Keeping piped water flowing in rural India

Rob Hope, Duncan McNicholl, Medha Mukherjee and Nicolas Dickinson

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Authors

Rob Hope | Professor of Water Policy,
University of Oxford & Director of Policy, Uptime Global | robert.hope@ouce.ox.ac.uk

Dr Duncan McNicholl | CEO, Uptime Global | duncan@uptimeglobal.org

Medha Mukherjee | PhD/DPhil student, University of Oxford

Nicolas Dickinson | Principal, WASHNote

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Executive summary

The Government of India aims to provide every rural household with piped drinking water by 2024. Significant public investments have been allocated (Rs 3.6 lakh crore; USD 48 billion) between 2019 and 2024 to support Prime Minister Modi's vision through the Jal Jeevan Mission (JJM). As the construction phase nears completion, maintaining piped networks to keep water flowing is an increasing priority. This paper considers global evidence and a random sample of data from 3,400 villages, as reported on the JJM Dashboard, focusing on the state of Maharashtra. We examine three factors to support sustainable service delivery, including: a) contract design, b) data systems and verification, and c) results-based funding. A key challenge to consider is how a proposed '*utility mindset*' can complement '*community ownership*' to maintain piped schemes.

The JJM has the potential to deliver generational impact for 1.3 billion Indian citizens and influence global progress to safe drinking water for all. To achieve this, developing and executing appropriate plans and monitoring systems for keeping water flowing in piped schemes is essential. Three areas of engagement are considered for pilot work in one or more states to allow testing and evaluation of service delivery models: 1) Contract design with service delivery metrics 2) Linking metrics to service delivery monitoring, and 3) Sustainable funding mechanisms.

1. The Jal Jeevan Mission

Prime Minister Modi's commitment to provide every rural household in India with piped water by 2024 is unprecedented in scale and ambition. It requires four-times more progress from 2019–2024 than in the preceding 75 years. The Jal Jeevan Mission (JJM) demonstrates India's leadership and vision in a world where over two billion people lack safe drinking water services. Globally, decades of efforts and billions of US dollars have failed to end the enduring challenge of providing everyone with safe drinking water every day.

In the global context, the Government of India has made similar financial commitments as the recent US Bipartisan Law which allocated USD55 billion from 2021–26 to modernize piped water infrastructure to address leakages, water quality risks, and service gaps for vulnerable users, including schools.[1] The public investment partly responds to an estimate in 2012 that USD1 trillion is required over 25 years to repair and expand the USA's aging infrastructure.[2] The USA faces geographical inequalities in affordable tariffs, social inclusion, and water resource constraints. These are global challenges which investments in piped infrastructure alone will not guarantee the daily delivery of safe drinking water services.

By early 2023, there is evidence of significant progress in the share of Indian households with functional household tap connections (FHTC). However, there is uncertainty on what will happen when the JJM concludes work in 2024. This paper considers global evidence and data from JJM Dashboard to consider critical factors to support long-term sustainable service delivery, including: a) contract design, b) data systems and verification, and c) sustainable funding, which feature in the Operational Guidelines (2019: pp. 7–8[3]).

A key challenge is how a proposed 'utility mindset' can complement 'community ownership' to maintain piped schemes in the years and decades ahead. Examples of successful community management are well-documented in India though the scale and scope of the JJM is unprecedented.

