

Rural water service delivery: addressing the hidden development crisis

Adam Harvey and Joel Mukanga

Abstract: *This paper discusses a financial and institutional solution to the ongoing crisis of poor functionality of rural water sources in less-developed countries in Africa and elsewhere. It describes the outcomes of a learning journey undertaken since 2011 by Whave Solutions, a Ugandan rural water maintenance provider and advocacy body operating in several hundred rural communities working in close partnership with communities, local governments, and the Ministry of Water and Environment. The paper describes the root causes of failed rural water delivery, and describes how these have been addressed through collective action on the ground. The aim is to fulfil Uganda's national development goals and Sustainable Development Goal (SDG) 6.1, building a comprehensive system for rural water functionality. This paper presents evidence of the cost of full functionality assurance, and discusses which tariff modalities and institutional structures are best suited for stable and sustained reliable water supply in future years nationwide. Weak regulation and weak governance are found to be among the barriers preventing these modalities and structures from being established. However, the dominant constraint to progress is found to be the failure of the aid sector to recognize its contribution to weak governance and its failure to take coordinated action to correct this. The paper concludes with specific recommendations for investors in water infrastructure, donors, and aid practitioners.*

Keywords: Rural Water O&M, functionality, rural water service delivery, Sustainable WASH Systems, Public-Private Partnership, Performance-payment, WASH and Rural Water, Functionality Assurance, Rural Water Utility, Maintenance Service Provider

The approach

THE LEARNING JOURNEY DESCRIBED HERE has taken place over eight years and is ongoing. It is conducted through baseline surveys and rigorous monitoring of output indicators and finances, combined with continuous practical collaboration with all tiers of local government (district, sub-county, parish, village), as well as with local farmers in rural communities, local private-sector individuals and bodies (such as district Hand-Pump Mechanics Associations), voluntary bodies such as non-governmental organizations (NGOs), and senior officials of the Rural Water Department of the Ministry of Water and Environment (MWE) as well as MWE regional representatives. The planning started with discussions with the MWE in late 2011 in respect of an innovative solution for poor functionality, through performance-payment of local

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technicians to incentivize preventive maintenance. This was developed and trialled in collaboration with local government, the Hand-Pump Mechanics Association members, and rural communities from 2012 onwards. The process has allowed rural residents, farmers, technicians, and local government councillors and officers to participate in solving the issue of poor functionality of water sources. Maintenance fees were paid by communities from 2014 onwards in exchange for full functionality, the amounts and compliance levels increasing over time, providing an evidence base for system change. The process included the innovative establishment of a Ugandan prototype rural water utility, Whave Solutions, staffed by local professionals working from local experience and exercising skills in data monitoring and analysis. No Whave staff or managers were domiciled outside Uganda. Public-private partnership agreements were signed with local governments, and maintenance contracts were signed between Whave and local communities, over several years in several various geographic areas of the country. Whave's staff has grown to number 57 nationals, at the time of writing. The study, therefore, represents a Ugandan voice and perspective on addressing a developmental challenge working long-term at ground level. Techniques of baseline surveying and output monitoring were developed from the existing MWE monitoring and indicators base and also from the founders' previous experience of: a) rigorous monitoring in the carbon accreditation sector; b) developing results-based financing mechanisms for both cook-stove emissions efficiency, and for Water and Sanitation, Hygiene (WASH) service delivery (Folland and Harvey, 2016); c) developing service delivery orientated public-private partnerships in the rural electrification sector. The financial accounting approach was developed as a necessary structure for sustained functionality assurance. In general, our approach has consisted of identifying systemic causes of poor functionality and developing solutions to each one in consultation with stakeholders. These solutions have effectively been hypotheses. We then allowed plenty of time for testing on the ground at relatively large scale in different areas of the country, such that collectively owned 'real-world' solutions have emerged. Figure 1 illustrates Whave's theory of change.

Baseline

Figure 2 illustrates in broad terms the contractual and financing structure for maintenance currently practised in rural Uganda. Community water user committees are formed under prompting from the government and NGOs investing in construction and major rehabilitation. In principle, and in accordance with the national policy of the Community Based Maintenance System (CBMS), the committees collect maintenance tariffs (typically 1,000 or 2,000 UGX/month/household, or 0.27 to 0.54 USD converted at 3,700 UGX/USD) prescribed by committee constitutions, so that funds are ready at hand to prevent breakdowns or to immediately repair a breakdown. However, Whave's field research and evidence from numerous surveys (Owor et al., 2017; MWE, 2011; Foster, 2013) have shown that this principle is not operational in practice in all but very few exceptional communities. In practice, maintenance tariffs are rarely pre-paid.

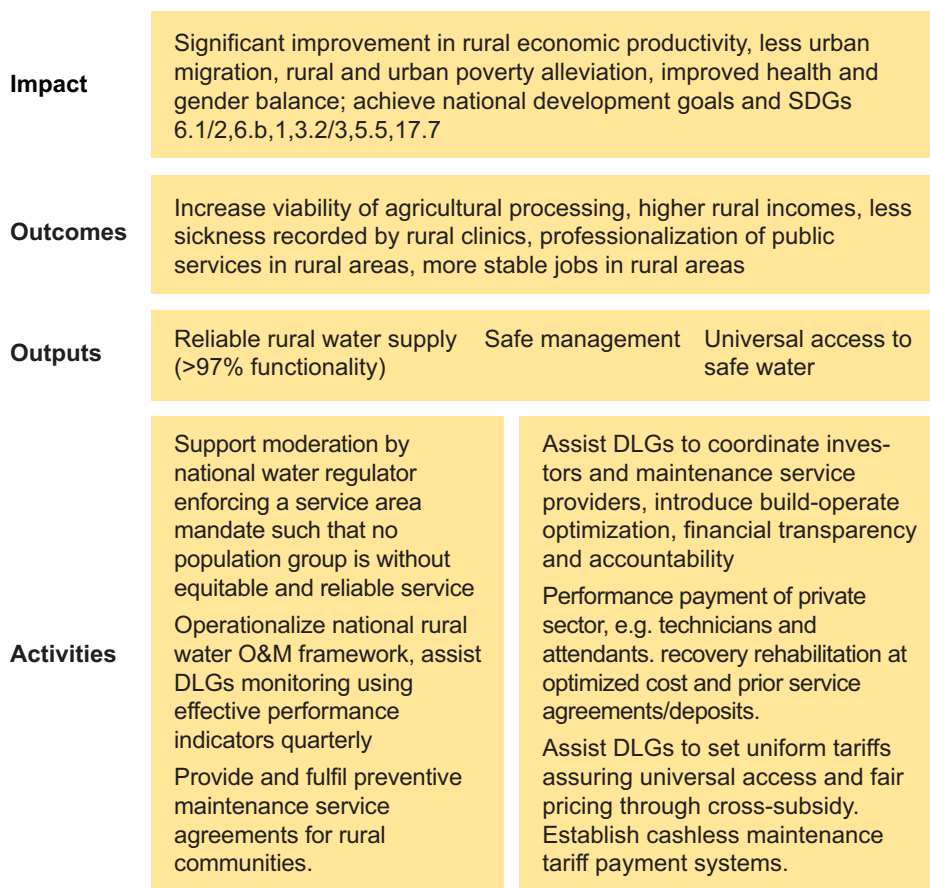


Figure 1 Theory of change

Notes: SDG = Sustainable Development Goals; O&M = Operation and Maintenance; DLG = District Local Government

Preventive maintenance (regular servicing and alerts leading to prevention of breakdown) hardly occurs at all; instead, repairs take place after a breakdown occurs, often after long delays. The repairs are sometimes done by a local mechanic commissioned by the community after it has collected sufficient finance, and sometimes, when the repair cost is high, by an external entity such as the local government or by a sponsor such as a church, NGO, or politician. A common pattern is for minor repairs to be neglected by communities, leading to the requirement for more major assistance by external entities, so triggering long delays and even abandonment of the water source and requests for a new source to be constructed.

External sponsors often have their own incentives to construct new sources or undertake major rehabilitations despite the failure of minor repair and preventive care. Figure 2 shows the principle of community prepayment of maintenance tariffs, and the caption notes that the principle is not followed in practice. The diagram

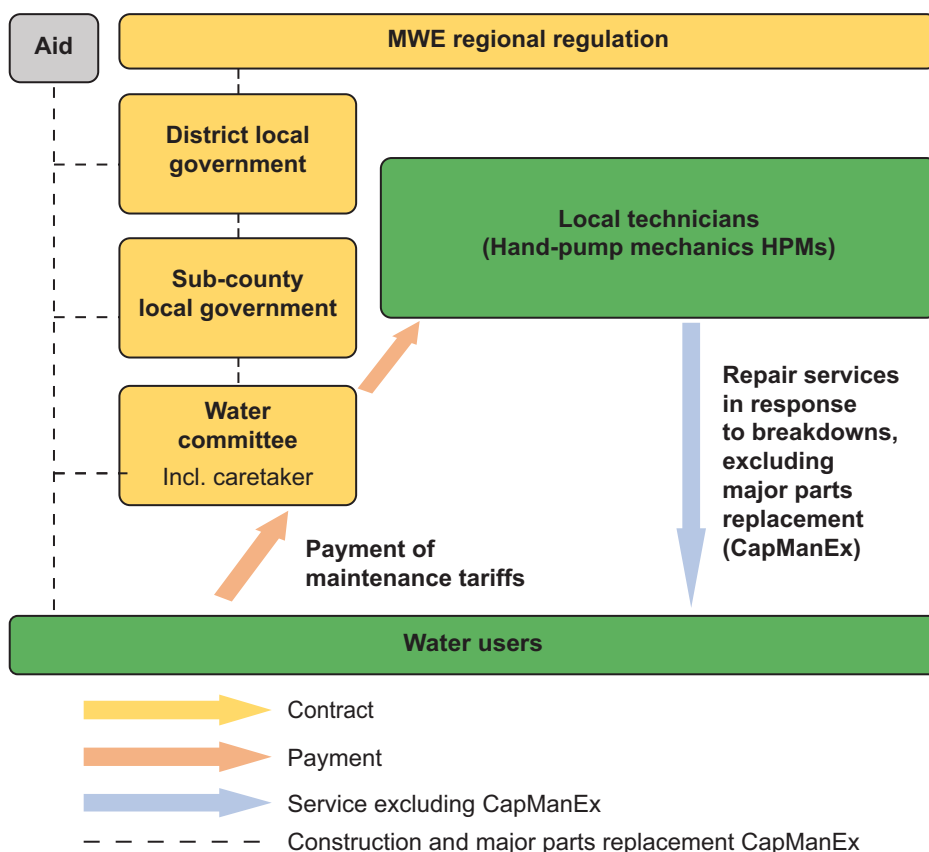


Figure 2 Baseline maintenance structure, farming communities. Tariff-flow direct to local technicians. Institutional structure: no rural water maintenance Area Service Provider (ASP). Notes: In principle, committees collect subscription tariffs and use them to prevent breakdowns and conduct immediate repairs. In practice, consumers usually pay directly to HPMs for repairs after a breakdown occurs, or wait for external financial and technical assistance from district government, NGOs, politicians, sponsors such as churches. Many breakdowns are left unattended during long downtimes, or hand-pumps are prematurely abandoned. There is no maintenance Area Service Provider.

mainly focuses on payment patterns for maintenance, in the sense of finance needed to assure a pump is reliably functional. It also shows with the dotted line, the typical flow of finance taking place for major rehabilitations or new constructions. In this respect, local government water offices receive annual grants from the Ministry of Finance and MWE. Local technicians are individual entrepreneurs loosely organized under the Hand-Pump Mechanics Association, which competes with drilling and construction companies for borehole drilling, construction, and rehabilitation contracts. NGOs and politicians are also active in providing funds and conducting new construction and major rehabilitations.

