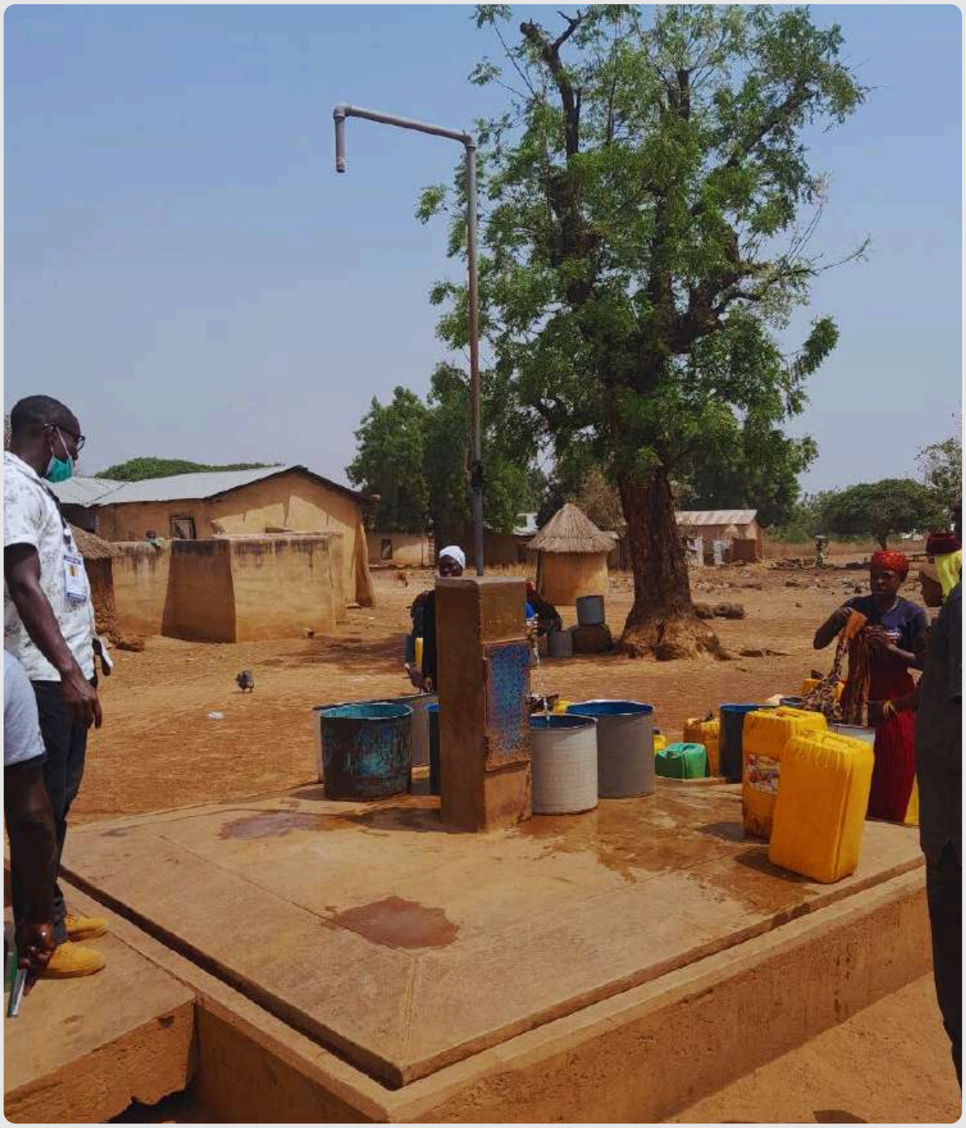
RESEARCH BRIEF

EXAMINING THE PERFORMANCE OF PIPED WATER SUPPLIERS IN RURAL GHANA

Funded by Global Communities and the Conrad N. Hilton Foundation



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Introduction

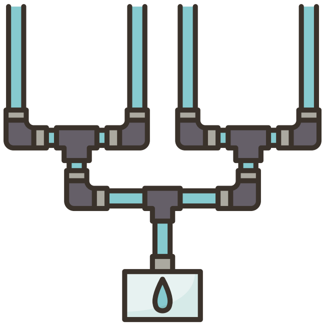
An elevated water tank in a rural Ghanaian community, surrounded by locals, supporting improved water access under the EnWASH program.