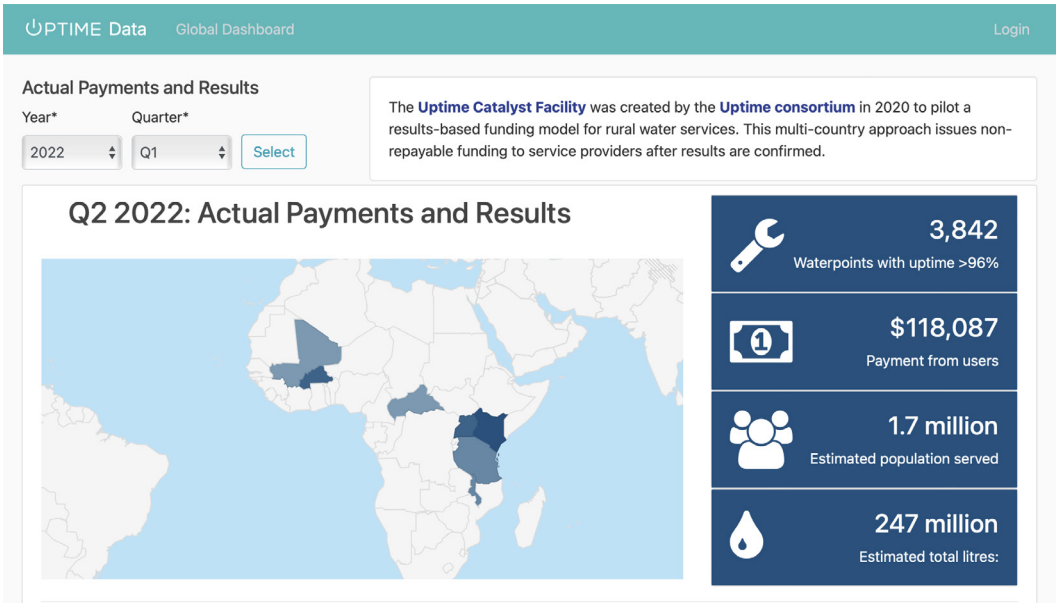
The aim of this paper is to promote a discussion to explore steps where the national and state governments can consider policy options and practical steps to sustain the USD 48 billion (Rs 3.6 lakh crore), budgeted for JJM's investment in piped water services from 2019–2024.

1 The US Bipartisan Infrastructure Law: Reinvesting in water

2 Buried no longer: Confronting America's water infrastructure challenge

3 Operational guidelines for the implementation of Jal Jeevan Mission

The analysis draws empirical data from two primary sources. First, a random sample of 100 villages from 34 Districts in Maharashtra reported on the JJM Dashboard. Second, operational data and analysis from the University of Oxford's collaboration with Uptime. Uptime has designed and executed results-based contracts in seven African countries since 2020. Central to Uptime's work is standardised reporting of current and historical, operational and financial data to monitor drinking water performance and pay results-based contracts (Figure 1).



- **Figure 1**: Uptime public dashboard reporting data for April to June 2022 (www.uptimewater.com)

2. Delivering results-based contracts

In 2023, Uptime will expand its contracted services to Asia and Latin America, and expand country coverage in Africa to guarantee reliable rural water services for over four million people. Uptime's work is premised on robust data and verification systems with standardised reporting systems. Such systems are a feature of piped utilities in OECD countries which Uptime has revised to the context of remote and low-income rural communities and small towns where low population density, affordability challenges and water resource scarcity are more common.

Research by the University of Oxford has supported the evolution of Uptime's results-based model. The contracting model provides a guarantee for waterpoint service reliability to rural villages, schools and health care facilities for which they pay a share of the costs. Non-repayable funds are paid to local professional service delivery providers through a UK non-profit organisation (Uptime Catalyst Facility) on delivery of verified results for reliability, volume of water, and local payments. Over USD 1 million has been disbursed to professional service providers since 2020 in seven African countries.

Uptime contracts operators to provide service delivery at scale and also promotes provision of water services to public facilities, such as schools and health care facilities. The rationale for working at scale over an individual waterpoint or village is to ensure common performance metrics are independently verified to trigger results-based payments. This is consistent with the idea of a rural 'utility mindset' to promote exclusive service area contracts. The logic for including rural facilities reflects the documented gap in service levels despite the known development dividend from safe water for public health, education and gender equality.

