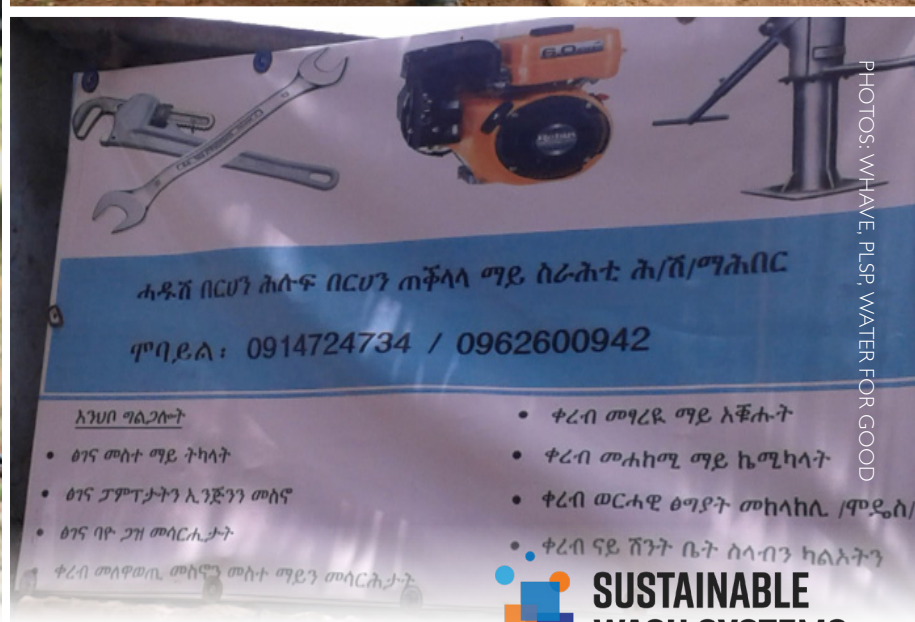


Sustainable WASH Systems Learning Partnership

SUSTAINING RURAL WATER: A COMPARATIVE STUDY OF MAINTENANCE MODELS FOR COMMUNITY-MANAGED SCHEMES

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PHOTOS: WHAVE, FLSP, WATER FOR GOOD



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Table of Contents

Acronyms.....	3
1. Introduction and Background	5
2. Maintenance Service Provision Typology.....	10
3. Analytical Framework	12
4. Maintenance Service Provider Model Case Studies Overview	14
5. Findings	24
6. Emerging Lessons and Recommendations	51
References	55
Annex 1: Key Informants	57
Annex 2: Desk Study Overview of Maintenance Providers	58
Annex 3: Case Study Overviews	62
Annex 4: Further Resources	85

Figures

Figure 1 Maintenance Service Provision Typology	11
Figure 2 Map of PLSP Woredas by Supporting Agency	19
Figure 3 Map of Tigray Showing Wahis Mai Cluster Areas	20
Figure 4 Overview of Institutional Arrangements for Case Study Maintenance Models	31

Tables

Table 1 Overview of Analytical Framework.....	12
Table 2 Overview of Maintenance Models and Operating Contexts.....	15
Table 3 Maintenance Tasks, Triggers, and Staffing for Maintenance Activities	29
Table 4 Overview of Payments, Maintenance Costs, Tariffs, and Subsidies for MSP Models	34
Table 5 Summary of Regulation of MSP Models and Accountability Mechanisms for Consumers	43

Acronyms

ANEA	National Water Supply and Sanitation Agency (Agence Nationale de l'Eau et de l'Assainissement)
CAR	Central African Republic
CBM	Community-based management
CBO	Community-based organization
DOT	Digital Opportunity Trust (a partner of SNV)
DWO	District Water Office
ETB	Ethiopian birr
HPMA	Hand Pump Mechanics Association
iWET	Inspiring Water Entrepreneurship in Tigray (a program of SNV)
Kebele	Lowest administrative unit of local government (equivalent to a ward)
LSP	Local Service Provider (part of Whave model)
MFI	Micro-finance institution
BOT	Build-Operate-Transfer
JSR	Joint Sector Review
KPI	Key performance indicator
MSP	Maintenance service provision
MWE	Ministry of Water and Environment
O&M	Operation and maintenance
PAYF	Pay-As-You-Fetch (a pilot model in Kabarole district)
PLSP	Private Local Service Providers
PM CRA	Preventive Maintenance and Continuous Rehabilitation Agreement (an investment service provided by Whave, Uganda)