Piped water access remains limited in Ghana. Only 45% of households use piped water as their primary drinking water source.[1] This proportion is much lower in rural areas, where only 19% of households have access to piped water.[1] Achieving the Sustainable Development Goal for water in Ghana will require substantial expansion of piped water supply in rural areas.

Increasing the coverage and quality of piped water services requires financial investment, but financial data from rural water suppliers across Africa is often unavailable and unstandardized. As a result, funders, governments, and service providers struggle to accurately characterize costs of delivering safe water services. Limited planning and financing for the ongoing operation and maintenance (O&M) of rural water systems leaves many communities with inadequate access to safe water.[2] For example, in rural Ghana, piped water systems often supply water intermittently and without consistent treatment.[3,4]

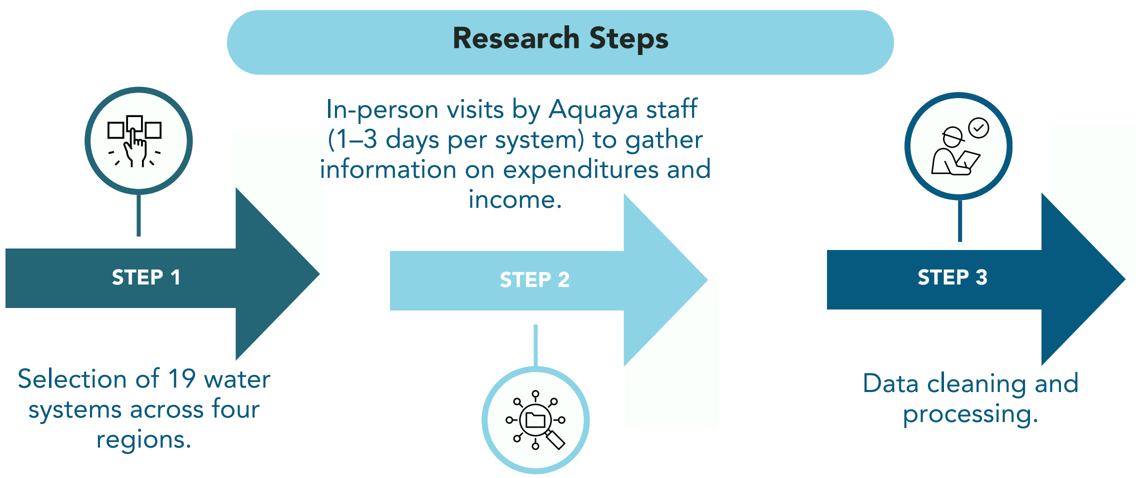
Performance-based funding is a potential strategy to improve service delivery and financial performance in rural water systems by linking payments to measurable outcomes. While this approach has been successfully used to incentivize private service providers in Asia and Africa, its application in public rural water systems remains limited.[5,6] Benchmarking, a complementary tool, allows service providers to track their performance against standardized indicators and fosters improvements through competition and peer learning. However, little is known about the feasibility of implementing these approaches in rural Ghana, where data availability and financial reporting practices are inconsistent.[7]

This research assessed the financial data availability, financial performance, and service levels of rural piped water systems in Ghana. This information is essential to design interventions aimed at improving service delivery, such as performance benchmarking and performance-based funding. This brief highlights key findings from financial performance and service levels analysis and discusses implications for implementing performance-based funding programs.



Methods

Aquaya collected information on data availability, financial performance, and service levels for 19 water systems in 2023-2024. All systems were managed by Water and Sanitation Management Teams (WSMTs) in rural Ghana. WSMTs are part of Ghana's Community Ownership and Management model, serving as the primary management structure for rural water systems. We selected the 19 systems from four regions (Northern, Savannah, North East, and Volta) to capture diverse contexts and complement data collected under other USAID-supported studies: Rural Evidence and Learning for Water (REAL Water) and Enhancing Water, Sanitation, and Hygiene (En-WASH). We intentionally selected water systems that were more likely to have financial and service level data available, potentially biasing the selection toward better-performing systems. Similar research is underway with water systems managed by the Community Water and Sanitation Agency (CWSA) to characterize performance across different models of public service provision. CWSA is a government agency transitioning to direct management of rural water systems, providing a more centralized management alternative to the decentralized WSMT model.