Areas of potential synergies to sustain JJM's infrastructure investments for rural water services in states and union territories include:

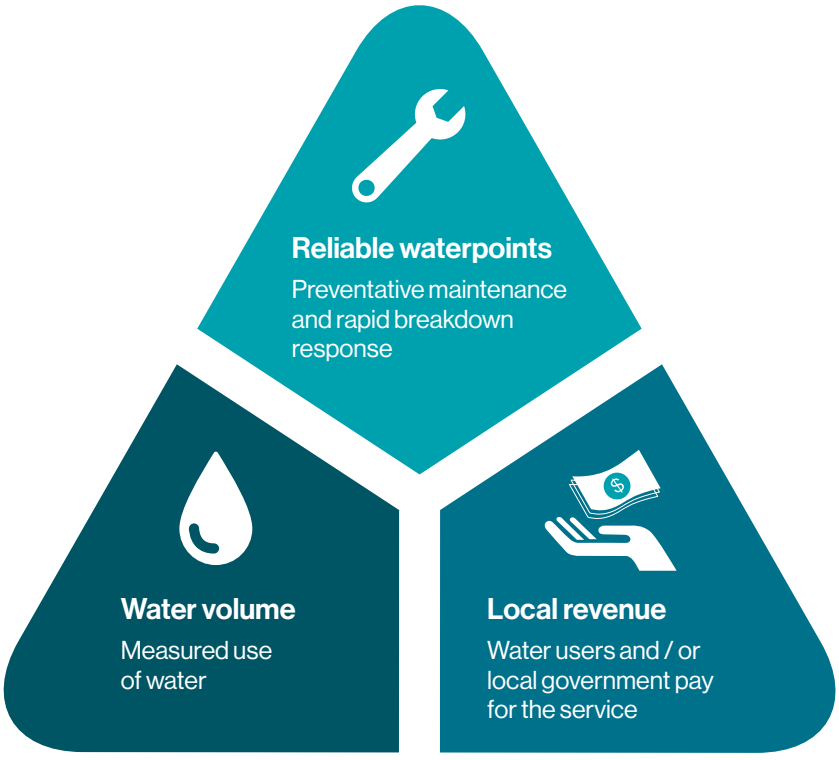
1. Contract design
2. Data systems and verification
3. Results-based funding

2.1 Contract Design

A utility mindset for rural water services requires consideration of an exclusive service area and performance metrics. Global experience is shifting from expecting individual villages to effectively manage their waterpoints. For example, villages can take weeks or months to repair piped schemes compared to a few days for a professional service provider.[4] Multi-village piped schemes are suited to a utility model in terms of how delivery of drinking water services are contracted, monitored and rewarded at scale over time.

Performance metrics of drinking water services merit standardisation to support and evaluate consistent and objective measures. This is reflected in policy and legislation under the Government of India. However, introducing metrics needs to be calibrated by institutional capacity to use and apply the information. Applying a few standardised metrics opens up the opportunity for new sources of funding to emerge if they are objective, measurable and independently validated, further informing policy decisions and implementation strategies. Uptime's work currently focuses on three metrics linked to results-based payments which could complement the JJM Dashboard (Figure 2).

- **Figure 2**: Performance metrics used for Uptime's results-based contracts



Water quality and affordability are further metrics under design and evaluation. Oxford researchers are field-testing the measurement, monitoring and treatment of water quality in Bangladesh, Kenya and other countries using small rural laboratories managed by professional service providers. This work follows the WHO best practice guidelines which are reflected in the water quality protocols and standards in India.

4 Professionalized maintenance of rural water services: Four findings from Kitui County, Kenya

Work has also examined challenges of affordability in collaboration with UNICEF, WHO and the World Bank. Currently, no robust measure of affordability is available, with flaws in existing metrics, such as applying a percentage of household expenditure.[5] It is anticipated a water quality metric can be included in results-based contracts in the near term.

2.2 Data Systems and Verification

What is the range of funding required to ensure operational performance to a defined standard? A simple question and essential to guide financial allocations within and between states. Uptime's data platform has been designed to provided transparent insights to allow more objective and transparent assessment of performance. By understanding key performance indicators, such as subsidy range, limited financial resources can be allocated to do more with less. For example, the JJM investments in piped water schemes may result in lowering operational expenditure for higher service delivery than current water supply infrastructure. While it is rare to have long-term data of observed operational costs, work by Uptime partners in Africa illustrates piped systems may incur lower costs to maintain in comparison to handpumps (Figure 3). The shift from handpumps to piped systems may generate social, economic and financial returns.