PPP	Public-Private Partnership
REST	Relief Society for Tigray
RSP	Regional Preventive Maintenance Service Provider (part of Whave model)
SNV	Dutch Development Organization
SWS	Sustainable WASH System Learning Partnership (a project funded by USAID)
UGX	Uganda shillings
WfG	Water for Good
WASH	Water, sanitation, and hygiene
WASHCo	Water, sanitation, and hygiene committee
WSMTF	Water service maintenance trust fund
WUC	Water user committee

Central African Republic

DGH	General Directorate of Water (Direction Générale de l'Hydraulique), within the MMEW
MMEW	Ministry of Mines, Energy and Water (Ministère des Mines, de l'Energie et de l'Hydraulique)

Ethiopia

TSP	Technical Service Provider
TVET	Technical Vocational Training Centers
WUC	Water User Committees

Uganda

TSU	Technical Support Unit (a unit of the rural water department within the MWE)
WUC	Water User Committee

I. Introduction and Background

As rural water supply coverage rates rise across many countries, attention is increasingly being paid to finding and implementing cost-effective mechanisms to ensure this improved initial access is sustained over time. Although there are insufficient large-scale quantitative insights into either the magnitude or the nature of the problem of poor performance of rural water schemes, non-functionality figures of between 30 and 40 percent are often cited and have been consistently reconfirmed in various studies over the last decade and more (Baumann, 2009; Lockwood et al., 2003; Sutton, 2005; RWSN, 2009; Lockwood and Smits, 2011; World Bank, 2017.a). These figures refer particularly to hand pumps in sub-Saharan Africa. In Tanzania, 40 percent of water points were reportedly non-functional as of 2016 (World Bank, 2017.b), with similar findings from Ghana (Adank et al., 2013). Country-specific experience also reveals important systems failure in piped systems. In Vietnam, for example, an estimated 25 percent of rural piped systems are not functioning or poorly functioning (World Bank, 2016.a).

Conventional approaches to maintenance have largely been based on voluntary community-based management (CBM) with communities taking on the burden of maintenance themselves, with limited, if any, support from external agencies or local government. This CBM model has struggled to ensure that rural water supply infrastructure is adequately maintained, with “fix on failure” becoming the default approach in most cases. This has resulted in lengthy downtimes, the incursion of unnecessary costs, and, ultimately, failure to attain the full impacts and desired improvements that access to reliable sources of water can bring. For example, a recent study from Ethiopia indicates that 26 percent of rural households using improved water sources as their main water point experience less than 6 hours per day of service (Tincani et al., 2015).

While some countries are moving toward replacing CBM models with alternatives that are more common in urban areas (i.e., private or public utility solutions based on concessionary contracts for service provision), in most countries CBM will remain an important, if not predominant, approach. Even in relatively advanced countries, CBM will continue to be part of the rural water service provision landscape, given the challenges of managing large numbers of small, dispersed water supply schemes and the fragmented institutional nature of the rural water sub-sector. Recently, there have been attempts to professionalize CBM through adopting a systems-based approach. A key component of this has been the development of new approaches for improving maintenance services, some of which now operate at a considerable level of scale and include different forms of innovation in technology adoption, contracting, and financing. This report documents key findings, emerging trends, and recommendations from an in-depth study of seven case studies of approaches to maintenance for CBM across four countries.

IRC Ethiopia commissioned this study as part of its work under the USAID-funded Sustainable WASH Systems Learning Partnership (SWS).¹ The purpose of the study is to provide information and lessons to inform ongoing innovations in maintenance models by learning alliances working with IRC in Ethiopia.²

¹ <https://www.globalwaters.org/SWS>

² Learning alliances are platforms that bring together actors at the district and town levels around a shared vision to develop and execute collective actions to strengthen systems for sustaining WASH services.

