, Daffiama, Lambussie, Hamile-Happa and Funsu Water Systems (Community Water and Sanitation Agency, 2023).

Therefore, this study investigates the performance of small-town water systems in the UWR, Ghana. Aside from Wa, the regional capital of the UWR, small-town water sources such as boreholes with hand pumps, mechanised wells, and small piped networks are the primary sources of water supply for the other towns and villages in the UWR. While some of these systems function reliably, many do not. Frequent breakdowns, seasonal water shortages, and poor maintenance often leave communities without safe water for extended periods. This situation poses serious health risks and disrupts daily life, especially for women and children, who are typically responsible for collecting water. Although many studies have examined the challenges faced by rural water systems in Ghana (Angmor et al., 2024; Boasinke & Braimah, 2022), most focus on the country as a whole or highlight broad national trends. Consequently, there is limited research that examines the performance of small-town water systems in the UWR in detail, considering the region's unique social, economic, environmental, and institutional contexts. Without such a local perspective, understanding the specific issues affecting small water systems in this part of the country remains challenging. This study aims to fill this gap and contribute to improving public health, enhancing water quality, and increasing the sustainability of small-town water infrastructure in Ghana and other developing nations. The findings are expected to offer actionable insights to inform policy decisions, strengthen monitoring systems, and promote more sustainable management of small water systems.

1.0 Methods

2.1 The study Area

The study was carried out in the UWR of Ghana, where most residents live in rural communities and mainly depend on small-town water systems for their water supply. The UWR of Ghana includes 22 STPWSS that rely on groundwater, serving communities typically with populations between 2,000 and 50,000. Since 2017, these systems have been managed primarily by the CWSA to provide sustainable, potable water, despite facing issues such as poor maintenance, financial mismanagement, and climate-induced shortages. The STPWSS in the UWR are illustrated in Figure 1.