Several publications indicate very low functionality rates in the baseline situation. In 2011 the Ministry of Water and Environment produced a study (MWE, 2011) finding that 47 per cent of recently installed improved sources were either broken, abandoned, or inadequately functional, and in 2017 a four-year study in several countries by an international consortium, part of the UPGro programme, (Owor et al., 2017) found that in ten districts of Uganda, 77 per cent of the 200 randomly sampled hand-pumps were insufficient in reliability and yield and 45 per cent were not working at all. Whave Solutions' baseline surveys had similar results: for example, a 2019 survey of 300 hand-pumps in the Mityana district found 73 per cent were non-functional or inadequately functional (Whave, 2019a).

The scale of the functionality crisis is rarely recognized, although some progress is now being made as an outcome of studies such as UPGro and Whave's publications and contributions to international and national dialogue in the past seven years. The baseline context more generally is that of populations unserved with improved water supply. Recent MWE data shows that 33 per cent of the rural population in 2020 do not have safe water access (MWE, 2020), defined as the absence of an improved water supply such as a hand-pump, protected spring, roof-water harvesting facility, gravity flow tap-stand, or metered connection. This corresponds to approximately 10 million people. However, if inadequate functionality (poor service delivery) is taken into account, then the studies referenced here indicate that at least a further 10 million people are unserved due to poor functionality, since water-borne disease and degraded education, nutrition, and productivity are as much the result of long (and short) downtimes as of absence of an improved source (Hunter et al., 2009; Thomson, 2018). Additionally, poor functionality or absence of improved sources in areas designated as urban may represent a further unserved statistic, so it is likely that the total of 20 million unserved is an underestimate.

In respect of aid programme design and government budgeting, these findings on failed service delivery represent a serious wake-up call which should trigger spending on service delivery assurance as a pre-condition of further infrastructure spending.

The questions

Whave's programme has focused on understanding the root causes of the very poor service delivery rates found in the baseline situation, and on finding sound and sustainable solutions. The primary questions guiding the programme are shown in Table 1.

Table 1 The questions

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1. How can reliable functionality be achieved?
 2. How is cost best understood?
 3. Who pays for what?
 4. What is the cost?
 5. What tariff and institutional structure is best?
 6. What are the barriers?
 7. How can aid help?
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Question 1: How can reliable functionality be achieved?

Performance-payment of local technicians

In the period 2012 to 2014, the functionality problem was tackled through development and testing of a performance-payment approach for local hand-pump mechanics following discussions in 2011 with the MWE. The hypothesis was that local mechanics would prevent breakdowns if they earned a monthly fee reflecting consistent functionality, disciplined by deductions for excess downtime. This arrangement for technician performance-payment is shown in Figure 3. By the end of 2014, 155 communities were serviced by hand-pump mechanics operating under performance-payment contracts, while functionality rates were continuously tracked by a monitoring team (Harvey et al., 2015). Each community was monitored monthly, both to ensure credible evidence for payment of the mechanics, and also to generate programme output results. 'Reliable functionality' was found to be consistently achieved using the performance-payment approach. This result was evident by 2015 (Harvey et al., 2016) and maintained subsequently (Harvey, 2017; Whave, 2019b).

However, success with performance-payment of local technicians has come with an important caveat: a professional entity, an 'Area Service Provider (ASP)', is needed to conduct monthly monitoring of functionality, contracting, training, and management of local hand-pump mechanics and the administration of performance-linked payments. And the ASP itself requires a license to operate, which implies the presence of a government body with capability and resources to supervise the performance of an ASP. The introduction of reliable functionality, therefore, required a fresh institutional structure and with it a financial model. Figure 3 outlines in simple terms the institutional and contractual structure and tariff-flow model adopted by district and sub-county governments, communities, and the ASP Whave for functionality assurance in three districts, Kumi, Kamuli, and Nakaseke, over the past seven years, with MWE involvement.

Figure 4 shows the same institutional structure but with a variation in the tariff flow path, which was developed by Mityana district government and Whave in 2018 and introduced to communities in 2019.

Local governments as rural water authorities

In early 2020, the MWE formally announced new national guidance on rural water operation and maintenance (O&M), with a core institutional structure as depicted in Figures 3 and 4. The structure is referred to both as the Professional Management Approach and CBMS+ (Community Based Maintenance System Plus), the essential feature being that ASPs are contracted by district governments to provide preventive maintenance and take responsibility for functionality. The MWE document describes tariff payment modalities as follows: 'All users pay for water on a monthly basis or per volume' and 'The ASP will take responsibility for collecting the user fees' (MWE, 2019), so corresponding to the structures trialled by Whave in collaboration with four district governments, shown in Figures 3 and 4. However, key features of operationalization of the national

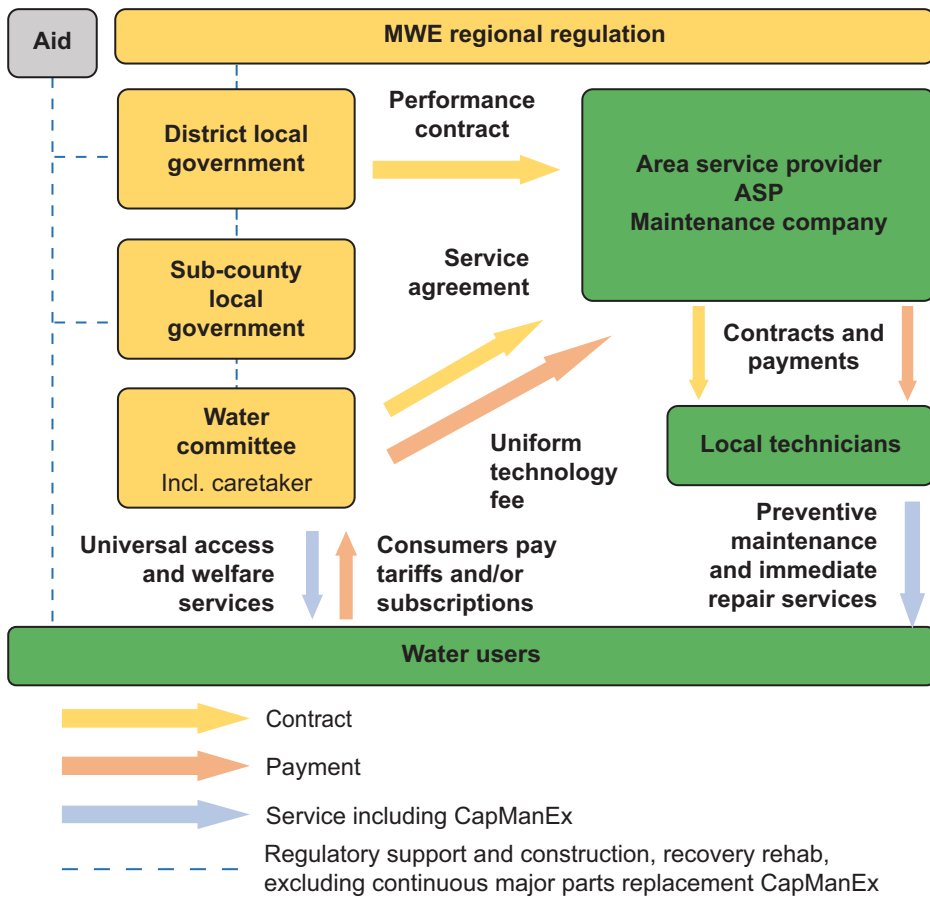


Figure 3 Tariff flow: Community collects from consumers, then pays an annual service fee to an ASP, and community decides individual user payment modalities. Whave Phase 1 model.

Notes: The committee pays a bulk annual fee, in several instalments during the year, to the ASP. It independently organizes subscriptions from the water users which may vary between types of users, and may include volume-based contributions.

The committee provides welfare oversight and the assurance of universal access.

Whave and local government are currently applying this model with Whave as an ASP contracting local HPMS (members of HPMA), paying them according to the degree of full functionality (preventive maintenance, deductions for excess downtime).

framework are yet to be resolved; for example, scaling of ASP business volumes to break-even to achieve financial sustainability, tariff setting, and inclusion or exclusion of the cost of major parts replacement within tariff calculations. These aspects, and others, are discussed in this paper.

The area service provider

The need for an entity to monitor local technician performance and performance-pay, was not the only reason why the ASP was introduced. It became clear as early

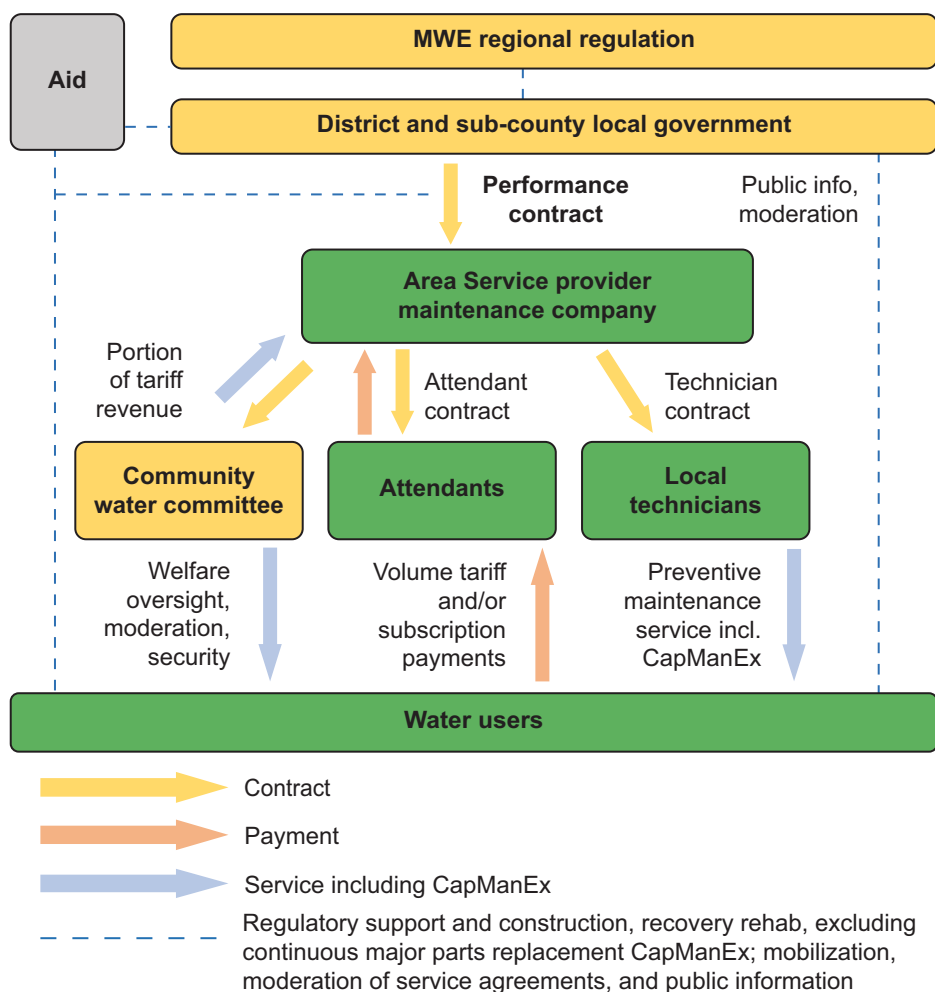


Figure 4 Direct payment. Consumers pay the ASP through an Attendant contracted by the ASP, using pre-paid automated dispensing (PAD) technology. Whave Phase 2 model.

Notes: The ASP contracts local attendants to assure security and collect tariffs using a manual record, and a PAD if available. The tariffs are per volume or subscription or a combination. The committee provides welfare inputs, moderation, and assurance of universal access. In the Whave model, the tiered price plan assists the committee with assurance of universal access. In the Whave application, the local HPMS (members of HPMA) are performance-paid and contracted by the ASP.

as 2013 that a professional entity had a critical role to play in view of other systemic issues in the baseline.