These learning alliances focus on strengthening or innovating within the existing institutional arrangements for maintenance and augmenting ongoing pilots. This final report builds on an inception report that was informed by a desk-based review of 22 maintenance service provision (MSP) models for CBM across 17 countries. The case studies included in this assessment are as follows:

1. Government-led kebele water technicians (Tigray region, Ethiopia)
2. Private local service providers (SNV, Tigray region, Ethiopia)
3. Wahis Mai program (Relief Society for Tigray and Charity:Water, Tigray region, Ethiopia)
4. Hand Pump Mechanics Association (Kabarole District, Uganda)
5. Water for Good circuit rider program (Central African Republic)
6. Whave Preventive Maintenance Service Area Provider model (Kumi, Kamuli, and Nakaseke districts, Uganda)
7. FundiFix guaranteed maintenance service model (Kwale and Kitui Counties, Kenya)

1.1 Objectives of the Study

SWS is a 5-year project operating in four countries to test new ideas, approaches, and tools to overcome barriers for improving water, sanitation, and hygiene (WASH) service sustainability. The project's underlying theory of change is that by understanding local WASH systems and using systems-based analytical tools and processes, interventions can be identified to strengthen these systems, which can lead to an improvement in the quality and durability of services delivered at the local level.

This comparative study is based on the premise that each maintenance model represents a sub-system of the broader water supply system and is constituted by a set of factors and actors, in a process of constant and dynamic interaction. Among other elements, these factors include technology and technological innovations, local political influences, the regulatory environment, social customs and norms toward the value of water, local institutional frameworks (including community, government, non-government, and private sector actors), and financing derived from different sources both within the system (i.e., household tariffs, private sector investments, and local government funding) and from external donor or NGO programs.

Within the system, there are formalized rules, such as a national policy on the types of organizations eligible to provide maintenance services, as well as informal incentives, or disincentives. Disincentives include political influence over contracting, conflicting approaches to payment of services that may undermine willingness to pay, and individual household behaviors around alternative water sources. Given these factors and the broad range of contexts in which they operate, as well as market size and viability (i.e., relative wealth, water resource availability, and population densities), each maintenance model is unique. The primary goal of this study is to generate evidence and better understanding of how these maintenance models operate, how they evolved, and how they can be scaled and applied in new

contexts, with the immediate objective of seeking to influence discussion on rural water supply maintenance models in Ethiopia. The specific objectives of this study are as follows:

1. To research, review, and describe a range of existing and newly emerging approaches to professionalizing maintenance services for rural water supply services operating under CBM;
2. To develop a typology of approaches based on the empirical findings of the literature review and case studies;
3. To develop an analytical framework to analyze the history, institutional set up, financing, and regulation of MSP examples; and
4. To apply the analytical framework to a limited number of examples under each one of the sub-categories of the typology identified through the literature review and to generate lessons and recommendations for strengthening these models and for potential scale-up under SWS and beyond.

The study was undertaken between October 2018 and February 2019. It involved face-to-face interviews, email contact, and questionnaires with key informants for each of the seven maintenance models investigated, as well as a desk-based review of existing documentation for the initial literature review of 22 MSP models. Annex I provides a full list of key informants.

This report is the primary output of the study and is structured as follows:

- The remainder of Section 1 details the study approach, methodologies, and case study selection, as well as a definition of maintenance for rural water supply;
- Section 2 provides an overview of the MSP typology developed under the inception period;
- Section 3 outlines the analytical framework developed under the inception period;
- Section 4 provides an overview of the seven case study MSP models researched for this report;
- Section 5 provides a comparative analysis and key findings from the review of the case study MSP models; and
- Section 6 outlines emerging trends and recommendations for broader consideration.