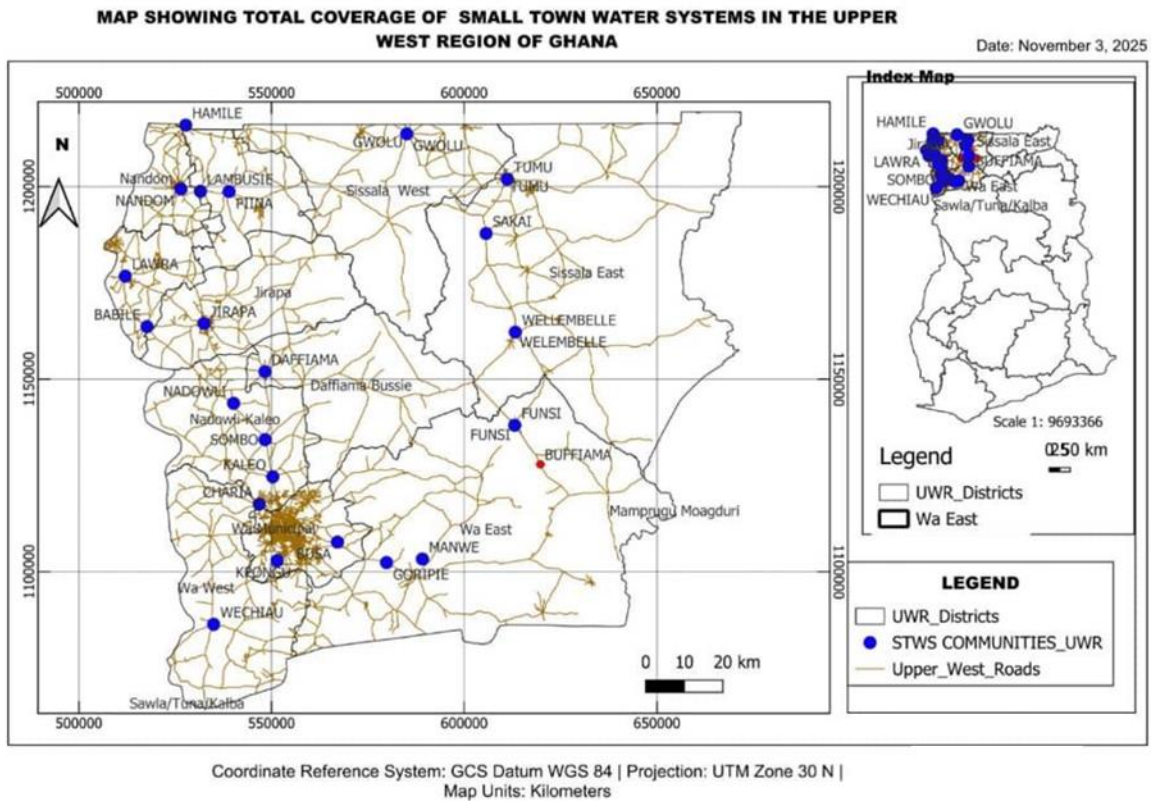


Figure 1: STPWSS in the UWR managed by the CWSA

2.2 Research Design, Data Collection, and Analysis

The study adopted an exploratory research design and employed both qualitative and quantitative methods. Additionally, the study used stratified random sampling to select the water systems, as shown in Table 1. The water systems were initially categorised based on location, type of system, and whether they were functioning well, partly functioning, or not functioning at all. Systems from each category were then randomly selected for the study. Subsequently, six water systems were chosen: the Nandom system in the Nandom Municipal Assembly, the Kaleo system in the Nadowli District, the Funsi system in the Wa East District, the Wellembelle system in the Sissala East District, the Gwollu system in the Sissala West District, and the Guropie system in the Wa East District. Within the communities served by these water systems, households were randomly sampled for a questionnaire survey, using simple random sampling. Simple random sampling is a probability sampling method where every member of the population (households) has an equal chance of being selected. Accordingly, due to randomisation, this method often yields high internal and external validity (Chassang & Kapon, 2022).

Focus group discussions and interviews were also conducted with stakeholders, including members of water user associations, system operators, members of the water and sanitation committee, district water officers, officials from CWSA, and non-governmental organisations (NGOs) operating in the water sector. The study population consisted of two hundred (200) water users and twenty-five (25) stakeholders, comprising system operators, members of water and sanitation committees, district water officers, CWSA officials, and NGOs. All the studied water systems had four stakeholders each, depending on those stakeholders who participated in the focus group discussion, except for the Nandom water system, where the researcher got five stakeholders for the focus group discussion. These groups were chosen because they play vital roles in the provision, operation, and management of small water systems, and their insights were essential for understanding both the technical and institutional factors affecting system performance.

Table 1: STPWSS Strata for the Data Collection

Status of STPWSS		
Functioning Well	Partly Functioning	Not Functioning at All
➤ Tumu	➤ Wellembele*	➤ Gwollu*
➤ Lawra	➤ Kpongu	➤ Pina
➤ Nadowli	➤ Chairia	➤ Sombo
➤ Nandom*	➤ Busa	➤ Sakia
➤ Jirapa	➤ Dafama	➤ Manwie
➤ Hamile	➤ Lambusie	➤ Guropie*
➤ Babelli	➤ Funsi*	
➤ Wechiau		
➤ Kaleo*		

*Selected water systems for the study

The data for the study were collected using a questionnaire and interviews. The questions focused on whether the water systems were operational, their reliability, the level of users' trust in water quality, the frequency of breakdowns, and overall user satisfaction. To validate the research instrument, all questions with scales were tested for reliability using Cronbach's Alpha. An alpha value of at least 0.700 is deemed acceptable, as it indicates the internal consistency of the instrument in measuring the same constructs (Mazhar et al., 2021). Additionally, focus group discussions were held with key stakeholders such as system operators and water vendors. Key informant interviews involved water committee members, CWSA officials, and NGOs, providing deeper insights into management practices, financial challenges, and institutional arrangements of the water systems. The quantitative data were analysed with the Statistical Package for Social Sciences (SPSS) software version 24.0, and the results were presented through descriptive statistics, including percentages and charts. Furthermore, ethical considerations were thoroughly addressed. Participation was voluntary, and

participants were informed of the study's purpose before consenting to take part.