Aquaya staff collected data at each water system via in-person visits, lasting one to three days. During each visit, we met with water system staff to gather all available information on past expenditures and income, both directly and indirectly related to the sale of water. We conducted an inventory of major assets at each water system through a series of interviews supported by field inspections of key infrastructure sites (i.e., pump houses, high-level storage tanks, powerhouses, etc.). We also collected data on infrastructure costs in terms of construction, operation, and maintenance over the past five years. We determined water meter usage during system visits.

We conducted this study with approval from the Council for Scientific and Industrial Research (CSIR) ethical review board and written approvals from District Chief Executives (DCEs). To ensure transparency and accountability, we will disseminate individual result briefs to each water system in person as part of the study's follow-up activities. We acknowledge that this study leveraged data that Aguaconsult and Kwame Nkrumah University of Science and Technology (KNUST) collected as part of the USAID REAL Water research program.

Data Availability

We assessed data availability across three key data types: billing, revenue, and operational expenditures for each of the 19 systems. For each data type, we calculated the percentage of months with available data over the last five years (60 months). To generate an overall measure of data availability, we averaged these percentages across the three data types and used the resulting value to classify each system into one of **three categories: low (0-33%), intermediate (34-66%), or high (67-100%) data availability.**

Financial Performance

We computed two financial key performance indicators (KPIs): revenue collection efficiency and operating cost recovery. Revenue collection efficiency was calculated as the total revenue collected from billed customers compared to the amount billed in 2023 or the most recent year for which data was available (expressed as a percentage, Table 1). **Operating cost recovery** was calculated as the total revenue from water sales compared to operational and maintenance expenditures (expressed as a percentage, Table 1). An operating cost recovery percentage above 100% indicates a surplus, while that below 100% indicates a deficit.

Service Levels

We estimated service level KPIs, including water accessibility, water reliability, water quality, and water quantity (Table 1). **Water accessibility** was reported as the number of connections per 1,000 people in the service area. **Water reliability** was computed as the estimated frequency of supply (days per month). **Water quality** was measured during a USAID REAL-Water[8] survey in 2023 at a subset of water systems and reported as a concentration of free chlorine in milligrams (mg) per liter of water. **Water quantity** was computed as the total volumetric consumption per day divided by the population served (liters/day/person). The specific KPI definitions, calculations, and data sources are summarized in Table 1.

Table 1. Summary of key performance indicators (KPIs), descriptions, calculations, and data sources for financial performance and service levels.

Key Performance Indicator (KPI)	Description	Calculation Method	Data Source	Notes/Limitations
FINANCIAL PERFORMANCE				
Revenue Collection Efficiency	Compares revenue collected to the amount billed	(Revenue Collected / Amount Billed)	Financial records	Based on 2023 or most recent data available
Operating Cost Recovery	Compares revenue to operational costs	(Revenue from Water Sales / Operational & Maintenance Expenditures)	Financial records	>100% = surplus, <100% = deficit
SERVICE LEVELS				
Water Accessibility	Number of connections relative to the estimated population in the service area	(Number of Connections / Estimated Population in the Service Area)	Geospatial data	Includes both private connections and standpipes; assumed the service area was the entire town
Water Reliability	Frequency of supply	(Days per Month)	Operator records and recollection	Not based on meter data
Water Quality	Free chlorine residual levels	(Free Chlorine mg per Liter)	REAL-Water study[8]	Data from 2023 survey
Water Quantity	Per capita water consumption	(Volumetric Consumption / Population Served)	Field data, meter readings	Only for systems with available data

Knowledge, Attitudes, and Practices

We conducted focus group discussions (FGDs) and individual interviews with water system staff to assess their knowledge, attitudes, and practices (KAP) with respect to financial performance and maintenance. We scored qualitative answers from 1-3, with a score of "3" indicating more sophisticated knowledge, attitudes, or practices (detailed definitions in Table 3). The FGDs held with WSMT staff also included a discussion on benchmarking.

Results

Table 2. Characteristics of the 19 community-managed water systems by region, population served, data availability, financial KPIs, and service levels. (Colors indicate data availability categories: green= high , yellow= intermediate, red= low.)