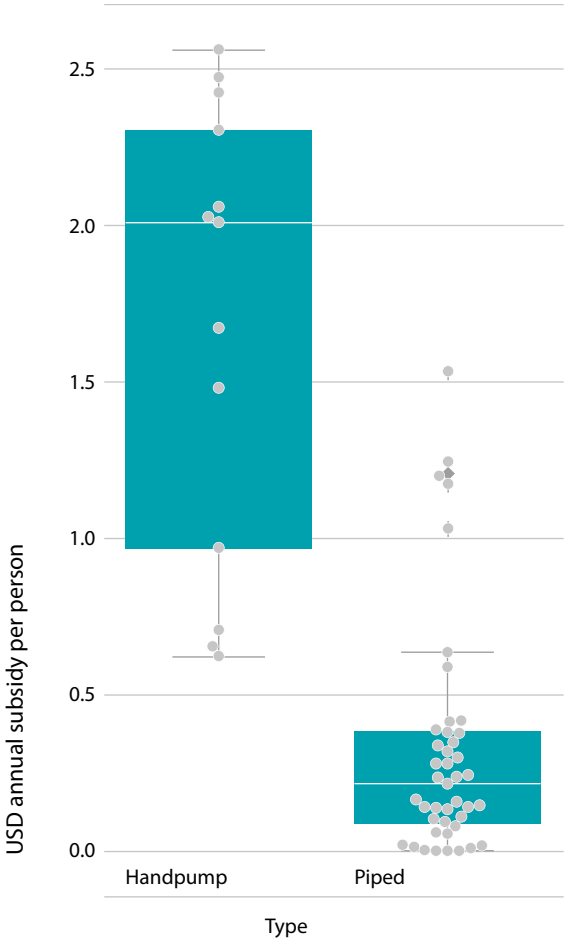


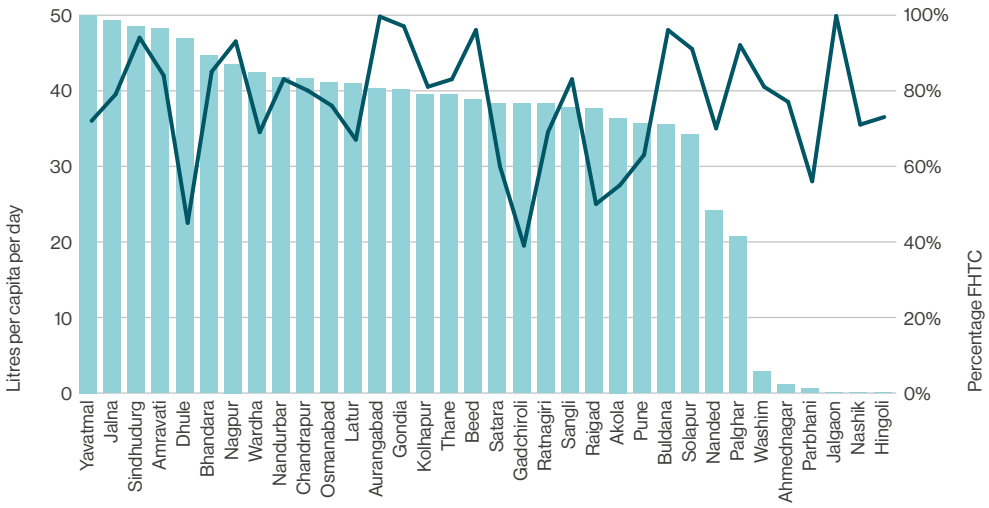
Figure 3: Annual subsidy per person for handpumps and piped water schemes (source: Uptime)

Variation in costs and performance can help to understand differing contexts and challenges. It also allows bench-marking, so there is an opportunity to progressively improve collective performance and promote efficient and fair allocation of resources. Every reporting period creates more data for further insights, analysis and action.