1.2 Methodology, Study Approaches, and Case Study Selection

This study considers different variations of maintenance approaches. It includes examples that are carried out by a range of actors, apply both supply- and demand-driven triggers, operate under different financing mechanisms and business models, and are applied at different scales with varying levels of external (donor) support. The common element across these cases is the drive to professionalize maintenance services. The first stage of the study was a literature review of 22 MSP models from 17 countries that represented a broad geographic range, as well as countries with varying levels of

economic development. The information from this literature review was incorporated into an inception report that also provided a typology for characterizing MSP models and a framework for analyzing them.

The principal methodologies used for this study were a review of publicly available and informal documentation and key informant interviews, with follow-up information collected by email. These various sources of data and information were collated and analyzed using a common framework (see Section 4) that considered different aspects of each model, its genesis and evolution over time, key factors, and, where possible, the dynamics between key stakeholders and links with the broader WASH system in each country. Information and data were not available to the same level of detail across all the case studies, and due to the limited scope of the study, it was not possible to carry out primary data collection beyond what was made available by SWS implementing partners and the Water for Good (WfG) team. Inevitably, this led to some inconsistencies and gaps in the comparative analysis.³

This final report presents an in-depth study of the seven maintenance models selected because they all operate within the scope of SWS⁴ and represent different cases from the typology of approaches. The study focuses on maintenance activities for existing infrastructure, although some of the examples also conduct rehabilitation activities and other functions, and some are even starting to work on new construction. It is important to note that the case studies selected for further analysis are all based on arrangements in which communities retain a significant stake in the daily management of their own water supply scheme and receive external support for maintenance functions. As such, all the cases can still be identified as operating under CBM principles. In the analysis of the examples, the term “district” (or “sub-district”) is used as a generic term to describe a decentralized administrative unit of local government that may be referred to by another term in different contexts (e.g., municipality, commune, woreda). The term “region” is used to describe a higher-level administrative unit between district and central level. Case study MSP models from federated countries (Ethiopia) are clearly stated.

1.3 Defining Maintenance for Rural Water Supply

Maintenance of any water supply scheme is a basic and essential intervention in preventing individual component failure, extending the useful life of such components, limiting deterioration of service levels, minimizing disruptions in services, lowering the costs of sustaining access levels to water in rural areas, and ultimately ensuring the continued operation of the scheme over time. Maintenance is a subset of activities that come under a broader umbrella of infrastructure asset management (often simply termed asset management). This set of approaches and practices can collectively ensure the continued functioning of a water supply facility, and hence the services delivered by that facility. Managed service delivery is achieved by having knowledge of individual components and their costs and ensuring the incremental repair and replacement of these components in a planned manner, with a related financing

³ Where there is a reference to gaps in this report, such as “no data available,” it means that the author was not able to access such data, not that it does not exist.

⁴ There is one exception, namely the case of WfG’s circuit rider program, which is included because it is a strong example of this sub-typology and because the organization has collected a large amount of data and information about the model.

plan in place. Different forms of maintenance are an essential part of asset management (Boulenouar and Schweitzer, 2015).

Asset management is a well-tested practice applied largely by utility operators in many countries, including the global south. Many examples exist of good practice in terms of the individual elements, including procedures for asset development, setting up asset registers, inventories, and maintenance regimes. However, these practices are much less common in the rural water sub-sector, where even basic information on the location, age, and composition of individual water supply facilities is not available or patchy. The situation for regular maintenance is also often sub-optimal, meaning small problems can quickly turn into much more costly and major technical challenges that result in service disruption. In terms of maintenance interventions, the following categories can be identified (Brikké and Davis, 1995):

1. **Preventive maintenance:** regular inspection and servicing, including replacement of consumable spare parts, to preserve assets and minimize breakdowns carried out on a regular schedule according to the requirements of components of the scheme;
2. **Corrective maintenance:** repair and replacement of broken and worn-out parts to sustain reliable facilities; this category can also include what is sometimes referred to as “crisis maintenance,” implying a catastrophic failure, which requires an unplanned or emergency response to breakdowns and user complaints.

Regular preventive and corrective maintenance costs money, and an approach based on crisis maintenance alone may appear cheaper in the short term. However, continuing crisis maintenance leads to frequent breakdowns, an unreliable supply, poor service levels, and a lack of user confidence, which is hard to rebuild. Long-term reliance on crisis maintenance may ultimately lead to the complete failure of the infrastructure.