One such issue was that hand-pump mechanics undertaking minor repairs and parts replacements usually fail to find suppliers of hardware components of adequate quality in their localities, and do not have the resources to source them in Kampala or import them from overseas. Local suppliers commonly carry sub-standard

substitute parts. Consequently, the maintenance ‘business-as-usual’ scenario is dominated by frequent replacement of components with poor quality substitutes, causing breakdowns to be repetitive and frequent and generating mistrust.

In addition, much of the work done by larger contracting companies on new water installations and major rehabilitations, even in many cases by NGOs, was also found to be vulnerable to sub-standard materials, as proven by the MWE’s investigations with cameras lowered into borehole rising mains (Senfuma, 2018). This was clearly linked to short-term accountability on the part of the investors in these construction and rehabilitation contracts, principally politicians, NGOs, aid programmes, and district offices. The observation was that long-term accountability was needed to ensure the selection of quality materials and correct installation design. This indicated that a dedicated maintenance company, an ASP, was essential, since it is contracted on the basis of achieving full functionality long-term with the sanction of loss of license if it fails to meet this target. Furthermore, a build-operate principle is called for: the ASP investing in installations and rehabilitations would not use sub-standard materials or designs if its contract was for long-term maintenance, since it would make initial decisions based on optimum life-cycle cost.

Another relevant observation was that community committees lacked the resources or skills to supervise the work of hand-pump mechanics, and to control the quality of hardware and installation design. In addition, it was observed that many community members were unwilling to trust a committee with maintenance tariff payments, due to experience with poor accountability of committee members. An ASP capable of, and incentivized towards, management of technicians, quality control of hardware, and transparency in collecting and spending tariff revenue collected, would win the trust of communities.

There has been a growing recognition among stakeholders that the role of the ASP is essential because without it, there is no clear accountability for functionality. Urban water users know who to call if their water supply fails, as do electricity users; but in rural areas, there is no entity, in the baseline scenario, which is specifically accountable for the functionality of water supply. Councillors and government water officers can be alerted in case of failure, but their remit is very large, and they can complain of lack of resources. They have not signed into a functionality assurance agreement specific to each community, with details understood by each community. In contrast, the Whave programme invites water users to pay for a functionality assurance agreement, such that by virtue of paying they have a right to a reliable service and use a toll-free customer care number provided by Whave in cases where functionality fails.

A key institutional detail introduced by the Whave programme, therefore, has been the service agreement signed between the ASP and each individual community. This is the equivalent of the contract signed by a property owner accepting a metered water or electricity supply; it defines the respective obligations of each party and moderates the relationship. In Whave’s case, this has been labelled the Preventive Maintenance and Continuous Rehabilitation Agreement (PM CRA) – although a long title, the labelling is deliberate to clarify the transition

of rehabilitation – the replacement of end-of-life major components – into the category of maintenance rather than capital investment; this is discussed in this paper. Another important key feature in the agreement is a list of exclusions; these are services that the ASP does not provide, which are enabling environment services provided by the government.

By 2019, after Whave had prototyped the ASP role in practice since 2013 with reliable functionality outputs of consistently over 97 per cent, the MWE was persuaded of the need for an ASP as a key actor in a national O&M framework. However, the introduction of an ASP incurs additional cost, and the national framework is faced with critical questions as to how it can be operationalized from the point of view of meeting these new costs. Clearly government budget allocations could be used more efficiently, since the ASP is being introduced to solve the baseline problems of construction and rehabilitation using sub-standard materials and design and lack of preventive maintenance, both leading to premature and costly major repairs. While these savings would mitigate the new cost of the ASP, the presence of ASP managers, monitors, engineers, and accountants clearly presented a new cost challenge.

Question 2: How is cost best understood?

Consensus on language

The work thus far indicated that reliable service provision is dependent on ASPs being accountable for long-term full functionality and capable of performance-contracting local technicians, incurring significant ASP staffing costs. However, the costs went even further than this, because it was evident that regulation of the ASP by local government was also a cost liability. It became evident that an agreed taxonomy of cost was essential, since in the baseline situation, there was no clarity as to detailed definitions within the conventional categories of customer services, enabling costs, and investment. The optimum allocation of cost and task responsibilities has been a major component of the Whave programme and of key importance in building consensus for the design and implementation of a full-functionality system. Table 2 shows the conventional categories and investigates how they can each be dissected to help demarcate clearly between community, government, and the ASP.

Defining the terms subsidy and discount

Table 2 proposes a cost taxonomy consensus to act as a foundation for operationalization of the institutional structure prescribed by the Ministry's national O&M framework illustrated in Figures 3 and 4. When Whave started in 2014 to charge communities a subscription fee for preventive maintenance and immediate repairs, the most vital part of the conversation was to define the cost of the services offered, so the communities would appreciate they were getting a fair deal. It made no sense to underestimate the serious cost of ASP management, as this would lead to unsustainable tariff levels; however, management costs were high compared to the conventional expectation that tariffs would cover only hardware replacement and

Table 2 Definitions of cost categories

	<i>Recurrent</i>	<i>Recurrent</i>	<i>Temporary</i>
Cost Category	Customer Service: Conducted by communities and ASPs	Enabling: Conducted by local government with temporary assistance from aid	Investment: Conducted by central and local government with temporary assistance from aid
Local responsibilities of each community	Caretaking, for example, security of installed equipment from vandalism and theft, cleanliness and prevention of contamination in communal water fetching area; oversight of welfare of community members to ensure no one is excluded from access	Regulation: setting standards and setting prices Information dissemination to the public Oversight of maintenance arrangements Administering and using budget efficiently Performance-control of private sector actors	Drilling of boreholes and fresh installation of pumps Building a national contractual structure for O&M Training of government actors Advocacy for politicians and NGOs to harmonize engagement by all actors
Examples of questions raised	Does this include major components? Does the ASP decide tariffs individually with community? Is the ASP role to control quality of hardware, performance of technicians? Is tariff collection an ASP or community responsibility?	Does the local government decide tariffs? If so, by sub-county or by district? Or does central government do this so tariff can be uniform at least by region? Is the government responsible for low-yielding boreholes, monitoring, and treatment of contamination?	Does this include recovering sub-standard materials and designs? For ongoing sources that were installed correctly, does this include major parts replacement for already installed sources, or is that a customer service?
Proposed Consensus on cost taxonomy	Customer Service: Includes CapManEx and end-of-life infrastructure costs Service cost at economic scale is agreed, and labelled Projected Economic Fee Communities sign into this tariff in clear agreements (Whave calls these Preventive	Enabling: Government pays for regulation, initially using a mix of tax revenue and aid assistance, eventually from tax revenue with the possibility of cross-subsidy from urban and industrial water supply license fees Government pays for exclusions in ASP – community agreements, e.g. aquifer yield	Investment: Government, voluntary agencies, and private investors (such as politicians) finance new infrastructure, one-time-only recovery of degraded infrastructure (tariff takes care of CapManEx and end-of-life costs), temporary discounts to the tariff, while also subsidizing growth of ASP operations to economic scale when tariff revenue matches service cost.

(Continued)

Table 2 Continued

<i>Recurrent</i>	<i>Recurrent</i>	<i>Temporary</i>
Maintenance and Continuous Rehabilitation Agreements) To assist transition from baseline conditions, temporary discounts are offered	Government stops paying for on-going recurrent rehabilitation of degraded technology, and stops paying for end-of-life infrastructure costs, instead regulates this as a tariff revenue and temporary discount remit	The term discount is used to distinguish shortfall on payment of the full tariff, from subsidy for growth of ASPs to full economic scale

technician fees, and this was true even in a projected future scenario where the ASP volume of business was large enough for its staff costs to reduce to a minimum calculated on a per-community-served basis. The compromise reached was to project the future economic cost of management, which when added to hardware replacement and technicians' fees, determined a projected economic fee. This was found to be within affordable limits, and so it became perfectly feasible to present this as the sustainable service fee, and vocal members of almost all the communities and local governments engaged in this conversation expressed an understanding of the reasonableness and attractiveness of achieving a sustainable and reliable service through such a fee. However, some participants in the discussions resisted (usually in reference to free repair offers from NGOs and politicians) and it was clear that progress could only be made through temporary promotional discounts. The word *discount* was adopted by Whave to make sure that the sustainability concept was not lost – the Whave service agreements, therefore, all charge the full fee at the projected economic fee rate, then mention a temporary discount.

This approach avoids confusion with another important cost item, which is the cost of ASP management while the volume of business is so small that the marginal cost of staffing is excessive in relation to affordable tariffs. This ASP growth cost cannot be charged to communities as it is part of the process of building a comprehensive service delivery system. Both the ASP growth cost and the cost of providing discounts are investments rather than recurrent costs. Hence, the word *subsidy* is restricted to the cost of financing the ASP growth, and the word *discount* is restricted to the difference between the projected economic fee charged to communities and the promotional tariffs or fees.

Question 3: Who pays for what?

Cost-sharing basics

The Ugandan government's policy for rural water has required communities to pay maintenance tariffs, ever since the community-based maintenance system was formally established in 2000. The answer to the question 'Who pays for what?', therefore has an official response already, in respect of the first cost category, recurrent customer service costs, as shown in Table 3. The second recurrent cost, enabling

environment, is also already accepted as the responsibility of local and central government. The third cost, investment, is in practice shared by government, international aid, private sponsors such as electioneering politicians, trust funds, and others such as churches. This cost-sharing formula has the merit of being simple and therefore suitable for consensus-building. It can be dissected more deeply to allow government enabling cost responsibilities to be derived from tax revenue and cross-subsidy from urban and industrial water revenues. In the course of time, it is expected that donor aid to the government will reduce and government tax revenue increase; the simple cost-sharing formula in Table 3 nevertheless remains an important foundation for consensus-building and prepares the way for questions that wait to be answered in the process of operationalizing the national O&M framework. Table 3 summarizes these deeper questions and the programme's findings from fieldwork.

Major parts replacement

One of the observations made of the baseline scenario of systemic causes of poor functionality is that the distinction between service function and the enabling function is blurred, causing disincentives for preventive maintenance and immediate repair. In the baseline scenario, water users are usually exempted from payment for major repairs, largely due to the financial incentives that exist for entities involved in major repairs and component replacements. District water officers and procurement committees, together with politicians and NGOs, usually decide to supply major components, and the district offices often set a threshold: if a repair cost exceeds a certain amount, the district pays and procures the work. This approach was observed to disincentivize water users from conducting minor repairs rapidly or replacing worn parts in a timely manner to prevent breakdowns. It was evident that small repairs are left unattended in the expectation that they become major repairs and the cost can be deferred. While benefit may accrue in this arrangement to politicians, NGOs, and some individual district officials (politicians may win votes, NGOs win favour with their donors in other countries for spending money on ongoing hardware replacement) the disadvantage observed was that the government, NGO, and aid programme budgets have proven insufficient to cope with the avalanche of major replacement costs triggered by the absence of preventive measures and attention to minor repairs, so that many hand-pumps remain non-functional for long periods of time.

This observation led to the hypothesis that viable functionality assurance is best achieved when major component replacement Capital Maintenance Expenditure (or 'CapManEx') is a cost responsibility falling to water users, and therefore should be met through maintenance tariffs. Figures 3 and 4 illustrate this, showing tariffs inclusive of CapManEx. The first edition of the MWE national framework for O&M is silent on this question, and Whave as a pioneer ASP continues to trial this payment modality as an operationalization pilot of the national framework.

Tariff collection

The evidence arising from the practical achievement of full functionality was that community water committees were appropriately resourced to undertake

some customer service tasks and not others. For example, they could control the security of installed equipment and they could oversee social welfare, but to expect committees to manage technicians' professionalism, hardware procurement, and hardware quality control, has proven unrealistic. Responsibility for tariff collection was conventionally in the committee's hands, and in the three districts of Kumi, Mityana, and Nakaseke, Whave has not changed this convention, although there is evidence that the capability of committees in this respect is very often severely limited, due to the suspicion of committee misuse of funds by water users. As a compromise arrangement to accommodate the convention of committee collection, Whave worked with local government to establish mandatory banking and registration of committees as legal entities, in an effort to increase their accountability and therefore, the trust of water users. In the Phase 1 Whave model shown in Figure 3, community members are aware of the service fee charged by Whave and pay it to the committee, observing that the funds are passed to Whave, knowing it is the service provider contracted by the community, and knowing it is formally appointed as the ASP by the local government. Whave pools funds from numerous committees and spends the revenue on preventive maintenance activities and hardware purchase within the district it is collected from, akin to an insurance arrangement. The task of tariff collection is, therefore, shared between the committee and the service provider, while the overall costs of tariff collection are rolled into the tariff and therefore, met by the water users. In practice, this compromise may be described as the committees being responsible for mobilizing tariff payments on behalf of the ASP.