2.0 Results

This section highlights community opinions on access, availability, safety, and the management of water systems, along with officials' views on technical challenges, funding, and policy support. By comparing community responses with those of officials, this section offers a clear understanding of the strengths and weaknesses of the studied water systems and identifies areas needing improvement for sustainable management.

3.1 Preliminary Analysis

Cronbach's Alpha measures internal consistency, showing how well a set of items fits together, with values from 0 to 1. Higher values mean greater reliability, with a common threshold of 0.70 or above. The construct "small town water systems performance in the UWR" has a Cronbach's Alpha of 0.82. This exceeds the 0.70 threshold, indicating acceptable reliability. This suggests that the variables used to evaluate the performance of small-town water systems in the UWR are reasonably consistent, although there is potential for improvement in the scale's design or item selection.

3.2 Demographic Information of Respondents

The majority of respondents were female (80.5%), while males accounted for 19.5%. This was a significant finding because in many rural communities, women are the primary users and managers of household water. They are typically responsible for fetching, storing, and using water for domestic purposes such as cooking, washing, and sanitation. Therefore, their higher representation in this survey ensured that the findings captured the perspectives of those who were most directly involved in water-related activities.

Regarding the age distribution of the respondents, the largest group was within the 21–30 years range (36%), as shown in Figure 2. This age group is typically active in both household and community responsibilities, which means their perspectives offered valuable insights into the functioning and management of the water systems. Conversely, only a small number of respondents (2%) were between 16 and 20 years of age, indicating limited participation from younger individuals, possibly because they were still at school or less involved in household water responsibilities. Overall, the age distribution suggests that the study reflected the views of the most active working-age population, who are directly affected by water challenges and likely to be involved in community water management activities.

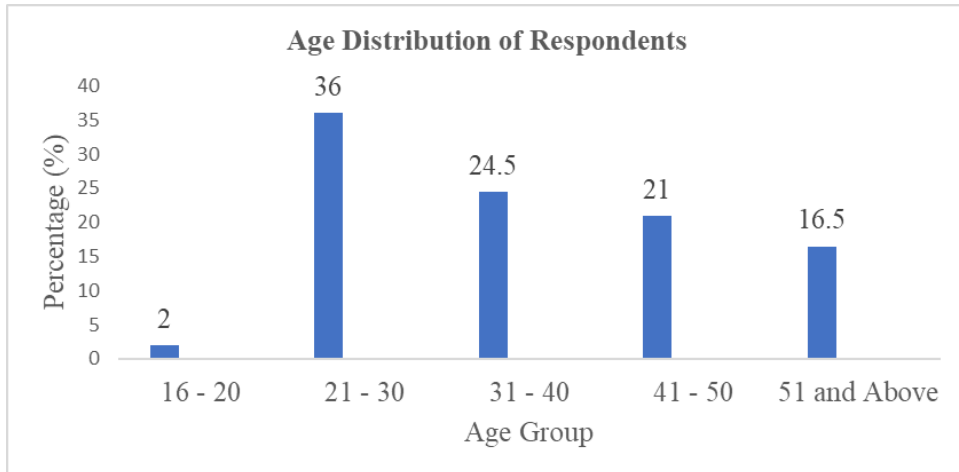


Figure 2: Age Distribution of the Respondents

3.3 The Performance of the Small-Town Water Systems in the UWR

3.3.1 Officials' Rating of the Functionality of the Water Systems

The responses from officials regarding the assessed water systems' functionality showed varying performance levels, as depicted in Figure 3. Most respondents (48%) rated the water systems as fair because they experienced intermittent operation, frequent breakdowns, or inadequate water supply to meet community needs. In comparison, 20% of respondents rated the systems as poor. Overall, the findings indicated that most small water systems in the UWR were operational but not optimal. The prevalence of “fair” ratings emphasises the need for improved maintenance, better technical support, and stronger management practices to enhance performance and ensure sustainable water service delivery. Consequently, many small-town water systems face premature failure within a 10-year design period, requiring significant capital maintenance that can cost six times more than regular, ongoing upkeep (Palash Chandra, 2026).