2. Maintenance Service Provision Typology

A desk review carried out during the inception phase of this study assessed 22 examples of experiences with maintenance provision from 17 countries. While all examples under review operate in rural contexts (ranging from low-density scattered communities to more densely populated small towns and rural growth centers), they can be characterized as operating at different levels of scope or aggregation, are led by different actors (e.g., a government entity, NGO, donor, or private company), have been in existence for differing lengths of time, and either are already part of sector policy or are operating as pilots with government approval at various levels. Annex 2 provides an overview of the examples, country context and how they function, tasks performed, level of the application, and important contextual information.

Based on this review and analysis, a typology for maintenance services was developed, presented in Figure 1. At the highest level of the typology there are three broad approaches that characterize the principles upon which maintenance services are provided:

1. **Ad hoc reactive approach:** Under this approach, services are provided on demand (i.e., when something goes wrong and the community actively seeks out maintenance assistance) and are therefore mostly concerned with corrective maintenance when there is a significant problem. Maintenance services tend to be unplanned and normally, but not always, provided by local government or a deconcentrated technical agency of government. Typically, communities would not be expected to pay for such support, but they would contribute to or cover the costs of the spare parts and supplies required to carry out the maintenance task in question; they may also contribute in free labor time. Small private providers sometimes provide one-off services under this model on a fee-for-service basis covering both spare parts and their time.
2. **Structured proactive approach:** Under this approach, maintenance services are provided on a structured basis, with an agreed range of periodicity (i.e., bi-annual or quarterly visits), and typically include both preventive and corrective maintenance tasks. These examples normally also include broader support functions, such as technical guidance and advice on management issues and on linking communities with other external resources. Typically, these services are provided by a higher-level or umbrella provider, which can be organized through the clustering of CBMs or private operators into associations, federations, or water boards. In a limited number of cases this type of proactive support can be provided by NGOs or outsourced to external private sector providers. Where there are adequate resources made available, local government may also provide this type of support. Another common way of organizing is around the circuit rider model, which was developed in the U.S. in the mid-1970s and has been applied extensively in the global south, particularly in Latin American countries.⁵

⁵ The circuit rider model is supply driven, involving technicians making rotating visits to rural communities on a pre-determined schedule. Such visits are typically to troubleshoot and provide advice and correct maintenance before a problem occurs or before a small problem is amplified. Circuit riders can also respond to direct demand from communities to make repair visits where resources allow. The name is derived from the technicians moving around a circuit of visits to the same group of communities.

3. **Guaranteed service approach:** This approach is relatively recent to the rural water sub-sector and typically involves private companies or social enterprises providing both preventive and corrective maintenance for a fixed fee that is paid collectively by the community via the CBM or a caretaker. Typically, communities pay a flat fee on a monthly or annual basis, which covers all costs for any potential repairs and maintenance. In some instances, the maintenance provider also commits to paying for capital maintenance investments, but this is stipulated by contract. The main difference with this model is that services are guaranteed by contract, with performance targets such as repair response time and functionality rates clearly specified. Risks to the maintenance provider can, in theory, be minimized by having many water schemes to service, thereby applying an insurance principle of pooling maintenance risk. Financial risks can also be spread by blending different sources of financing under one mechanism, to include tariff revenue, public funding (including aid borrowing), grant funding, and private finance, where possible.

Below the three highest-level approaches, the MSP typology outlines five mechanisms of delivering maintenance services that are distinguished by the principal actors in the model. The typology details the maintenance tasks performed, the triggers for maintenance, the extent of CBM activity, and the financing at point of service. All 22 of the MSP models reviewed during the inception period were characterized using this typology.