However, experience with operating this model for the collection of tariffs has demonstrated that tariff collection at the level required for full recovery of customer service costs is severely impeded by the intermediary role of the committees. Given this constraint, an alternative approach was developed by Whave and presented as an option to district governments; this is the approach shown in Figure 4, where the ASP directly collects tariff revenue. Of the four district governments presented with this option, only one so far (Mityana) has adopted it, although others are showing interest.

Growth cost

The programme found that persistent weakness of community committees as intermediary tariff-collectors was not the only reason for shortfalls in tariff collection, well below the stipulated projected economic fee. Many hundreds of conversations and meetings with communities showed that farming families were divided between those willing to pay a fair tariff in exchange for reliable functionality and those refusing to pay. The main influence was found to be the prevalence of alternative water sources free-of-charge within walking distance (both unsafe open ponds and un-tariffed hand-pumps or tap-stands) (Olaerts et al., 2019). This suggested that scaling of ASP customer size and saturation of ASP activity within a service area were essential components of a systemic solution for reliable functionality.

Progress to scaling and saturation comes with a significant cost challenge in terms of public information and communication with organizations investing in construction

Table 3 Summary of cost responsibilities

	<i>Recurrent</i>	<i>Recurrent</i>	<i>Temporary</i>
Cost Category	Customer Service	Enabling	Investment
Cost accountability	Maintenance tariffs paid by water users	Local government budgets provided by central government and aid, transitioning to tax	Central government budgets and aid, transitioning to tax
Programme questions	Who pays for, and who is accountable for, these aspects of rural water service delivery? <ul style="list-style-type: none"> • Quality Restoration: recovery of sources afflicted by sub-standard materials and designs • Yield/structure: inadequate yield, silting, collapse, persistent contamination • Routine maintenance: hardware and labour for preventive maintenance and minor repairs • CapManEx: hardware for major repairs and component replacements, assuming quality restored beforehand • Technician management: ensuring cost-efficiency of technicians' work • Tariff collection • Moderation of ASP – community service agreements • ASP management and ASP growth to economic scale, to minimize management margin • Regulation, performance management of ASPs • Tariff setting • New infrastructure: capital • Capital oversight of infrastructure design and materials/construction quality • Welfare oversight to ensure universal access to reliable, safe water • Unsafe aquifer water; localized or near-surface contamination of groundwater 		
Findings	Customer Service tasks	Enabling tasks	Investment tasks
Delivery Accountability	Area Service Provider/Utility <ul style="list-style-type: none"> • Tariff collection • Technician management • CapManEx, end-of-life replacements of all components • Routine maintenance • Oversight of infrastructure design and materials/construction quality 	Government, assisted by coordinated aid agencies <ul style="list-style-type: none"> • Yield/structure: inadequate yield, silting, collapse, persistent contamination; unsafe aquifer water • ASP management • Implementing regulation, standards, regulating construction and recovery rehabilitation investors through a point-source maintenance protocol 	Government assisted by coordinated aid programmes and other investors such as politicians, churches, NGOs <ul style="list-style-type: none"> • Establishing regulation, standards, and contracts, e.g. performance contracts for ASPs, point source maintenance protocol for construction and recovery rehabilitation investors, and service area mandates

(Continued)

Table 3 Continued

<i>Recurrent</i>	<i>Recurrent</i>	<i>Temporary</i>
<ul style="list-style-type: none"> • Localized or near-surface contamination of groundwater • Implementation of new construction and recovery rehabilitations, following cost-efficiency incentive/build-operate principle 	<ul style="list-style-type: none"> • Monitoring, performance management of ASPs • Tariff setting • Awareness-raising and mobilization to engage rural communities with service and tariff agreements • Moderation and arbitration: Helping ASPs and communities to mutually honour their service and tariff agreements 	<ul style="list-style-type: none"> • Build-operate incentive capital to ASPs for new infrastructure and for recovery rehabilitations (recovering sub-standard quality materials and designs) • Temporary discounts on tariffs (declining shortfall on projected economic fee) • Temporary and declining growth subsidy to ASPs not yet reaching breakeven economic scale • Capital to investors in new infrastructure

and rehabilitation, such as politicians and NGOs. Another reason that some community members were refusing to pay the fee was the prevalence of investors with a tendency to offer all-new-parts replacement of hand-pumps free-of-charge or fresh drilling and construction, without paying sufficient attention to the ongoing maintenance implications of these investments. The charity mindset was clearly a major influencing factor, since in the baseline, these investors typically ask questions to community members like 'how much do you want to pay?', suggesting that water reliability was heavily subsidized, free of charge, or that government was responsible for paying all costs, contrary to actual government policy requiring communities to pay for maintenance and contrary to bylaws and resolutions specifying actual figures, actually in force but neglected in implementation.

Whave responded to this particular growth challenge by stimulating local governments to issue directives to investors. One example was the Point Source Maintenance Protocol that the Mityana government issued to NGOs constructing new water points.

Other costs

Table 3 summarizes the findings presented so far, namely that in an optimum structure for full functionality assurance, the tasks of tariff collection and technician management fall to the ASP but are paid for by tariffs, along with CapManEx and routine maintenance. This implies an unsubsidized approach to customer service as a method of ensuring sustaining reliable functionality, in line with studies carried out by the World Bank on rural water service delivery (Andres et al., 2019).

However, this conclusion leaves open the question as to sustained delivery of functions not defined as customer services. Table 3 presents these, allocating

responsibility to government and donors. This topic is addressed below in the context of institutional arrangements and aid contributions.

Question 4: What is the cost?

Service during the growth period

Figure 5 shows findings during 2019 for average hand-pump service costs. Approximately 80,000 people were served in approximately 300 communities which had signed preventive maintenance and continuous rehabilitation agreements

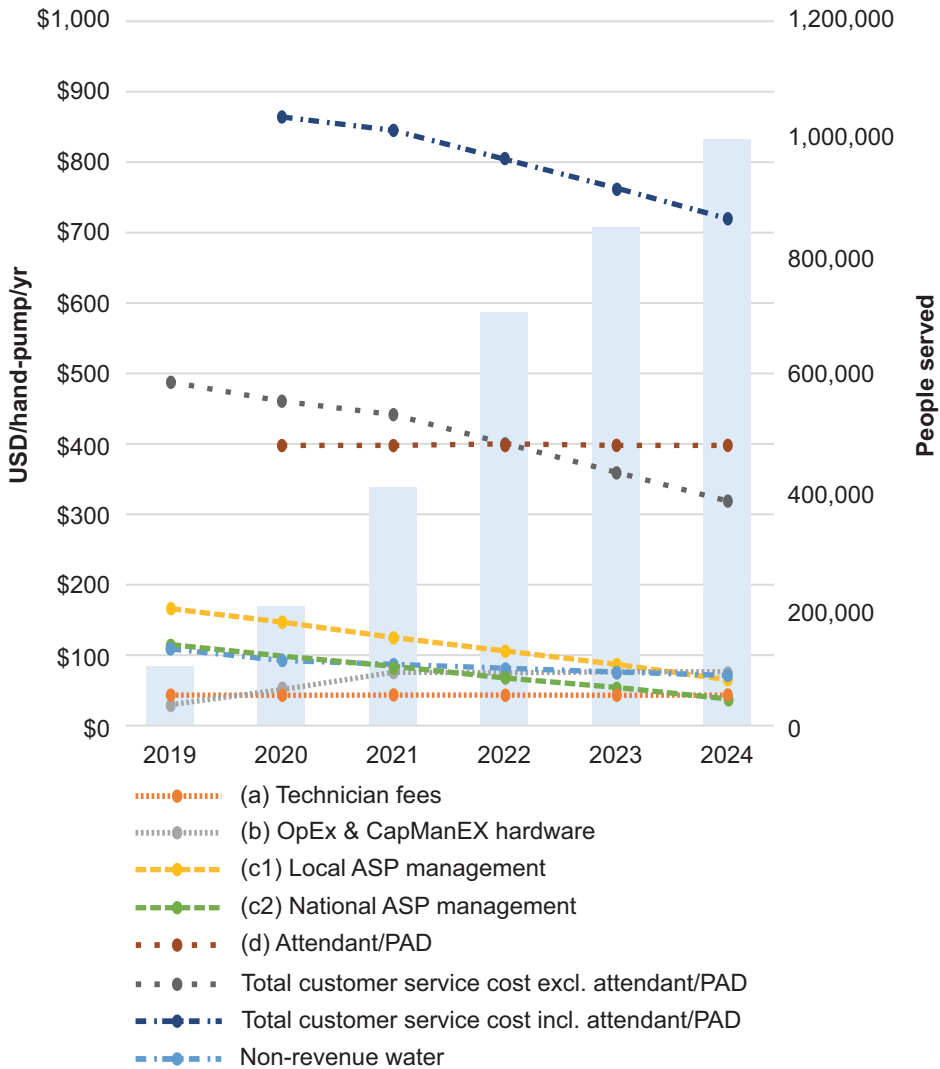


Figure 5 Hand-Pump Service Cost

with Whave as the ASP. The figure plots cost items against the number of people benefitting from over 98 per cent functionality consistently, by way of performance-paid technicians contracted and managed by Whave.

Hand-pump service cost is divided into a) fees earned by local technicians contracted to Whave, b) hardware replacement, to take account of wear of pump components, c1 and c2) management costs incurred by Whave in the form of salaries to staff and operating expenses for the training and supervision of contractors, and for monitoring functionality and moderating service agreements with the communities and d) fees paid by Whave to attendants or caretakers, or community committee members for tariff collection.

Cost item (a) combines minor hardware, principally above-ground components such as bearings associated with routine preventive maintenance, with major hardware components, such as rising mains. These are respectively OpEx and CapManEx hardware, amounting in practice to \$35/hand-pump/year on average. Cost item (b), technician fees, averaged \$50/hand-pump/year.

Cost item (c) is Whave management cost. Whave operates through local teams working in different areas of the country. A national ASP team based in Kampala consists of senior managers, accountants, and engineers, supporting several regional ASP teams. In 2019, average regional ASP management costs were \$171/hand-pump/year, while national cost was \$119/hand-pump/year. Expenses associated with communities in breach of service contract, payment arrears, and under warning of suspension, added a further \$114, implying 30 per cent 'non-revenue water'.

Observation of baseline conditions and experience of service agreements indicated that it is not feasible in all areas of the country to expect that the tasks of tariff collection and ensuring security of installations can be done effectively by community water committees without remuneration. It is generally recognized by many Ugandans working in the rural water sector that 'volunteerism' is a thing of the past. However, as collective action develops in 2020 to operationalize the MWE O&M framework, it is likely that several stakeholders still work in communities where committees collect tariffs without remuneration. Therefore, the cost analysis shown in Figure 5 presents two options for hand-pump service cost, one with cost item (d), fees paid for tariff collection, included and one with it excluded.

Excluding item (d), total hand-pump service costs averaged $50 + 35 + 119 + 171 + 114 = \$490/\text{hand-pump/year}$.