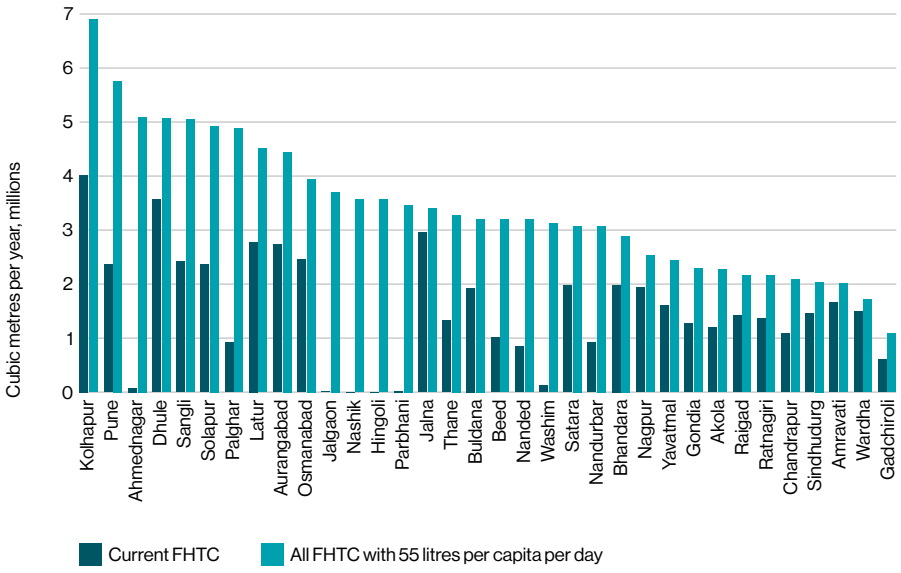
5 Examining the economics of affordability through water diaries in coastal Bangladesh

In Maharashtra, a random sample of 3,400 villages from the JJM Dashboard provides around 8% of the 41,000 villages in the state. On 25th October, the JJM Dashboard reported 8.75 lakh of FHTCs with a population of 0.57 crore. Schools and anganwadis had a high percentage of FHTCs at 97% (n=6,896) and 95% (n=7,581), respectively. At this time, no public data were available on the Water Quality Management Information System, which aims to record testing at the village level.

- **Figure 4**: District percentage of functional household tap connections and average litres per capita per day (n=3,400 villages, Maharashtra State)



- **Figure 5**: Estimated water demand by district for functional household tap connections (n=3,400 villages, Maharashtra State)



Service levels in litres per capita per day (lpcd) is estimated as the production capacity of the scheme divided by the number of FHTCs. Six of the 34 districts have unexpectedly low lpcd figures given the high share of FHTCs (Figure 4). Of the 28 districts with lpcd figures above 10 lpcd, the average across these districts is 34 lpcd compared to the national target of 55 lpcd. If all districts meet the 55 lpcd target, the annual water resources required would increase from 625 million m^3 (current estimate) to 1.4 billion m^3 (Figure 5). Given pressure on water resources in different parts of the state, the geographic distribution of demand requires careful consideration to ensure sustainability in the context of other water requirements for agriculture, industry, urban centres and the environment.

Given water resource constraints and competition in some states, data verification systems will help identify and respond to potential challenges. Data integrity in continuous reporting cycles will provide data on water demand and support financial oversight. For example, Uptime has developed a three-phased approach to data integrity: visit, validate and verify. Data drive Uptime's work and the results-based funding which are disbursed based on satisfactory performance.