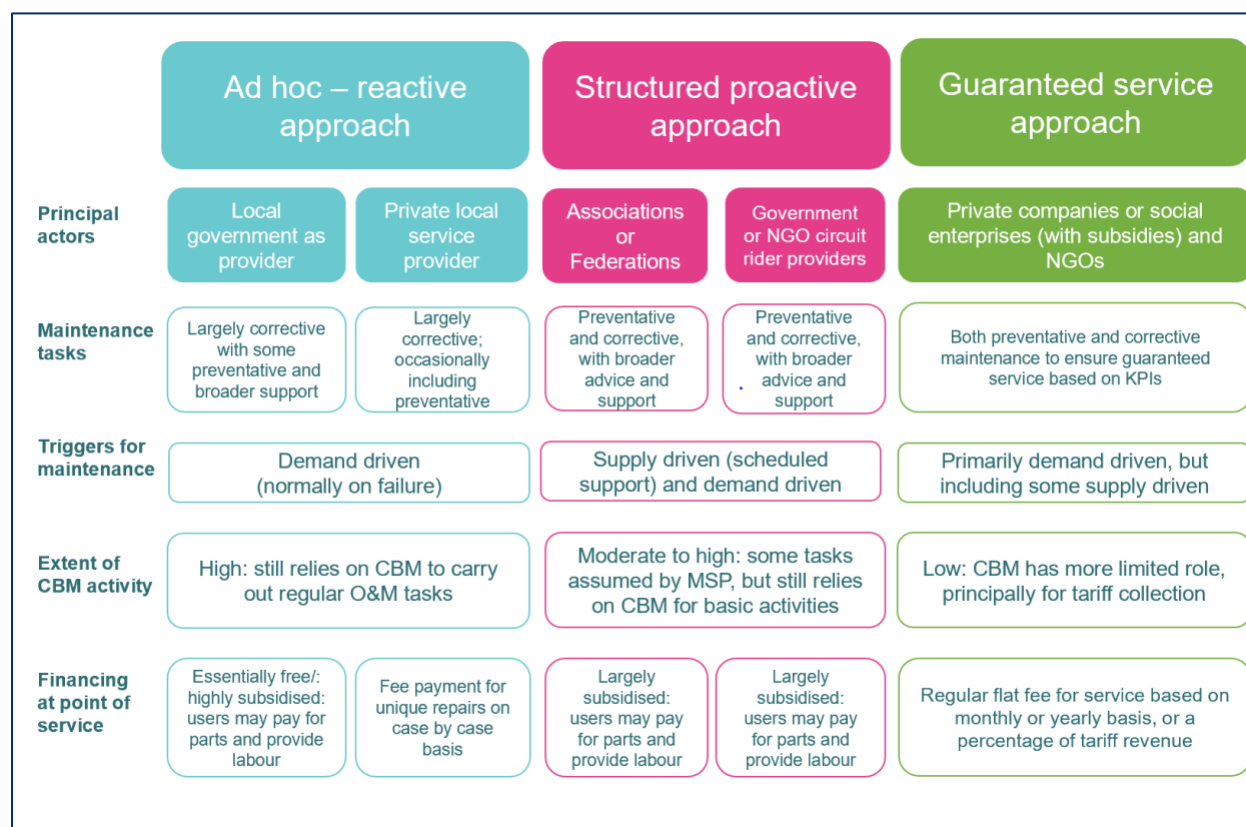


Figure 1 Maintenance Service Provision Typology

3. Analytical Framework

Based on the literature review, an analytical framework was developed as a tool for investigating the seven selected case study MSP models in greater detail. This analytical framework reflects the main factors that have been developed over the past 5 to 10 years by a range of organizations working in sustainable rural water service delivery, including IRC's Triple-S building blocks, UNICEF's WASH Bottleneck Analysis Tool, WaterAid's sustainability framework, USAID's Sustainability Index Tool, and the FIETS⁶ taxonomy. SWS also adopted the FIETS framework as part of its scorecard measuring the likelihood WASH services are sustained in target geographies. It should, however, be noted that the framework presented in Table I includes a somewhat different set of factors or areas of focus, which reflect the specific nature of MSP.

The effectiveness of any model is not determined in isolation. It is shaped by the wider operating environment, which can afford opportunities or raise significant challenges for the design of a sustainable model or scaling successful pilots. Accordingly, the analytical framework also accounts for important contextual factors (locally and nationally), such as the physical context, population density patterns, transport linkages, localized water availability issues, and the relative dynamism of the private sector.