Cashless payment methods using mobile payment and electronic card-readers in water ATMs have the potential to help significantly with collection efficiency and accountability, and in 2019 Whave started to request mobile money tariff payments from committees with a view to this being mandatory for payments to Whave from all serviced communities by the end of 2020, with committees still drawing cash from individual users. A promising solution for fully cashless collection is the Pre-Paid Automatic Dispenser (PAD), already common in piped water distribution but costly and difficult-to-source for hand-pumps. Whave started in 2019 to deploy prototype hand-pump PADs with a view to these becoming the standard for communities using the pay-for-volume modality

(Figure 4). These methods have the potential to reduce management costs in the future, but they do not significantly reduce tariff collection costs since it is most likely that an attendant will be needed alongside a PAD to troubleshoot glitches in PAD performance. In addition, a caretaker or attendant is most likely needed for security, and while this is also a committee responsibility, the reality is that it is unlikely to be effective without remuneration by an ASP to an attendant, committee member(s), or a caretaker.

The cost of item (d) was not experienced or measured by Whave in 2019. Instead an estimate of 1.5 million UGX/year (equivalent to \$400/year) for future years is suggested here as a placeholder awaiting evidence. This estimate is not considered by Whave to be conservative, but rather it is optimistic, for two reasons: it includes PAD operational and maintenance costs which are otherwise not included in the CapManEx figure, and it represents an income of only just over 100,000 UGX/month for a local attendant. Therefore, the assumption is that PADs are functioning smoothly without glitches, and that this is a part-time unskilled task and not an onerous one. Inclusive of (d) under these assumptions, hand-pump service cost is augmented by \$400 per hand-pump/year. As management costs decline with reducing margin in future years, this item (d) estimate is unlikely to reduce even as cashless collection improves, since it is already optimistic. Figure 5, therefore, shows (d) as a constant in future years.

Service at scale

Scaling clearly generates savings in management expense due to reducing marginal cost per source serviced. For example, the signing of large numbers of service agreements with neighbouring communities creates significant savings in transport and brings efficiencies in accounting, engineering, and management staffing. The term 'saturation' is associated with scaling, to reflect the savings accruing from working in concentrated geographic areas. Willingness-to-pay, as discussed earlier, is closely linked to saturation since free-of-charge hand-pumps within walking distance are no longer available.

An analysis of scaling and saturation was undertaken. The combined OpExCapManEx cost is expected to increase in an initial period before it stabilizes, because the recovery rehabilitation process is still fresh for most communities in the early years. New pipes installed during the recovery remain in good condition for several years, but as the volume of customers increases, the expiry of major components becomes a constant. Whave's tracking of major and minor component replacement, and its work on performance-contracting technicians, is generating evidence that OpExCapManEx hardware expense will settle in the future at \$81/hand-pump/year (Harvey, 2019).

The analysis, therefore, shows technician, attendant, and non-revenue-water costs as constants in future years, and OpExCapManEx hardware becomes a constant.

Management costs reduce, and Figure 5 shows scaling to an ASP customer volume of 1 million people in neighbouring rural communities comprising a

saturated service area. The five-year period is nominal for the sake of clarity in the figures; the reality is that this scaling may take 10 years or more, depending on availability of finance the capacity of local government for effective regulation, and coordination of investors. By the end of the period, hand-pump service cost reduces to \$321/year cost excluding attendant/PAD cost, and \$721/year including attendant/PAD cost.

The breakeven volume question was discussed from 2015 onwards between Whave and the MWE and it became clear that a single district contract for an ASP was unlikely to enable the ASP to reach economic scale, since rural populations in many Uganda districts are less than required for economy-of-scale, and recently new districts have been created with smaller populations. The ministry concluded that one feature of the national O&M framework would be the clustering of neighbouring districts and the appointment of a common ASP, to clear the path for sustainable economics (MWE, 2019).

Whether or not economic break-even for an ASP occurs at a customer volume below 1 million is under debate. Whave has made several detailed evidence-based projections, and found that scenarios exist whereby smaller volumes entail break-even, for example, a minimum being 200,000 people in approximately 700 neighbouring communities. These rapid break-even scenarios depend on a high degree of aid agency coordination, considerable volume of finance rapidly available for recovery rehabilitation, and a high degree of local government implementation of new regulations such as a point source maintenance protocol controlling investor conduct and a service area mandate assisting ASPs to cross-subsidize between larger communities and small ones and controlling 'cherry-picking' contraventions. A more realistic projection is to break-even at population volumes of approximately 1 million or 4,000 rural communities of varying sizes.

Investment: Capital, upgrade, recovery rehabilitation, discount, subsidy

Whave's investment cost analysis is distinct from service cost analysis and has its own taxonomy of items, as shown in Table 3. The first item is the usual one of infrastructure capitalization, since the MWE estimate that 33 per cent of the population has no improved water supply infrastructure in place (MWE, 2020). The government's priority for infrastructure investment is for piped water networks to supply metered premises and, where that is unfeasible, to have tap-stands close to people's homes. Further expenditure on new hand-pumps is the least priority but remains a necessary intermediate measure to cover for the large populations who inevitably will not receive piped water in the forthcoming decades. Whave follows the government policy and is upgrading hand-pumps to solar-energized point-source pumps with tap-stands and metered connections wherever geology is suitable, capital finance is available and recovery of maintenance cost looks feasible, following the build-operate principle which incentivizes optimum functionality cost-efficiency. Whave's analysis of investment costs includes a range of scenarios with different rates of conversion: for example, findings following 2018 evidence

were 7.7 million USD at a 30 per cent upgrade rate (Whave, 2019) exclusive of new hand-pump infrastructure and borehole drilling capital, but inclusive of all the other investment items listed in Table 3, as follows:

- Recovery rehabilitation (once-only restoration of poorly functional or non-functional hand-pumps);
- Discount (market stimulation through promotional tariff reductions);
- Subsidy (for growth of ASPs to economic volume);
- Establishment of new regulation such as maintenance protocol, service area mandate, performance contracts for ASPs, and capacity-building for effective implementation;
- Conversion of existing boreholes to motorized pumping energized by grid or solar power.

To explain recovery rehabilitation, there is evidence of quality-control-compliance abuse being commonplace to such an extent that water users cannot be expected to foot the bill through tariffs for the restoration of sub-standard materials, design, and construction; Whave's finding has been that recovery rehabilitation can be conducted efficiently with average expenditure on quality hardware and local technician fees being in the order of 1.5 million UGX/recovery on average. In all cases, the communities receiving the recovery have previously signed with Whave (as the ASP) a Preventive Maintenance and Continuous Rehabilitation Agreement which assures them that all components not replaced during the recovery works will be replaced under their tariff agreement as and when they reach end-of-life. The programme found that this costing represented a fourfold saving in district government spend on rehabilitation (Harvey, 2019).

Why are discount and subsidy presented as investment costs and how soon can they be removed? A development process can take 10, 20, or 30 years to accomplish its aims, and the removal of the discount and subsidy costs, transitioning these to affordable tariff revenue collection from rural water users is no exception. As mentioned earlier, the full range of investments listed in Table 3 are necessary conditions for this transition to sustainability; eventually, all investment expenditure will disappear and be replaced by water user tariff revenue and government budgets for recurrent enabling services. Progress so far in reducing subsidy and discount is steady but slow.

Question 5: What tariff and institutional structure is best?

Affordability

Discussions of tariffs immediately raise questions of affordability and uniformity versus diversity: what is the threshold where tariffs become unaffordable to rural communities, and is it feasible to build a national system for reliable service delivery with varying tariffs, or is uniformity necessary? For the purposes of this discussion, the assumption is made that nominal uniformity of tariff is necessary for progress towards sustainable full functionality of rural water services, given that in reality, there are many types of uniformity, and each has scope for variation of

expenditure between households, for example, depending on volume consumed and the number of people in a community sharing one hand-pump.

A starting point is average national rural income, which was found by census to be 303,000 UGX/month (UNHS, 2016/7), corresponding to \$82/month at the exchange rate applied throughout this paper of 3,700 UGX/USD. Income is a complex matter in the case of rural areas where families are large and have multiple productive activities among several members; some families are small subsistence farmers, where food is grown for direct consumption as well as sale; harvests are uncertain; and many community members are larger land-owners, shop-keepers, and traders, such that incomes vary widely.

Three per cent of this average rural income is 9,100 UGX/month or \$2.5/month, which takes into account international recommendations, for example, the UN guideline that 'water costs should not exceed 3 per cent of household income' (UN, 2020; UNESCO, 2020). Whave conducted many discussions with representatives of farming communities and the recommendation was that typically around 5 per cent of families are unable to afford such tariff levels, but such deprived persons or families are traditionally under the care of the community as a whole, and water committees are conventionally responsible for finding ways of assuring they have reliable water access through internal village and family welfare arrangements, and in general, tariffs can be collected at harvest times.

Current ad-hoc and unregulated tariff levels in Uganda in rural areas, are usually in the range of 200 to 500 UGX per 20 litre jerry-can, with 1,000 UGX sometimes occurring especially in dry months. At a family consumption of three standard-size jerry-cans or 60 litres/day, the monthly spend is between \$5 and \$12.

Whave has focused on regulated tariff levels which do not exceed 4,000 UGX/month, or approximately \$1/month, less than 2 per cent of the average rural income. In the case of tiered price plans, the lifelines rates have this target. For example, at 40 UGX/20-litre jerry-can, a family lifeline consumption of three standard-size jerry-cans or 60 litres/day, the monthly spend is 3,600 UGX or approximately \$1.

Tariff derivation

The section above presenting cost evidence and estimates, concluded with two options for hand-pump service cost, one including tariff collection expenditure, and one excluding it assuming volunteerism. Whave's finding has been that tariff collection costs are unavoidable, and therefore it is recommended that tariffs are determined by the hand-pump service cost estimate inclusive of the PAD/attendant/tariff collection cost. This figure was estimated to be \$721/year/hand-pump and is labelled the Projected Economic Fee. It is associated with the lower estimate of service cost of \$321/year/hand-pump which is exclusive of PAD/attendant/tariff collection cost, collection cost.

The Projected Economic Fee is what is expected on average from hand-pumps to cover their maintenance and tariff collection costs; it does not necessarily have to be paid by each individual hand-pump, rather it has to be the average collected from all hand-pumps serviced by an ASP. In other words, an ASP servicing 1,000 hand-pumps and collecting half the economic fee from 500 of them because of a certain

tariff modality, but double from the other half because of another tariff modality, has reached its revenue target. Whave operates more than one tariff modality, and has tested a third modality. There are many important variations in tariff modality, as is generally the case in utility services; for example in Uganda electricity tariffs have 'lifeline' rates whereby very small volumes are charged at a lower unit price as a pro-poor incentive to connect and facilitate universal access, and there are reductions for early-in-the-month payment. These variations are important also for ASPs operating rural water services.

Uniform household tariff

In 2014 through to 2015 Whave charged a uniform household tariff to individual homes, with committees as tariff collectors, which was an equal amount for each household regardless of how many households shared one hand-pump, and regardless of the volume of water consumed by one subscriber. The result was that communities with few houses sharing the hand-pump generated small revenues and large communities more. Whave pooled this revenue and used the overall total to pay for hardware replacement and local technician costs where and when needed within the district it arose from, so providing a simple and automatic cross-subsidy.

This approach promised social acceptability since it represented an equal tariff for all. Households were expected to be conscious of paying the same as their counterparts in other communities. The principle is illustrated in Table 4, which calculates the household tariff from the projected economic fee, assuming a notional spread of rural community sizes. Households all pay approx. 3,500 UGX/month or just under \$1/month. If volunteerism does turn out to work well, the tariff is approximately half as much. In the section below, 'pros and cons', this modality is compared with others with a view to operationalization of the national O&M framework.

Although nominally these subscription tariffs are paid monthly, the practical and cost feasible approach is for the ASP to collect fees mobilized by committees in bulk instalments during the year corresponding to harvest cash flows, and different community members in practice often pay different amounts in accordance with internal community welfare and social arrangements. This addresses the issue of low cash flow and drop in affordability levels between harvest or during poor harvest seasons. Whave collected the household tariffs in this way, with the committee as the tariff collector.