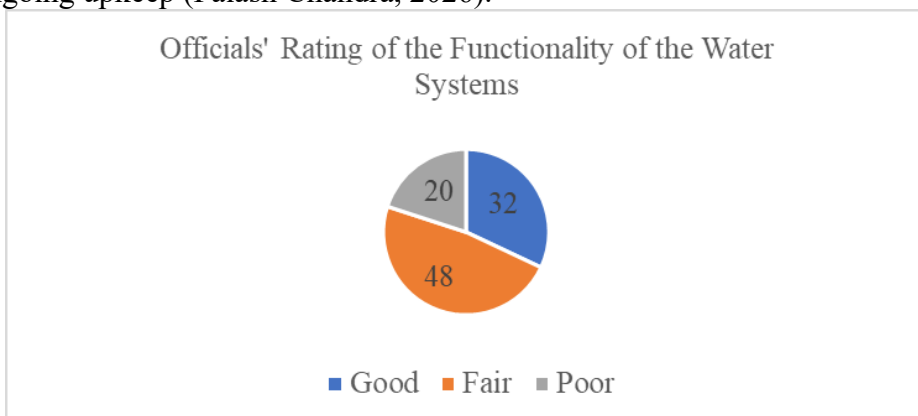


Figure 3: Rating of the Water Systems Functionality

3.3.2 *Water Users' Satisfaction with the Water Systems*

The evaluation of small-town water systems by water users offers valuable insights into user satisfaction. As shown in Figure 4, most respondents (77.0%) indicated that they were dissatisfied with their water system's performance. Only 13.5% expressed satisfaction, with a very small proportion, 1.5%, reporting being very satisfied with the water systems' functioning. The findings suggest that water users' satisfaction was generally low. The widespread dissatisfaction among water users could be attributed to ongoing issues such as irregular water supply, frequent breakdowns, poor water quality, and inadequate coverage.

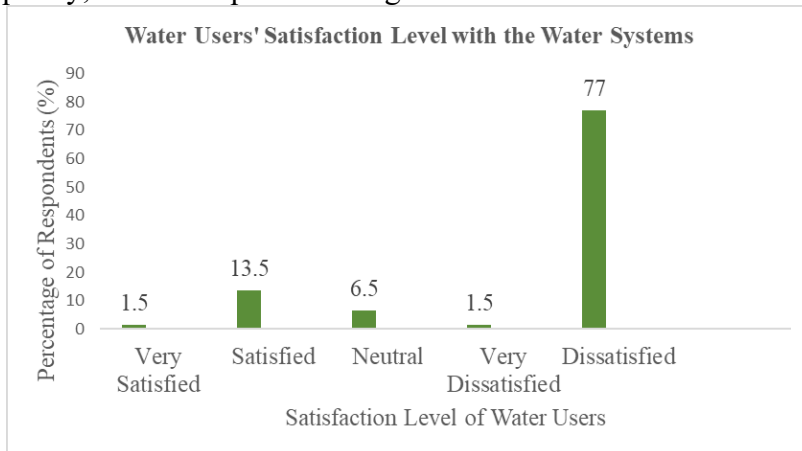


Figure 4: Water Users' Satisfaction Level with the Water Systems' Functionality

The low satisfaction with the functionality of water systems is supported by other researchers who observed that water users' satisfaction with small-town water systems is generally mixed. It is often characterised by high appreciation for the improved convenience of having a local source, but also accompanied by significant dissatisfaction regarding water quality, reliability, and maintenance (Kosoe et al., 2025; Osumanu et al., 2022). This highlights the need for improved maintenance, effective management, and regular monitoring to enhance service delivery and meet community water needs in the UWR.