- **Visit**
  - Pre-contract visit to confirm services and approve data systems and processes
  - Spot-checks to verify services and validate against submitted records
- **Validate**
  - Standardised data submission and screening process to minimise errors
  - Validation of quarterly metrics against service provider's historical data
- **Verify**
  - Data audit of representative waterpoint sample across portfolio
  - Financial audit conducted by a certified third party

The JJM Operational Guidelines promote local operation and management, which raises questions on how this will perform after the hand-over of piped schemes and local monitoring of performance:

> "Management and O&M of the water supply scheme by the Gram Panchayat and/or its sub-committee, i.e. VWSC/ Paani Samiti/User Group, etc., recovery of user charges and full O&M recovery will form the cornerstone of the long-term sustainability of the scheme." (2019:41)

Data on the JJM Dashboard provides important insights on the rate and distribution of coverage of FHTCs. However, it is not structured to independently verify operational metrics over time. The transition from infrastructure investments to service delivery outcomes will occur in 2023/24. This provides an opportunity to reflect on the current JJM Dashboard and how this might be adapted or complemented in the future.

2.3 Results-based funding

Data integrity is essential to allocate public funds efficiently and transparently, and to attract results-based funding (RBF), if required. RBF is aligned to the incentive fund featured in the JJM Operational Guidelines:

> The Gram Panchayat and / or its sub-committee, i.e. VWSC / Paani Samiti / User Group, etc. are eligible to receive the incentive when the scheme has been successfully managed for a year ensuring that every rural household covered under the scheme receives water in adequate quantity of prescribed quality on regular basis and water tariff for O&M has been regularly collected. SWSM may develop tangible and transparent criteria for providing this fund which is meant to encourage sustainability of water supply system and O&M by Gram Panchayat and / or its subcommittee, i.e. VWSC / Paani Samiti/ User Group, etc. (2019:61)

The incentive fund will be 10% of the in-village infrastructure cost distributed over five years. The resources are envisaged to serve as a revolving fund for urgent repair costs. Questions arise on evaluating the successful management over the first year due to self-reported data on drinking water of sufficient quantity, of prescribed quality, on a regular basis and with regular collection of water tariffs. Further, the funds will be proportional for future O&M costs and managed locally. Water resource challenges vary enormously within and between districts across India. Some will benefit from an equal share, others will face equity challenges based on their specific hydrological and social context. The extent to which Gram Panchayats will be able to respond effectively to these challenges is unknown.

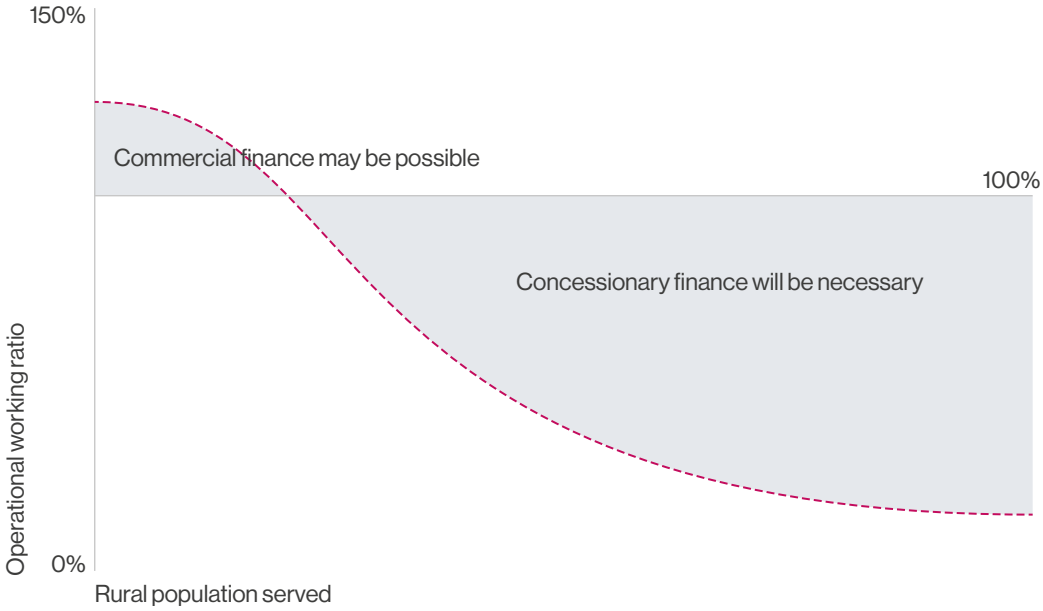
In Maharashtra, the JJM Dashboard provides estimated cost data for piped schemes for each village. A village may have a single piped scheme or be part of a multi-village scheme. Of the sample of 5,661 schemes reported, 242 are duplicates with others sharing the same cost and village profile through different IDs. Estimated costs vary greatly (range: Rs 55,893 – Rs 0.05 lakh) with 2022/23 and 1998/99 being the two highest costed years. Actual expenditure is reported for over one third of schemes (38%).