When this was introduced in the years 2014 and 2015, the advent of a maintenance company charging pre-breakdown preventive maintenance fees was so innovative and unusual, and counter to the general practice of 'wait-till-it-breaks', that it was only feasible to set household tariffs at a huge early-starter discount, and in 2014 Whave charged just 200 UGX, rising to 400 UGX/month/household in 2015 (Harvey et al., 2015). The strategy was to familiarize communities with the benefits of full functionality as a starting point, and work towards financial sustainability if and when full functionality was proven and appreciated.

Table 4 Hand-pump household tariffs contrasting method of distribution of Service Cost

Community sizes	Small farming	Average farming	Large farming	Mixed trade and farming communities under Rural Growth Center threshold of 1,500 people	Mixed trade and farming communities under Urban threshold of 5,000 people
A. Baseline	In most districts, hand-pumps are shared on average by 50 homes (a 'community')				
Socially accepted tariffs	1,000–2,000 UGX collected in practice; non-functional pumps are common and poorer families use unsafe sources; wealthier rural families often pay 200–500 UGX/20 litres to vendors, so if family consumption is 60 litres/day, the monthly spend is between 3 and 8 \$/hh/month	Subscription is accepted but rarely common	Volume: 200–500 UGX/20 litres to private hand-pump operators, tap-stands, or vendors. If family consumption is 60 litres/day, the monthly spend is between 5 and 12 \$/hh/month	Subscription is not common. Instead, Pay-for-	
B. Tariff options based on full-functionality scaled hand-pump service cost projections					
Number of households/hand-pump	25	50	150	250	500
Example spread of community sizes	15%	40%	40%	15%	15%
Number of people total	150,000	400,000	150,000	150,000	1,000,000
Number of households total	30,000	80,000	30,000	30,000	200,000
Number of hand-pumps	1,200	1,600	200	120	3,180
Total customers Service Cost					
Uniform household tariff (UHT) is charged to individual water users	UGX 1,575 \$0.4	UGX 1,575 \$0.4	UGX 1,575 \$0.4	UGX 1,575 \$0.4	UGX 1,575 \$0.4
Incl. cost of tariff collection/security	UGX 3,536 \$1.0	UGX 3,536 \$1.0	UGX 3,536 \$1.0	UGX 3,536 \$1.0	UGX 3,536 \$1.0
UHT is shared by business and institutional water users at higher rates	Decrease in household payments reflecting additional revenue from business and institutional water users paying at higher rates				
Uniform technology fee (UTF) is a bulk fee charged to each community using one hand-pump	UGX 3,963 \$1.1	UGX 1,981 \$0.5	UGX 660 \$0.2	N/A	N/A
Incl. cost of tariff collection/security	UGX 8,896 \$2.4	UGX 4,448 \$1.2	UGX 1,483 \$0.4	UGX 890 \$0.2	UGX 445 \$0.1
UTF is shared by business and institutional water users	Decrease in household payments reflecting additional revenue from business and institutional water users paying at higher rates				
					\$321
					\$721

The reality was disappointing, even given the very small pre-payment amount. It proved impossible to control community size when charging per household, because the serviced communities increasingly represented themselves as small, shrinking their household listings in order to pay less. Monitoring of actual numbers by Whave staff was too expensive, especially given the situation where free-of-charge hand-pumps, and open ponds, were available to users within walking distance, so claims of shrinking user numbers could not be discredited. This shrinkage caused Whave's revenues to drop and jeopardized the trajectory towards sustainability. It was clear that scaling and saturation were important pre-conditions of effective application of the per-household tariff modality, and quite possibly for any effective tariff modalities.

The second obstacle was that larger farming communities correctly calculated the total revenue they were generating and judged it to exceed the average cost of maintenance of a single hand-pump. When it was explained to them that the surplus bulk revenue they were generating was needed to cross-subsidize smaller neighbouring communities that were generating too little, as a method of sharing a fair and equal payment system among all rural households, they were quick to refuse this generosity to their smaller neighbours.

This indicated that another important precondition for tariff application was social consensus and increased levels of direct support from local government. To build social consensus, Whave launched radio talk shows with local government and community involvement, providing toll-free numbers communities could use to acquire information. These continued through the years and continue to be effective, with many communities volunteering to sign service agreements after listening and calling in, some making visits to Whave regional offices.

To build more direct support from local government, Whave spent time working with local sub-county councillors to discuss the problems raised by poor functionality and solutions, starting with the prospect of fresh legislation. This was successful: all sub-county councils where Whave worked (fourteen in Kamuli, seven in Kumi, two in Nakaseke) were supportive of mandatory signing by all communities of the Whave preventive maintenance agreements and they resolved formally that all households should pay mandatory tariffs of not less than 2,000 or 1,000 UGX/month (in nine sub-counties in Kumi and Nakaseke the councils set the tariff to 2,000, in Kamuli and one council in Kumi, the minimum fee was set to 1,000). The principle of sub-counties imposing minimum 'floor' tariffs rather than strictly imposing fixed tariffs was partly a reluctance to break with the CBMS convention that committees were free to set tariffs independently, and partly to allow committees scope for welfare arrangements, charging more to wealthier families while imposing minimal fees to needy families.

The legislative work provided a foundation for sub-county extension workers and councillors to take part in community mobilization of preventive maintenance agreements – it became formally part of their remit, and increasing practical on-the-ground support from local government based on the legislative foundation is a major component of operationalization by Whave of the national O&M framework, labelled CBMS+ or Professional Management Approach, in 2020 and beyond.

However, despite these measures being taken, revenues were dropping due to nominal shrinkage of household numbers as mentioned above, and in late 2015 Whave searched for more effective tariff modalities.

Uniform technology fee

The second tariff calculated in Table 4 is the uniform technology fee: that is, each community with a hand-pump pays the same bulk amount to the ASP from all its water user members, totalling up to average hand-pump service cost equal to the projected economic fee. Water users nominally pay in monthly instalments, with amounts is calculated as shown in the table. Assuming volunteerism is not realistic, water users in large communities are paying very little, with communities of 500 houses paying only UGX 445/month or \$0.1, while families in smaller communities are in principle paying much more, nearly 9,000 UGX/month (\$2.4) in communities of 25 homes and approx. 4,500 UGX (\$1.2) in average size communities of 50 homes.

This was an awkward result for two reasons, even in principle without looking at practical application. Firstly, the tariff in small communities is higher than is socially acceptable and goes beyond the affordability threshold. Secondly this modality runs counter to existing reality of current ad-hoc water prices tending to be much higher in larger communities, since these communities generally have shop-keepers, markets, and cash flow, as mentioned in the notes in the table, so they have better potential to generate revenues needed for maintenance. They usually have already established water pay-for-volume arrangements (paying relatively high ad-hoc prices per jerry-can at a hand-pump or tap-stand or kiosk to an attendant), with good reliability because of the business incentive. In this context, it must be remembered that poor households in these communities do not find it easy to consume water at these high ad-hoc prices and are forced to use alternative sources which involve long walks, lack of reliability, and contamination; current ad-hoc arrangements in larger communities are, therefore, a major obstacle to universal access and achieving Uganda's national development goals or SDG 6.1.

Despite these disadvantages, Whave switched from the earlier uniform household tariff to this modality in 2016, because at that time, and even continuing into 2020, this the option which is preferred by most communities and most local government officials with the exception of Mityana council in 2018 and some individuals in Nakaseke in 2019. Whave, therefore, sees this modality as a necessary staging post, or Phase 1, preparing the ground for the transition to more advanced modalities which better suit financial sustainability and universal access.

The uniform technology fee modality was applied in the three districts of Kumi, Kamuli and Nakaseke in 2016, charging a bulk annual fee set at the lower rate of projected economic fee (exclusive tariff collection and assuming volunteerism from committees), allowing committees to collect and pay in intervals throughout the year corresponding to local needs. In practical application, communities with boreholes using only two or three lengths of rising main were unhappy to pay as much as communities with deep boreholes having many sections of pipe, so Whave established service agreements that divided the fee into tiers of 0.95, 1.1, 1.2, and 1.3 million UGX/hand-pump/year depending on the depth of the borehole.

It quickly became evident that communities would not pay more than they had already become accustomed to under the household tariff, so a large discount was awarded in order that tariffs remained at the 400 UGX/month/household level. This meant a 1 million UGX discount to reduce the annual bulk fee to 0.2 million UGX/hand-pump/year. This large discount was necessary to attract paying customers and thus familiarize district governments and communities with the new concept of a professional management approach involving performance paid technicians and full functionality assurance. The service agreements, however, clearly stated the full fee (0.95, 1.1, 1.2, and 1.3 million UGX/hand-pump/year depending on depth) and the temporary nature of the discounts, and Whave took care to substantiate its profile as a sustainability orientated social business by reducing the discount each year subsequently, in addition to taking care to reduce its marginal management costs progressively over the years.

It proved unfeasible to make discount reductions of more than approximately 10 per cent a year, so that by early 2020 the fee levels net of discount were 300,000, 450,000, 550,000, and 650,000 UGX/hand-pump/year depending on borehole depth. Compliance with these fee levels was high, averaging around 80 per cent, and district government support was strong; quarterly district-ASP PPP review meetings were held regularly and were well attended with increasing levels of practical assistance being provided by sub-county and district officials and extension workers. Functionality rates stayed above 98 per cent, increasing numbers of communities signed up, and the portion service cost recovered from tariffs rose progressively as marginal service management cost and discounts reduced, showing a trend towards financial sustainability.

However, the problem of small communities paying too much, and larger communities paying too little, was not solved, and modalities more suited to universal access and full financial sustainability were still needed. A shift to a pay-for-volume modality was discussed with the communities and governments of Kamuli, Nakaseke, and Kumi in 2018, 2019, and 2020, and refused except by some individuals.

Pay-for volume

In early 2018 Whave was invited to assess functionality problems and meet the government of Mityana district. Functionality rates were unusually low, and to explain this the district water engineer was vocal about the lack of maintenance planning by investors in the construction and rehabilitation of hand-pumps and about exploitation of rural communities by local technicians, while the district commissioner was vocal about rehabilitation procurement issues. The district councillors showed a high level of interest in preventive maintenance service agreements in communities, and expressed an agreement to the concept of district governments performance-contracting a pioneer professional ASP such as Whave. They also understood the shortcomings of the uniform technology fee payment modality, and decided to take up Whave's suggestion of a more advanced pay-for-volume modality as a potential solution for universal access and full functionality with sustained service cost recovery.

Whave proceeded to design the pay-for-volume modality involving a tariff per 20-litre jerry-can fetched from the pump and adopted a pro-poor tiered-pricing

approach to ensure universal access similar to Uganda's electricity 'lifeline' tariff. This complication was necessary to ensure sufficient revenues could be collected, ideally without any discount, while cash-poor families consuming basic-need water volumes could access water at an easily affordable price.

It was clear that volunteerism was not feasible, since tariffs would need to be collected at the pump by an attendant; whether it was to be a committee member, an ASP staff member, or a contracted attendant doing this onerous work, remuneration for tariff collection would be unavoidable. Total revenue from all communities would, therefore, need to be at the level of the projected economic fee, which was another reason why the tiered tariff approach was necessary.

Before working directly in the communities, Whave worked with the district government to establish relevant legislation at district level, in alignment with the planned national O&M framework with its focus on the district appointment of ASPs. The Mityana council accordingly passed a resolution that appointed Whave as its ASP and required all hand-pump-using communities to pay a maintenance tariff according to the volume consumed. The institutional structure and tariff-flow path is illustrated in Figure 4.

The district issued a point-source maintenance protocol in a series of NGO coordination meetings; this document directed NGOs investing in construction and rehabilitation to ensure: a) the ASP visited communities beforehand to sign service agreements and take advance tariff payments; and b) the ASP participated in or observed installation works such that the quality of the materials, designs, and site work were known to the company following up with responsibility for functionality assurance.