3.3.3 *Coverage of Water Supply from the Water Systems*

The assessment of small-town water systems across the six selected districts in the UWR showed that coverage levels are generally low, with notable differences in functionality among the districts. Overall, the findings indicated that the coverage of water distribution from small-town water systems across the districts was very low, below 3% in each of the study districts. Although all the studied districts have more than 130 communities, only the Wa East District, with 148 communities, had four communities with

small-town water systems (2.7% district-wide coverage); the remaining districts had three or fewer communities with small-town water systems. Furthermore, the high rate of non-functionality among existing systems remains a significant obstacle to achieving fair water access. However, an official of the CWSA, through an informal interview, revealed that “*the coverage of water in the districts has increased significantly in recent times due to donor-supported projects installing piped systems, leading to over 27 small-town systems in the UWR*”. Despite this, there is a need for strategic actions, including rehabilitating non-functional systems, expanding water infrastructure to underserved communities, and strengthening management and maintenance mechanisms to improve the long-term sustainability of water systems in the UWR.

3.4 Sustainability Challenges of the Small-Town Water Systems

3.4.1 Technical Challenges

Officials and staff of NGOs were presented with five technical challenges of the water systems (pump failure, pipe leakages, electricity/power problems, inadequate storage reservoirs, and water quality concerns) to identify which were more prominent. The most common technical issue facing small-town water systems was pump failure, with 48% of the respondents reporting this as the main challenge in the UWR, as shown in Figure 5. This indicates frequent breakdowns of pumping equipment, often leading to service disruptions and higher maintenance costs. The second most reported problem was pipe leakage, with 32% of respondents citing it as a challenge, implying that ageing infrastructure and poor maintenance practices may contribute to significant water losses. Water quality concerns were the least reported technical issue, likely because borehole water is generally of good quality unless polluted by human activities.

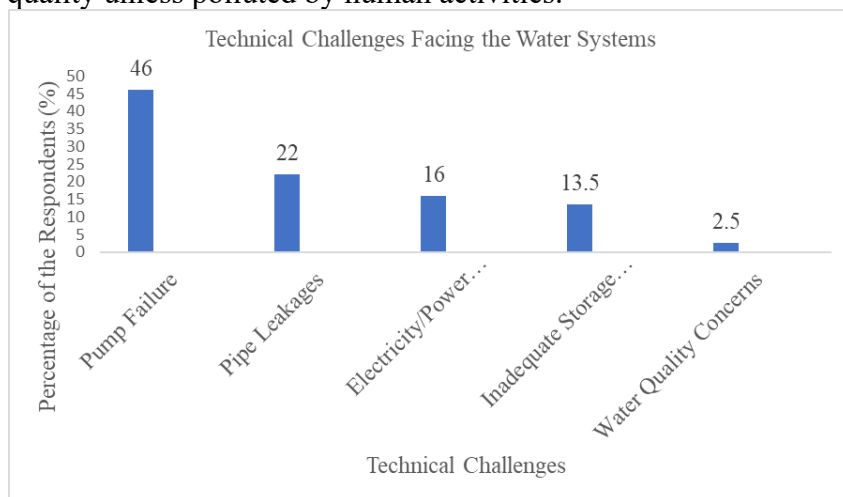


Figure 5: Technical Challenges Facing Small-Town Water Systems in the UWR

Many small-town networks depend on outdated, inefficient, or dilapidated pipes and equipment, and maintenance is often reactive rather than preventative, resulting in long downtimes and service disruptions when systems fail (Spoceter, 2023). Therefore, regular maintenance, technical training for local operators, and reliable power supply solutions or solar-powered water systems, alongside the timely replacement of ageing infrastructure, are vital for ensuring sustainable water service delivery in the UWR.

3.4.2 Technical Capacity of the Water Systems Officials

The study identified a significant gap in capacity building for those managing water systems. Over half of the officials (52%) reported that no training was provided to water committee members or system operators. This lack of training limited their ability to carry out effective maintenance, problem-solving, and long-term system management. However, 48% of water systems officials said they had received some training; many noted, however, that this training was irregular. Irregular training may impart some skills, but is insufficient to develop the technical expertise and management capacity needed for reliable and sustainable water service delivery. The technical capacity of small-town water system managers is a key factor in the sustainability of water supply systems, often hindered by limited resources, lack of specialised training, and reliance on reactive maintenance strategies (Angmor et al., 2024). Consequently, in many developing contexts, especially in rural Ghana, water management depends on Community Ownership and Management (COM) models, which often face challenges in technical oversight and maintenance.