System No.	Region	People Served	Average Data Availability %	Revenue Collection Efficiency	Operating Cost Recovery	Accessibility (Taps/1,000 people in service area)	Reliability (Days/ Month)	Water Quality – Free Chlorine Residual (mg/L)	Water Quantity (L/day/ person served)	Presence of Functional Customer Meters (in at least some service connections)
1	Volta	1,500	14%	NA	115%	27	18	0	NA	No
2	Volta	1,000	58%	NA	177%	14	28	0	NA	No
3	Volta	1900	73%	56%	109%	49	24	0	15	Yes
4	Volta	1,800	69%	79%	136%	64	30	0.1	22	Yes
5	Northern	4,000	100%	59%	89%	21	7	NA	15	Yes
6	Northern	2,000	62%	72%	126%	2	10	0	15	Yes
7	Northern	1,500	53%	NA	80%	3	8	0	NA	Yes
8	Northern	4,800	39%	69%	129%	1	19	NA	3	Yes
9	Northern	80	16%	NA	341%	2	20	0	NA	Yes
10	Northern	9,750	32%	NA	15%	2	15	0	NA	No
11	North East	3,117	15%	NA	110%	7	23	0	NA	No
12	North East	1,000	38%	83%	NA	5	30	NA	31	Yes
13	North East	4,317	23%	95%	NA	20	10	0	4	Yes
14	North East	1,211	0%	NA	NA	4	30	NA	NA	No
15	North East	7,000	28%	NA	43%	2	27	NA	NA	No
16	Savannah	5,000	2%	NA	241%	12	27	NA	NA	No
17	Savannah	7,812	59%	64%	83%	53	29	NA	29	No
18	Savannah	9,150	79%	52%	88%	59	7	0	16	Yes
19	Savannah	6,300	6%	NA	16%	6	27	0	NA	Yes

Table 3. Characteristics of the 19 community-managed water systems by region, population served, financial KAP scores, and maintenance practices scores.

System No.	Region	People Served	Financial Knowledge Score*	Financial Attitudes Score†	Financial Practices Score‡	Maintenance Practices Score§
1	Volta	1,500	1	1	1	1
2	Volta	1,000	1	1	2	1
3	Volta	1,900	1	1	2	1
4	Volta	1,800	NA	NA	NA	2
5	Northern	4,000	NA	NA	NA	3
6	Northern	2,000	2	3	2	1
7	Northern	1,500	3	2	3	1
8	Northern	4,800	2	2	2	1
9	Northern	80	1	1	2	1
10	Northern	9,750	1	2	2	1
11	North East	3,117	3	2	3	1
12	North East	1,000	2	2	2	1
13	North East	4,317	2	3	2	2
14	North East	1,211	1	1	1	1
15	North East	7,000	3	3	2	1
16	Savannah	5,000	1	1	1	1
17	Savannah	7,812	3	3	3	3
18	Savannah	9,150	3	2	3	1
19	Savannah	6,300	1	1	1	1

Financial Knowledge Score: *1 = No understanding of financial performance and associated challenges; 2= Basic understanding of some financial dimensions, though not quantitative; 3= Strong understanding of multiple dimensions, including quantitative insights.*

† Financial Attitudes Score: *1 = No motivation or commitment to improving financial performance; 2= Motivation and commitment by one staff member but constrained by systemic issues; 3= High motivation and proactive commitment across multiple staff members.*

‡Financial Practices Score: *1 = No data collection on financial performance; 2= Monitoring of some financial metrics without reporting, target-setting, or analysis; 3= Robust monitoring, reporting, and/or trend analysis of financial performance data.*

§Maintenance Practices Score: *1= Reactive, "fix-on-failure" approach with no maintenance budgeting; 2= Basic budgeting for some maintenance expenditures; 3=Proactive budgeting and planning for routine and in-depth maintenance.*

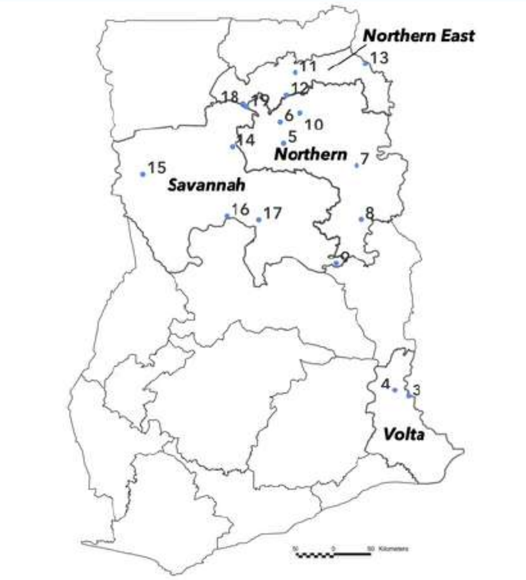


Figure 1. Locations of the 19 water systems across the four study regions (Northern East, Northern, Savannah, and Volta).