Whave conducted a survey of hand-pump-communities in five sub-counties to ascertain functionality results and baseline characteristics (Whave, 2019). It designed a fresh version of the Preventive Maintenance and Continuous Rehabilitation Agreement which reflected the new payment modality, and trained pump attendants how to keep track of water-use credit, while also training local technicians in preventive maintenance procedures. Whave held multiple introductory meetings with communities, with sub-county leaders, and councillors, and trained local government extension staff how to mobilize communities to understand and engage with the new service agreements.

Data is not yet sufficient to assess the viability of this tariff approach. By mid 2020, 42 communities had signed service agreements and were paying for water according to the per volume rate, and one NGO was actively compliant with the point-source maintenance protocol. However, issues were emerging with the management of attendant contracts, which resulted in non-revenue-water losses.

The analysis in Table 4 spans rural communities ranging in size from 25 homes (Whave services such communities in Nakaseke district) to 50 homes (a common average in many districts and roughly equivalent to government guidelines that a hand-pump should service 300 people), to 150 and 250 homes (just smaller than Rural Growth Centres, which are designated as having populations of above 1,500 people), up to 500 homes (approximately 2,500 people). The remit of district governments as rural water authorities includes communities of up to 5,000 people.

The larger communities are best suited to investment in piped water networks, while the realistic focus for rural water service provision through point-sources (whether motorized pumps, gravity flow, roof-water, protected springs, uncontaminated shallow and hand-dug wells, hand-pumps or other) is the range up to 500 homes (2,500 people). Cross-subsidy by ASPs between all community sizes is important if universal access is to be achieved, since this reduces tariffs to affordable levels or allows for low lifeline tariff rates in the pay-for-volume modality.

Pro-poor and tiered tariffs

The practical experience gained in implementing this range of tariff modalities has been productive. One outcome has been an appreciation of the importance of tiered tariff price plans. There are three realities that work together to require a price plan approach, as follows:

- a. Water is a human right, and international studies indicate that each person should have access to at least between 15 or 20 litres per day (Howard and Bartram, 2003), which implies low prices should be set for water to allow each family 100 litres per day/household. If for example, a family was paying 8,000 UGX/month for water (2.8 per cent of average rural income considering the references mentioned above) and consuming 100 litres/day, the price per 20-litre jerry would be just over 50 UGX, which is the price recently recommended by the MWE for hand-pumps.
- b. The reality in rural communities is that water also has high value and is sold for considerably more, up to 1,000 UGX/jerry-can, to wealthy or business consumers or farmers using the water for livestock or irrigation. The reality also is that most rural families generally collect far less than 100 litres per day, often collecting on average as little as 20 or 40 litres clean water from a borehole, especially during rainy periods.
- c. The sale of water at pro-poor pricing such as 50 UGX/jerry-can cannot cover the cost of maintenance unless large quantities are purchased.

Given these three realities, the sale of water at a low price in volumes greater than 40 or 60 litres per day, invites the logical market response (which is evident already at scale in urban areas), that consumers buy at a low price a larger volume than needed for personal consumption and sell the surplus at a high price, or share it with their neighbours. The effect is that insufficient revenue is collected.

The solution is a straightforward recognition that any consumption exceeding a threshold such as 60 or 100 litres/day/consumer, is automatically a business or commercial demand, for which the buyer can afford a higher price. Investigations on the value of water for growing tomatoes, for example, or for watering cattle, building works, and on-selling, bear this conclusion out.

There is also another implication, which is that consumers must purchase a minimum volume each month, or pay a basic standing charge, in order to be eligible for pro-poor tariff levels. Ugandans are already familiar with two-tier price plans, since their electricity provider sells the first 15kWh/month at a pro-poor 'lifeline'

tariff, and charges more once this threshold is exceeded. A two-tier rural water price plan would register consumers as eligible for pro-poor tariffs as low as 50UGX, on condition of:

- a. purchase of a minimum amount each calendar month, for example, 1,000 litres at 2,500 UGX;
- b. payment at a higher rate, for example, 100 UGX/20-litre jerry-can, when over the daily 'lifecycle' threshold of 60 to 100 litres.

Tariff collection by committees and local government

One discussion point in 2019 was the risk of exploitative and unregulated behaviours by ASPs. One point of view was that ASPs may in practice act without proper regard to regulated tariff levels and service standards, leading to water users being unwilling to pay maintenance tariff payments and therefore, continuing poor functionality. As a result, a proposal put forward in 2019 in an early draft of the O&M framework issued by the MWE was that community committees should be exclusively designated as tariff collectors, take a percentage (to solve the lack-of-volunteerism problem), then pass the remaining revenue to sub-county government who also took a percentage, in turn passing the remainder to the district government, who was to pass the remaining revenue to the ASP in line with its performance management role. The proposal was not conclusive as to CapManEx inclusion in tariff determination. Figure 6 shows this payment modality.

In response to this draft, several ASPs convened by Whave took another view, which was that:

- there was a risk that local government would not convince water users that the tariff revenue was used accountably, leading to unwillingness to pay and reversion to poor functionality;
- it is necessary that one entity be exclusively accountable for functionality and for revenue deployment, without confusion with other accountabilities; water users (and stakeholders such as central and district government, and aid agencies providing funds) would then know which entity to call on if and when their water supplies fail or financials fail;
- under performance contracts, ASPs survive only through successfully achieving functionality, and therefore, have no choice but to use tariff revenue transparently with full accountability; not doing so leads to unwillingness by water users to pay tariffs. ASPs with exclusive responsibility to collect tariffs directly, are, therefore, the safest bet for accountability;
- ASPs will not be willing to operate as providers of full functionality assurance if they are not directly collecting tariff revenue, because indirect revenue flow will introduce cash flow delays which are well known to be fatal;
- aid organizations have the capacity to support regulation and investment, and are integral to the institutional structure of the national O&M framework as drafted by the MWE, and therefore the control of ASP accountability is not dependent only on government supervision but also of the donor organizations providing investment finance.

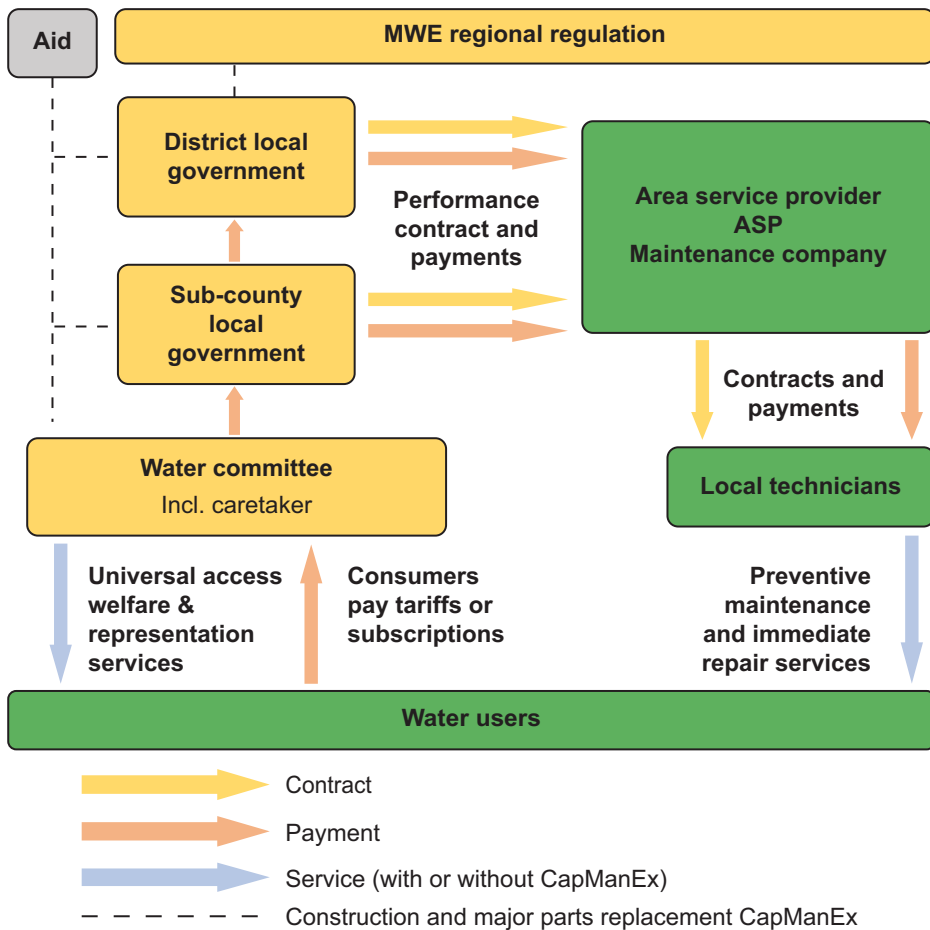


Figure 6 Tariff revenue flow through local government. Not a Whave model.
 Notes: Tariffs are collected by the Committee, which submits revenue to sub-county government which in turn submits to the district government, which then pays the ASP. Each party retains a percentage of tariff revenue, with the ASP receiving the final balance. The committee provides welfare inputs, moderation, and assurance of universal access. So far no ASP has trialled this model, rather the ASP function has been carried by local government. The functionality and other outputs of this model are not reported in this paper for lack of data.

This logic was conceded by MWE, and in March 2020 the MWE printed and circulated a first edition of a national O&M framework, stating that tariff collection was the exclusive function of ASPs, and ASPs would collect tariffs from water users either by subscription (monthly or periodic fees regardless of the quantity of water consumed) or by units of volume consumed. Community water and sanitation committees would mobilize these payments, as well as mobilizing hygiene and sanitation (MWE, 2019). The document did not in its first edition resolve tariff levels except to clarify that tariffs would be set by government.

Pros and cons: Selecting the social and economic optimum

Whave undertook an analysis of the tariff and institutional structures represented in Figures 3 and 4, making a comparison of the options described here, according to criteria for social and economic merit. The broad criteria considered were: equity in society, social demand, Ugandan constitutional and human rights, achievement of the SDG 6.1 goal of universal access, fulfilment of national development plans for improved productivity and health in rural areas based on delivery of services, shift of livelihoods to more efficient farming and agricultural value-adding industries away from subsistence farming, and in general a better and more self-reliant rural and national economy based on services and jobs in rural as well as urban areas. Initial results were as follows:

Uniform technology fee

- advantage: it is generally accepted in principle by farming communities because it does not require them to acquiesce to generating more revenue than directly required for their own maintenance needs;
- advantage: it presents lower tariffs than commonly paid in trading centres currently at tap-stands and at hand-pumps, therefore it includes the poorer members of trading centres;
- disadvantage: although accepted in principle, payment of the fee in full requires a declining discount approach, scale and saturation, and it runs the risk of excessive debate over tiered rates reflecting different technologies and varying features of each technology and installation;
- disadvantage: it does not cross-subsidize between communities, and therefore presents high tariffs in small communities (where many of the poorest families live) to levels which may not be affordable. It, therefore, fails the social and economic criteria.

Uniform household tariff

- advantage/disadvantage: it cross-subsidizes between communities, delivering affordable tariff levels for the poorer, smaller communities, as well as for the poorer members of larger communities and trading centres. However, within each community, it fails to price water fairly: a small family is paying much more for water than the large family, and small families may often be poorer families and persons;
- advantage: it presents lower tariffs than commonly paid in trading centres currently at tap-stands and at hand-pumps, therefore it includes the poorer members of trading centres and provides a solution for the full rural population;
- advantage: it is suited to tiered tariff price plans to ensure all households including the poorest get a minimum volume of water daily for health at a low lifeline pro-poor tariff;
- advantage/disadvantage: it mimics the convention of subscription per household which has been accepted in principle for many years so may have social acceptability, although it carries risk of following the failure of this convention in implementation for many years;

- disadvantage: it is difficult to implement because separate households have an incentive to merge and present themselves as a single subscriber. Revenue for an ASP and attendant tends to fall too low for ASP viability and attendant incomes;
- disadvantage: it requires larger communities to acquiesce to generating more revenue than directly required for their own maintenance needs, and therefore tends to be resisted by some communities; it therefore needs strong implementation.