3.4.3 Financial Challenges

The study revealed that financial constraints continue to pose significant challenges to the effective operation and maintenance of small-town water systems in the UWR. Most water system managers (48%) identified irregular payments by consumers as the most critical issue, as shown in Figure 6. This irregularity often leads to inadequate revenue generation, limiting the ability of management committees to fund repairs and operational expenses. Moreover, high repair costs (22%) were highlighted as another major challenge. The expense of spare parts and technical services makes it difficult for communities to maintain systems regularly, especially when revenues are irregular. Additionally, some respondents pointed out a lack of external funding, indicating limited financial support from government or development partners for system rehabilitation and expansion. Low tariff revenue was also emphasised, suggesting that current tariffs are often insufficient to cover operating costs.

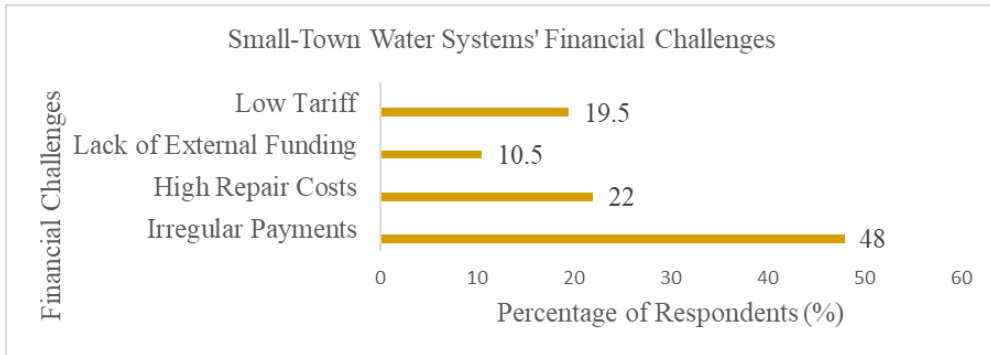


Figure 6: Financial Challenges facing Small-Town Water Systems in the UWR

Small-town water systems often face significant financial instability due to insufficient revenue, high costs of capital maintenance, and limited management capacity (Musiimenta et al., 2023). These systems deal with ageing infrastructure, low tariffs that do not cover operational costs, and over-reliance on unreliable donor funding.

3.5 Management of the Small-Town Water Systems

The study revealed that community participation in the management of small-town water systems was generally low. A majority of water users (56%) indicated that the communities were somewhat involved. In comparison, 36% stated that communities were not involved at all in managing the water systems, with only 8% of respondents reporting high levels of community involvement. Community involvement in small-town water systems, often structured as community-based management, is crucial for sustainable, locally appropriate water supply and sanitation, as it enhances accountability, fosters ownership, and utilises local knowledge for operation, maintenance, and, increasingly, water quality monitoring to ensure long-term resilience (Geremew et al., 2024; Machado et al., 2022). However, the role of communities in management, monitoring, and maintenance was limited. The moderate or low levels of participation may be attributed to weak institutional structures, lack of training, inadequate inclusion in decision-making, or a low sense of ownership among community members. To improve system performance and ensure sustainability, there is a need to strengthen community involvement through capacity building, awareness-raising, and the inclusion of local representatives in water management committees. Empowering communities to take active roles in planning, monitoring, and financial oversight can enhance ownership and ensure the long-term functionality of small-town water systems.

Regarding support from government and NGOs for small-town water systems, the study found that this was generally limited and inconsistent. The

most common form of assistance reported by the officials was financial support (28%), followed by training and capacity building (24%). Government and NGO support for small-town water systems, particularly in developing regions, focuses on funding infrastructure (boreholes, piped systems), technical assistance, and management capacity building (Dakyaga et al., 2023). Key initiatives include grants for solar-powered systems, rehabilitation of existing facilities, and the promotion of sustainable, community-led management models to ensure long-term, safe access to water.