Data Availability

Most of the 19 water systems had very limited data available (Table 2). Most data were in a hard-copy format, usually handwritten, to varying degrees of completeness and legibility; a relatively small number of digital records were available. Out of the 19 systems, nine (47%) had low data availability, six (31%) had intermediate data availability, and four (21%) had high data availability (Table 2). **Only one system had complete revenue and billing data for the past five years.** Almost half (8/19) of systems did not have any billing data, and 3/19 did not have any revenue collection data for the past five years (data not shown).

Financial Performance

We found substantial variation in financial performance. Revenue collection efficiency ranged from 52% to 95% for the 9/19 systems with sufficient data available (Table 2). **We found functional customer meters in 11/19 (58%) of the systems** (Table 2). The eight remaining systems either had never had meters or had non-functional meters. Operating cost recovery ranged from 15% to 113% for the 16/19 systems with available data (Table 2). **Only four systems achieved full cost recovery** (operating cost recovery ≥100%), while the majority operated at a financial loss (Table 2). However, it is important to note that high cost recovery does not necessarily indicate strong financial health. In some cases, it may reflect deferred maintenance or unpaid expenses, such as salaries, rather than robust financial management. Water systems operating at a financial surplus may have avoided necessary maintenance costs. We also found substantial year-to-year variability in cost recovery, resulting from wide fluctuations in expenditures as well as revenue.

Service Levels

We observed wide differences in water accessibility and reliability between systems. Water accessibility ranged from <1 to 64 taps per 1,000 people (Table 2). With respect to water reliability, systems supplied water between 7 and 30 days per month (Table 2). **For water quality, only one system had a detectable free chlorine residual** though 7/19 systems did not have available data (Table 2). For water quantity, the volume of water distributed ranged from 3 to 31 liters per person per day for the 9/19 systems with available data (Table 2).

Knowledge, Attitudes, and Practices

We assessed staff knowledge, attitudes, and practices (KAP) with respect to financial performance and maintenance practices across the 19 water systems. We could not calculate the financial KAP scores in two systems (no. 4 and 5), as the interviews conducted in these systems used different questions and did not allow for comparison to the other systems. These were the first two systems visited, after which the interview questions were updated.

Financial Performance

Knowledge

Staff knowledge of financial performance varied considerably. Nearly half of the systems (8/17, 47%) scored a "1", indicating that staff seemed to have no insight into any aspect of financial performance or its associated challenges (Table 3). Four systems (22%) scored a "2", reflecting an understanding of some aspects of financial performance, though not quantitatively, with the ability to cite challenges (Table 3). Five systems (28%) achieved a "3", demonstrating an understanding of multiple dimensions of financial performance, including quantitative insights for at least some dimensions (Table 3).

Attitudes

Motivation and commitment to improving the financial health of the system were similarly uneven across systems. In seven systems (41%), no staff or board member was particularly motivated or committed to improving financial performance (score of "1", Table 3). Six systems (35%) had one staff or board member showing motivation and commitment but unable to take initiative due to power dynamics (score of "2", Table 3). Only four systems (24%) scored a "3", reflecting strong motivation and commitment from multiple individuals, accompanied by proactive initiatives to improve financial performance (Table 3).

Practices

Most systems demonstrated limited financial data monitoring practices. Staff in four systems (24%) did not collect any data to characterize financial performance, earning a score of "1" (Table 3). In nine systems (53%), staff monitored at least one metric related to financial performance but did not report on it, set targets, or analyze trends, resulting in a score of "2" (Table 3). Staff in four systems (24%) achieved a score of "3" by conducting robust financial monitoring, which included tracking one or multiple metrics, reporting results, setting targets, and/or analyzing trends (Table 3).

Systems with higher scores in financial practices tended to also exhibit higher scores in financial knowledge, though this relationship was not consistent across all systems. This finding suggests that while financial data monitoring (i.e., "practices") is an important foundation, it does not always lead to a sophisticated understanding of financial performance (i.e., "knowledge").