Uniform volume tariff

- advantage: it is an automatic cross-subsidy approach, delivering affordable tariff levels for the poorer, smaller communities, as well as for the poorer members of larger communities and trading centres. It, therefore, achieves SDG 6.1 and national development goals;
- advantage: it presents lower tariffs than commonly paid in trading centres currently at tap-stands and at hand-pumps, therefore it includes the poorer members of trading centres and provides a solution for the full rural population;
- advantage: it mimics conventional payment at tap-stands and at metered premises, so can act as a transition vehicle and trigger towards community contribution to upgrades to piped water;
- advantage: it is suited to tiered tariff price plans to ensure all households including the poorest get a minimum volume of water daily for health at a low lifeline pro-poor tariff;
- advantage: it assists with conversion of hand-pumps to motorized ground-water distribution by inviting hand-pump communities to demonstrate compliance to volume payment;
- disadvantage: it is unfamiliar and unconventional to rural water actors currently (it is often considered unacceptable at hand-pumps because they do not have the convenience of tap-stands) and therefore difficult to implement in most areas, needing prior transitional stages and demonstration districts to lead the way.

Comparing these three options, it is noticeable that the first two both generate higher prices for some poorer consumers, in small communities in the case of the uniform technology fee and in small households in the case of the uniform household fee. Both suffer from severe constraints in implementation, since shrinkage of consumer representation is difficult to avoid. The only option that fulfils the criteria for an optimum tariff structure, and achieves SDG 6.1 and national development goals, is the uniform volume tariff as illustrated in Figure 4, because it cross-subsidizes both within communities and between communities, and management of tariff collection is less vulnerable to the shrinkage tendency.

Question 6: What are the barriers?

The comparison of options has concluded that the structure shown in Figure 4 satisfies social, economic, and institutional criteria best. The analysis indicates that Figure 3 represents a transition stage, since it is a significant step forward in establishing practical familiarity on the ground with the ASP function, but

current contextual factors do not allow a jump immediately, in most areas, to the arrangement shown in Figure 4. However, the evidence of early work in Mityana by the local government and Whave indicates that this is now an acceptable approach at least in pilot areas, and an important element in operationalization of the new national framework for O&M.

Electioneering and gifting

However, even if the arrangement depicted in Figure 4 is agreed as the social and economic optimum by civil servants in central and local government, by communities, and by other stakeholders such as investors in infrastructure (churches, NGOs, politicians), it still faces a barrier: electioneering politics. National elections take place in March 2021, with a leadup of almost two years, and rural votes are critical to the final result. This barrier has, therefore been part of the reason for the slow uptake of undiscounted fees under the Figure 3 structure, and resistance to the structure shown in Figure 4.

Conventional vote-seeking involves promises by politicians that hand-pumps will be repaired free of charge, new sources will be constructed, and maintenance will be taken care of by the government or by private sponsorship from the politician. These promises are typically substantiated by examples of private sponsorship of repairs and new constructions paid for by campaign funds, often involving sub-standard works leading to early functionality failure. This sponsorship is not associated with obligations to pay maintenance fees; indeed, the concept that the community committee takes care of that is convenient because it opens a door to gifting for votes.

Debates over payment of water maintenance tariffs reflect national debates on fee-for-service in sectors such as schooling and hospital care. Many citizens advocate that suffering is worse in a free-of-charge environment; rather the payment of small fees for critical services improves the lives of the poorest as well as the middle class, because service is then available reliably and money is actually saved rather than lost.

To address this barrier, it is necessary that the issue of tariffs for rural water supply functionality is depoliticized. Just as no politicians currently promise a removal of water tariffs from town supplies, or even promise their reduction, it is necessary that politicians of all parties respect rural water tariffs while campaigning for re-election. The fact that the tariffs proposed in this paper are at levels well below the ad-hoc pricing currently found in rural areas (vendors common sell at 500 to 1,000 UGX/20 litres), the fact that payment by water users for maintenance has been formal government policy for 20 years already, and the fact that guaranteed functionality and a regulated tariff is a major cost-saving solution for cash-poor families, should be enough to substantiate a politically neutral approach. Training of MPs in neutralizing tariffs is a priority solution to address the functionality crisis.

The activities of many large and small aid organizations and programmes or projects in the WASH arena is also identified as a major barrier since aid finance dominates rural WASH investment. These activities prioritize construction and rehabilitation of

water sources, and do not attend adequately to maintenance structures, such that the real effect is gifting which undermines sustainable service provision. To a large extent these organizations, projects, and programmes currently operate independently of each other, and undermine effective government regulation by by-passing compliance or acting in ignorance of policies and procedures already in place. The establishment of, and compliance with, government regulation has not yet been identified as a priority in their agendas, and resources are therefore not directed to strengthening the regulatory environment, nor to coordinating aid interventions. These failings are consolidated by the failure of aid programmes to recruit staff who are experts in the critical areas of regulation, coordination, and public service management.

Service area mandates

The availability of alternative free-of-charge water sources has been mentioned as a barrier already, as has the issue of ASPs having small customer volumes such that management costs are too high for recovery of service costs through affordable tariffs. These two constraints are already identified in the text above, and the importance of saturation and scaling in concentrated service areas is identified as a critical solution. The O&M framework published by the MWE provides for exclusive service area mandates for ASPs, and the scaling imperative is also recognized through mention of clustered districts appointing one ASP.

However, implementation of service area exclusivity is still a major barrier to full functionality assurance. One reason is that controls are not in place yet to assure an ASP that servicing of the larger communities with good revenue-generating potential will not be transferred at short notice to, or be summarily adopted by, a non-rural utility, such as the umbrella authorities or National Water and Sewerage Corporation (NWSC) regional branches. When this happens, and it already commonly does, the ASP business plan fails, as it depends on cross-subsidy between large and small community revenues. This failure means that smaller communities do not receive service without continuing dependency on subsidy which is uncertain and stop-start, such that functionality is not achieved consistently.

Large rural areas have already been service-area-mandated (or 'gazetted') to the piped-network-water utilities, principally the umbrella authorities and National Water and Sewerage Corporation. These areas contain large populations dependent on hand-pumps, yet point-source reliability assurance is not yet included in the utilities' performance contracts.

Implementation of the service area principle, therefore, implies a concerted effort to solve these two barriers through service area mandates that are respected by all parties. It is likely that a national water regulator, empowered to demarcate between the ASPs, the NWSC, and the umbrella authorities, is needed for this to be effective.

Question 7: How can aid help?

International aid programmes and NGOs active in Uganda are the dominant investors in rural WASH and are, therefore, in a strong position to address the barriers listed above. The question is, how this is best done.

The first answer is relatively simple and does not require a difficult shift from current activity. It is simply that all investments in point-sources should be made according to a longer pre-requirement list than is currently normal. It is already normal for WASH, NGOs and programmes focused on community work to undertake as pre-requirements of investment works:

- a. training a community committee in managing improved sanitation and hygiene;
- b. community-wide improved sanitation and hygiene behaviour change.

To address the poor functionality issue, the pre-requirement list should include additionally the obligations to:

- c. ensure that the district is aware of the national O&M framework and is implementing it effectively. If in doubt, find aid partners and assist. Act as a communication facilitator in this respect between the MWE and the district, and the sub-county governments;
- d. check that the district has set rural water tariffs suitable for ASP viability and obtain approval from the MWE;
- e. check that the district has appointed an ASP and the ASP is aware of each NGO's plans and budgets;
- f. clarify to communities that compliance to maintenance tariffs and service agreements is a pre-condition of investment;
- g. invite the ASP to establish maintenance service agreements in the targeted communities before undertaking construction or rehabilitation works.

For NGOs or programmes focused on advocacy, the priorities are:

- h. as above, check that a Point Source Maintenance Protocol has been issued to NGOs and aid programmes, and if not, assist the district government to develop one, issue it, and implement it;
- i. work collectively with other aid organizations, district governments, and regional regulators of the MWE, to address the Service Area mandate issue and establish a national water regulator, and support that regulator in its task.

There are, however, some changes in aid conduct which are not as easy as the above. It essential that aid programmes and NGOs act as follows:

- j. agree among themselves a single harmonized advocacy approach which addresses the issue of electioneering in the context of achieving viable service delivery;
- k. provide financial assistance on the basis of contribution to ASP business plans and national O&M framework operationalization, rather than on the basis of isolated projects;
- l. withdraw diverse fiscal and administrative practices which conflict with measures needed for functionality assurance and instead harmonize with the accountability procedures and formats shared between ASPs and district governments. Conflicts include: a) budget spend imperatives often dictate rapid investment in conflict with the pre-requirement of service agreement

sign-up and advances paid on maintenance tariffs; b) fiscal and Monitoring and Evaluation (M&E) accountability structures commonly imposed on a two, three, or five year project basis are different from those agreed within the long-term public–private partnership contracting structures, with the result that both government and ASP actors are disabled by an overload of responsibilities, especially when several aid agencies are investing in a single service area. Aid agencies, therefore, must agree on ‘right-fit’ fiscal accountability and M&E, and ‘right-fit’ budget spend requirements that align seamlessly with the Professional Management Approach/CBMS+ contractual structures;

- m. agree that service areas consist of clusters of districts with a population size of at least 1 million, so that economic viability of ASPs becomes feasible, and help the MWE and district governments achieve the necessary clustering;
- n. help establish regulator capability for service area mandates which ensure that surplus revenue from large communities is used by ASPs to subsidize deficits in small communities, as a method of achieving universal access to a reliable supply of safe water;
- o. collectively assist the MWE and district governments to decide on modernized tariff modalities which ensure universal access via pro-poor tiered price-plans prices with lifeline rates, higher rates for business users, and appropriate rates for institutional users, and assist with public information campaigns that convey the benefits of regulated pricing sufficient to cover service costs, in contrast to ad-hoc pricing;
- p. agree among themselves that investments they make in infrastructure (whether new installations or recovery of quality of existing assets) are conditional on the prior application of the cost-recovery pricing structures;
- q. assist district governments to demarcate of cost and task responsibilities between communities, sub-county and district offices, and external investors, according to the national O&M framework, also helping the districts to refine the framework so it is feasible in its local context, and harmonize this advice with other aid agencies;
- r. adopt a common language and terminology, with clear definitions of standards, indicators, and targets for ASPs and investors;
- s. deploy personnel with skill-sets and professional experience appropriate to the tasks described, with particular focus on public service management and accounting, engineering cost-efficiency analysis, and contractor performance-orientated management.

Conclusion

An overriding finding from the programme has been that impact of future WASH aid programmes depends on effective coordination between aid agencies, aid programmes, NGOs, local government, the MWE, and the emerging area service providers, in support of the national O&M framework.

Acknowledgements

Rural families pay tariffs to Whave, so are principal contributors to recurrent service costs, even under current discounted tariff conditions; their contribution already successfully meets the cost of local technicians' labour and post-recovery hardware.

The enthusiasm of community leaders and members, together with local government councillors and staff is acknowledged as the lead expertise underpinning the programme. Many senior staff of the MWE have supported the programme throughout since 2011 and generated invaluable guidance to the programme, encapsulated in the National O&M framework printed and circulated in early 2020. Local technicians, all members of the district Hand-Pump Mechanics Association, have mobilized communities to sign Preventive Maintenance and Continuous Rehabilitation Agreements (PMCRAs), and have conducted preventive servicing and immediate repair in a professional manner. District water officers have demonstrated commitment not only through enthusiastic collaboration and initiatives such as supporting council meetings and issuing directives to NGOs, but also by transferring local government budgeted hardware for efficient use by Whave as their appointed ASP maintenance contractor.

Investment finance is gratefully acknowledged from UNICEF Uganda, USAID via the Sustainable WASH Systems Learning Partnership, Siemens Foundation, the German Ministry of Development (BMZ), USAID via Mercy Corps, the Austrian Development Agency (ADA), Osprey Foundation (USA), Waterloo Foundation (UK), Silicon Valley (USA), and the Climate and Development Knowledge Network (UK and NL).

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