Furthermore, the study indicated that the CWSA, the agency responsible for rural water supply, played the most prominent role in managing small-town water systems in the UWR, as 76% of respondents confirmed. This shows that management of most systems remained highly centralised, with limited delegation to community or local authorities. The dominance of CWSA in management may ensure some level of technical oversight; however, it can also restrict local ownership, accountability, and responsiveness to community-specific issues. The limited involvement of system operators and local authorities may lead to weak maintenance practices, slow responses to breakdowns, and low community participation, which ultimately undermine system sustainability.

3.6 Multinomial Logistic Regression Analysis on the Performance of the Water Systems

The study employed multinomial logistic regression analysis to investigate the relationship between the water systems' performance and the systems' functionality and sustainability drivers, as indicated in Table 3. The dependent variable categories were technical sustainability, with the nominal variables as pump failure, pipe leakage, electricity/power challenges, inadequate storage, and water quality issues; and financial sustainability, with the nominal variables as inadequate external funding, repair cost, and irregular payment. The Multinomial logistic regression is a classification method used to predict a nominal dependent variable with three or more unordered categories based on one or more independent predictor variables (Li et al., 2024). The multinomial logistic regression was highly appropriate for analysing the small-town water systems' performance because it effectively handled non-numeric, categorical, and nominal outcomes that define the systems' functionality (fully functioning and partially functioning). Unlike linear regression, it can model multiple, non-ordered choices or statuses, making it ideal for classifying water systems into performance categories. The analysis revealed that the partial water systems' performance was significantly predicted by decreased pipe leakages. Electricity/power challenges were more positive between the partial and peak water systems' performances. Pipe leakages and electricity/power problems also significantly distinguished peak

water systems performance, with the same direction of association as in the partial water systems performance. The model produced 21% of the variance of the water systems' performance in the UWR.

Table 3: Multinomial Logistic Regression Analysis of the Water Systems Performance

Variable	Partial Water Systems' Performance					Full Water Systems' Performance				
	B	SE B	p value	β	95% CI	B	SE B	p value	β	95% CI
Technical Sustainability										
<i>Pump Failure</i>	-1.551	2.324	0.505	0.122		-1.556	2.276	0.494	–	
<i>Pipe Leakages</i>	-0.001	0.000	0.003	0.999	0.998 – 1	-0.001	0.000	0.022	0.999	0.999 – 1
<i>Electricity/Power</i>	1.562	0.451	0.001	4.767	1.968 – 11.55	1.699	0.436	0.000	5.470	2.326– 12.86
<i>Inadequate Storage</i>	-0.027	0.589	0.963	0.973	0.307 – 3.08	0.233	0.580	0.688	1.262	0.405–3.93
<i>Water Quality</i>	-0.006	0.020	0.779	0.994	0.957–1.03	0.012	0.019	0.542	1.012	0.974– 1.05
Financial Sustainability										
<i>External Funding</i>	-0.724	1.364	0.596	0.485	0.033 – 7.03	0.925	1.341	0.490	2.522	0.182– 34.89
<i>Repair Cost</i>	-1.209	1.211	0.318	0.299	0.028– 3.2	-0.139	1.200	0.908	0.870	0.083– 9.14
<i>Irregular Payment</i>	-0.176	1.256	0.888	0.839	0.072–9.82	0.353	1.246	0.777	1.423	0.124– 16.35

B = Unstandardised regression coefficient; SE B = standard error of the coefficient;
 β = Standardised coefficient; Pseudo R2 Nagelkerke = 0.210, n = 225.

4.0 Discussion

The findings of the study indicated that most small-town water systems in the UWR were functional but operated below optimal levels. This aligns with Sharpe et al. (2022), who reported that nearly 25% of rural and small-town water systems in sub-Saharan Africa are non-functional at any given time due to technical breakdowns and poor maintenance structures. The predominance of “fair” functionality ratings in this study (48%) suggests that while systems are operational, they face intermittent interruptions and reduced efficiency, a trend also identified by Nyanyofio et al. (2022), who noted that inconsistent service delivery often stems from irregular preventive maintenance and inadequate funding mechanisms.