Appreciating the operating context and identifying key factors are important steps in understanding MSP from a systems-based perspective. However, gaining insights into the behavior of actors and how and why they interact, including their response to formal and informal incentives, is also of critical importance when attempting to understand the dynamics within a WASH system. While this study was limited in nature (time and resources), an attempt was made to include an assessment of such behaviors in the framework by asking a series of pertinent questions to key informants for each MSP model. It is acknowledged that this only utilizes a limited number of respondents and does not represent a rigorous use of system-based analytical tools (which is beyond the scope of the study). The framework consists of four main parts, as summarized in Table I.

Table I Overview of Analytical Framework

Main Areas of Comparative Analysis		Specific Topics for Respondents to Address
I.	Operating context	<ul style="list-style-type: none">• Country context (including decentralization, extent of sector maturity or reform, private sector participation)• Operating context of specific case study: population density, geography, topography, transport, and connectivity• Relative economic development or wealth (compared to rest of country)• Strength of local government• Dynamism of local private sector• Active conflict or hazards (i.e., fragility)

⁶ FIETS is an acronym and framework developed by the Dutch NGO consortium, standing for financial, institutional, environmental, technology, and social factors. See <https://wash-alliance.org/our-approach/sustainability/> for details.

2.	History and evolution of the model	<ul style="list-style-type: none"> • Innovator of case study • Instigation and establishment processes • Extent of collective action • Timelines • Level of support and the role of external financing
3.	Factors in maintenance provision	
	Institutional arrangements	<ul style="list-style-type: none"> • Institutions and organizations involved • Responsibility for maintenance services and roles • Types of tasks and services provided • Triggers for maintenance services • Capacity building and support for the maintenance service providers • Governance and decision making • Links with broader government frameworks • Embedding MSP within sector policy and guidelines
	Financing	<ul style="list-style-type: none"> • Identification and planning for different cost categories • Sources of financing for different types of costs (operating costs, capital investments, cost of capital, etc.) • Subsidies at operational level to ensure inclusive provision and protect the poorest users • External subsidies by government or donors
	Asset ownership and delegation	<ul style="list-style-type: none"> • Asset ownership and responsibility for maintenance • Ability to delegate MSP • Contract design and structuring (including infrastructure asset management approaches)
	Regulation, oversight, and accountability	<ul style="list-style-type: none"> • Presence and effectiveness of formal or delegated regulatory functions • Monitoring performance of maintenance service providers • Accountability routes for consumers of maintenance services
	Technology	<ul style="list-style-type: none"> • Scheme technology and performance, including monitoring • Spare parts and supply chains • Use of innovative technologies such as remote sensing and telemetry, pre-payment meters, etc.
	Environmental	<ul style="list-style-type: none"> • Impact of local water resource availability patterns on viability of the MSP model, including alternative sources
4.	Dynamics and actor behaviors and relationships	<ul style="list-style-type: none"> • Centrality of actors to MSP model and degree of interaction or power influence over other actors in the system • Information flows and decision-making patterns among the MSP case study, its clients, and government (where relevant) • Formal and informal incentives and responses with the MSP model
5.	Strategic lessons	<ul style="list-style-type: none"> • Key enablers and challenges or barriers to MSP model • Scalability and replication at both operational and system level

4. Maintenance Service Provider Model Case Studies Overview

This section provides an overview of the scale and operating context of the maintenance models and describes their main features and structure. The maintenance models studied include three from the Tigray region in Ethiopia, which are in fact closely linked, one model operating in Kenya, two in Uganda, and one from the Central African Republic (CAR). Annex 3 provides a more detailed description of each model. Table 2 provides an overview of the main characteristics of the country and operating environment of each model, given that some are only currently active at the sub-national level.

Primary responsibility for day-to-day operation and minor maintenance, as well as administration and tariff collection, is retained with the community management body across all models in the study. In many instances, rotation of committee members and dissolution of water committees remains a challenge. In almost all cases, regular payment of tariffs, and the amount contributed by households, is problematic, although this is starting to change, specifically in the cases of more structured and guaranteed service delivery models (see Section 5.3.2).