Maintenance Practices

Staff rarely implemented proactive maintenance practices. In fifteen of the 19 systems (79%), staff followed a reactive, 'fix-on-failure' approach without anticipating or budgeting for maintenance costs, resulting in a score of "1" (Table 3). Staff in two systems (11%) earned a score of "2" by budgeting for some routine maintenance expenditures (Table 3). Only two systems (11%) achieved a score of "3", where staff demonstrated proactive maintenance practices, including in-depth budgeting and routine maintenance planning (Table 3).

Larger systems (i.e., systems serving larger populations) generally scored higher across all KAP categories, potentially reflecting greater capacity or resources to support advanced practices (Table 3). In contrast, smaller systems often scored lower across all categories, highlighting that resource limitations may hinder their ability to implement robust financial and maintenance practices.

Insights for Future Interventions

Staff from most systems (12/19 systems) agreed that performance benchmarking would be beneficial and would encourage motivation through competition. Potential downsides of benchmarking included;

- **Creating enemies with competing systems.**
- **Political issues (e.g., district officials interfering).**
- **Potential motivation to increase tariffs above customers' ability to pay.**

Aquaya team members at the Savelugu Water & Sanitation System during an ENWASH project field visit.

Water system staff also highlighted several pain points affecting their daily jobs.

One common challenge was transportation

Many staff members relied on their private motorbikes for work and expressed a need for dedicated motorbikes for system operations.

Other frequently mentioned pain points included ;

- Insufficient printing supplies
- Lack of digital tools like laptops
- Inadequate infrastructure (e.g., pumps, tanks, or pipes).

Some staff also cited a need for ;

- System extensions, such as additional pipes or boreholes.
- System improvements, such as upgrades to pipes and tanks, as critical to improving water service delivery and revenue generation.

Awareness of these pain points will be important when designing performance-based incentives to increase staff motivation.

Discussion and Recommendations

This research revealed substantial challenges in data availability and performance across the 19 systems with community-based management, which has important implications for implementing performance-based funding approaches. A key finding is the sparsity of data on financial performance and service delivery among the systems studied. With only 21% of systems having high data available, **any benchmarking or performance-based funding mechanism must first address these fundamental data gaps** and build the capacity of water system staff to document their KPIs. Simply excluding systems with poor data from performance-based funding arrangements would likely exacerbate existing inequities. The systems with the least data are often those with the fewest resources and may be those most in need of performance-based funding to improve their operations.

Multiple programs have attempted to implement performance-based incentives for small water supplies. Some models, such as the Uptime Global model,[9] focus on engaging with donor-supported social enterprises, which are more likely to have accurate revenue and infrastructure use data. In our context of community-based management, where only 58% of systems had functional meters and less than half had consumption data, such an approach would be challenging to implement immediately. Other models, such as The World Bank's Vietnam Results-Based Rural Water Supply and Sanitation Project,[6] also favor systems with better data, which are often located in wealthier geographies that are already on track to meet targets. These examples highlight that directing resources toward systems with better data may widen the gap between well-functioning and struggling water systems. Addressing data challenges in underserved areas will be critical for ensuring equitable improvements in water service delivery.

In contexts with limited data availability, a phased approach that includes capacity strengthening to improve data collection may be necessary prior to the implementation of performance-based incentives. For example, the PRONASAR program in Mozambique[10] applied performance-based funding to rural water and sanitation systems managed through decentralized provincial and district governments. This program used a phased approach starting with intensive capacity strengthening, followed by the development and tracking of comprehensive indicators, and next by incentivized funding. The program first applied performance-based funding to reward improvements in data management and documentation (i.e., setting data availability as a key performance indicator), giving all systems the opportunity to participate regardless of their initial practices. Over time, as data quality improved, the focus gradually shifted to reward good financial performance and service delivery. A similar approach was done by the Public-Private Infrastructure Advisory Facility (PPIAF) in Addis Ababa.[11] Their staged implementation strategy, which begins with input-based payments and progressively transitions to performance-based payments as more data becomes available, could be an effective approach in our context with limited data availability.

Phased Approach to Performance-Based Funding

PHASE 1

Capacity Building
Data management improvements.

PHASE 2

Performance Benchmarking
Tracking of select KPIs.

PHASE 3

Performance-Based Funding
Focus on financial and service delivery.

Implementing performance-based funding in this context has the potential to drive substantial improvements in both data management and water system performance. By addressing the foundational issues of data availability, while considering equity and the unique characteristics of each system, a well-designed performance-based funding approach could contribute substantially to the financial sustainability and service quality of rural water systems.

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