The high rate of pump failures (46%) and pipe leakages (22%) indicates ongoing technical challenges noted in previous research. ActionAid Ghana (2025) and Achum Adeenze-Kangah (2022) both underscored that frequent mechanical failures are usually caused by limited technical skills, poor access to spare parts, and weak local maintenance systems. Likewise, the instability of power supply (16%) reflects findings by Geremew et al. (2024) in Eastern Ethiopia, which highlighted the vulnerability of small-town systems to unreliable grid connections, emphasising the need for alternative energy sources such as solar power, as recommended in this study.

The study’s observation that over half of system operators had not received regular training aligns with Abubakari et al. (2025), who found that many WSMTs in Ghana lack the technical capacity to manage infrastructure sustainably. The absence of structured training programmes leads to prolonged system downtime and reliance on external technical support, as also reported by the (International Water and Sanitation Centre (IRC) Ghana, 2025). This

reinforces the argument by Powe et al. (2022) that the sustainability of small-town systems heavily depends on ongoing local capacity development and institutional support. Financial constraints are another major issue, consistent with findings by the Safe Water Network (2021) and Cannon et al. (2022), who noted that irregular tariff payments and high maintenance costs undermine cost recovery in community-managed water systems.

Low community participation in water management, reported by 56% of respondents, also aligns with the findings of Rijal (2023) and Abas et al. (2023), who observed that limited involvement in decision-making diminishes local ownership and accountability. When community participation is weak or symbolic, system maintenance declines, as noted by Abid et al. (2024). Conversely, studies by Mutanda & Nhamo (2024) show that inclusive participation, especially involving women, enhances system functionality, transparency, and long-term sustainability. This supports the present study's recommendation for gender-inclusive and participatory management practices.

The limited government and NGO support identified in this study reflects similar trends documented by (Ngochemmbo et al., 2025), who found that post-donor withdrawal often leaves systems without consistent oversight or funding. The finding that most management roles are dominated by the CWSA (76%) highlights the ongoing challenge of over-centralisation noted by Hamzah et al. (2026). This management model, while technically advantageous, often weakens local accountability and community ownership, a concern echoed by (Sofyani et al., 2022) with evidence from Indonesia, where they advocated for decentralisation and local empowerment.

Overall, the study's findings closely match prior literature, reaffirming that the sustainability of small-town water systems relies on a balanced mix of technical reliability, financial stability, institutional support, and community participation. Nonetheless, ongoing gaps in training, maintenance, and policy enforcement underline the need for systemic reforms that extend beyond infrastructure to include long-term governance and financial planning mechanisms.

Conclusion

This study assessed the performance of small-town water systems in the UWR of Ghana, focusing on their functionality, operational challenges, and management practices. It used an exploratory research design and combined qualitative and quantitative methods. The findings showed that, although most small-town water systems are operational, they operate below optimal levels. Coverage remains very low, under 3% in all selected districts. Major obstacles to consistent service delivery included frequent pump failures (46%), pipe leakages (22%), and unstable power supplies (16%). Additionally,

technical breakdowns, lack of spare parts, and poor maintenance practices were the most pressing issues. A lack of technical capacity was also evident, as over half of the operators and water committee members reported receiving no formal training. Financial difficulties, including irregular user payments (48%) and high repair costs (22%), further hinder the systems' ability to sustain operations. These results are consistent with previous studies emphasising that inadequate funding and limited technical support undermine rural water system performance. Moreover, management of most systems was overly centralised under the CWSA, with limited involvement from local authorities or community representatives, which reduced community ownership and responsiveness to local issues. To promote the long-term sustainability and optimal performance of small-town water systems in the UWR and similar systems in other developing countries, the study recommends a comprehensive approach that includes technical efficiency, financial accountability, robust institutional collaboration, and inclusive community ownership. The authors acknowledge that excluding technical data such as water production figures, pumping rates, system downtime statistics, hydraulic performance, and water loss or leakage measurements is a limitation of this research.

Conflict of Interest: The authors reported no conflict of interest.

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