If states face gaps in funding service delivery over time, there will be pressure to generate support beyond the incentive fund. A very crude estimate for annual O&M costs is around 10% of CAPEX, which naturally varies by scheme type. The incentive fund would be sufficient for probably one or two years. As illustrated in Asia and globally, rural waterpoints, commonly handpumps, fail after three or four years with one in four waterpoints not in use at any one time.[6] In the case of piped schemes, a funding model for sustainable service delivery for 15–20 years will be a good investment by financial, social or economic measures.

Results-based funding is one approach that could be considered either to improve the allocative efficiency of public funds or to attract new sources of funding from donors, corporates or philanthropy. While commercial finance may be suitable for some piped schemes, global evidence suggests concessionary finance or subsidies are needed to ensure safe and reliable water services in rural areas (Figure 6).

6 Functionality of handpump water supplies: a review of data from sub-Saharan Africa and the Asia-Pacific region

Figure 6: An illustration of the relative role of commercial and concessionary finance for operational costs for rural water schemes (WSMTF, 2022[7])



Public facilities such as schools and health care facilities merit particular attention. In rural India, and globally, safe water services are not commonly available, with negative impacts for educational attainment, gender equality, future income generation, and welfare outcomes for the next generation.[8] Girls face significant inequalities which are compounded by the absence or unreliability of water in schools affecting menstrual hygiene management, school attendance and drop-out rates leading to wider social impacts.

Funding for public facilities are often limited and decentralised. Head teachers and health workers often face multiple and competing priorities. Keeping water safely treated, stored and available on a daily basis is non-trivial and not necessarily part of an individual's training or expertise. Inevitably, many facilities are unable to cope and when the water supply fails, it can take weeks or months to repair. Effective monitoring and management of water services can identify risks and mitigate them, if there is clear accountability and responsibility.

There is a public interest argument that facilities should have water supplies managed at scale. A local approach where each rural school or clinic manages its drinking water assumes all facilities are similar and are capable of managing services every day. The costs of professional service delivery may be modest with cost estimates of safe water and soap at around Rs 80 (USD1) per patient visit (rural Kenya[9]) and costs of safe water delivery in schools in coastal Bangladesh[10] at less than Rs 80 (USD1) per pupil per year.

7 Water Services Maintenance Trust Fund impact report, 2016–2021

8 Missed opportunities: The high cost of not educating girls

9 Improving water and hand-washing services in rural health care facilities in Kitui County, Kenya

10 Policy reform for safe drinking water service delivery in rural Bangladesh

3. Conclusion and recommendations

If the JJM is to ensure generational legacy and influence global progress to safe drinking water for all, developing a scalable plan for keeping water flowing in piped schemes is required before 2024. The Operational Guidelines provide key ideas to start this process. Three areas of engagement are being discussed with state governments to support how this process can be tested and sustained at scale.

1. Review service delivery metrics for performance monitoring

- Review service delivery metrics from the Operational Guidelines to test independent monitoring protocols for single and multi-village schemes in target districts.

2. Review monitoring systems to inform incentive funding

- Using piped schemes as the unit of analysis, consider the data architecture linked to 1) independently monitor service delivery metrics (reliability, volume, tariffs, quality).

3. Sustainable funding models

- Establish observed data on operational costs for piped schemes to understand range of costs against performance metrics.
- Explore long-term funding models which combine tariffs, government grants and/or corporate/donor funding.

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