Scale of Operation

Five of the models are established as part of national sector policies or are formally recognized by relevant sector agencies: the Hand Pump Mechanics Association (HPMA) model in Kabarole District, Uganda; the Whave model in Uganda; the Private Local Service Provider (PLSP) model in Ethiopia; the government's kebele-level technician in Ethiopia; and the WfG circuit rider model operating in almost half of CAR's territory. All these models are therefore already being applied at scale, at least on paper. They are expected to provide maintenance services to water points serving hundreds of thousands of people and across multiple administrative units (districts or equivalent). However, in practice, the extent and quality of maintenance services and the impact, in terms of improved functionality, can vary significantly. The Wahis Mai model — implemented by the regional NGO, Relief Society for Tigray (REST), with funding from Charity:Water — operates at scale across all woredas in Tigray but has historically focused on schemes built with funding from the same donor. This approach is now evolving to cover schemes regardless of donor or implementer (see Section 4.3). Both the FundiFix and Whave models operate at a smaller scale, in two counties and seven districts, respectively, and are being developed in close collaboration with national and local government sector agencies with the intention to scale up.

It is important to note that although one measure of scale of the model is the population served within its given area of intervention (as shown in Table 2), this should not necessarily be taken to equate with the success of the model or its effectiveness. As noted above, models that have been endorsed or adopted by government operate at scale by definition. However, just because a model covers a large geography or population, does not mean it is qualitatively better than an approach covering a smaller population. Section 5 elaborates on this discussion.

Table 2 Overview of Maintenance Models and Operating Contexts

Country	Service Provider Model	Partners	Typology	Intervention Area	Population of Intervention Area	Population Served Directly by Model	Functionality Rates (Average Self-Reported)	Population Density of Intervention Area (person per km ²)	Human Development Index (Rank) (UNDP, 2018)	National GDP per Capita, PPP (USD) (World Bank, 2017)
CAR	WfG	Direct provision	Structured proactive	Nine of the 16 prefectures in the country	2.1 million	500,000 to 600,000	>90%	Ranges from 5.2 to 13.4 (national average 7.37)	0.367 (188 th)	\$725.94
Ethiopia Tigray region (34 woredas)	Government-led kebele technician	Woreda and kebele staff	Reactive	National model and in all 34 woredas	4.56 million	4.56 million	No reliable data	91.2	0.463 (173 rd)	\$1,899.20
	PLSP	Direct provision	Reactive	22 of 34 woredas in the region	4.56 million	~2.95 million	>93%			
	Wahis Mai	Direct provision and support via PLSP or local government	Reactive – Structured proactive	4,500 of ~17,000 water points across all 34 woredas	4.56 million	~2.95 million	90%			
Kenya	FundiFix	Miambani Ltd. and Kwale Handpump Services Ltd.	Guaranteed service	Kitui and Kwale counties	2.1 million	75,000	86%	Kitui: 33.21 Kwale: 101.1	0.590 (142 nd)	\$3,285.91
Uganda	Whave	HPMA and local government	Guaranteed service	Seven rural districts; due to expand to 10 in 2019	1.6 million	1.1 million	99% (2018)	240.3 (national average)	0.516 (162 nd)	\$1,863.83
	HPMA	Hand pump mechanics and local government	Reactive	National model; Kabarole District	415,600	~300,000	59%	259		

Operating Contexts

Maintenance models all operate within broader political and governance systems that vary across countries and reflect different degrees and arrangements for administrative decentralization, which in turn have important implications for engagement with government and critical sector functions including regulation, coordination, and financing. Kenya has the most advanced form of decentralization, with devolution of powers to 47 county governments. This relatively recent change in government structure means county-level policies, regulatory frameworks, and budgetary arrangements are still fluid and are being finalized for the water sector, including for maintenance. The CAR is decentralized to prefecture and sub-prefecture levels and then down to communes, but because of the size of the country and very limited public financing, local government is highly constrained in its ability to carry out water sector functions. Ethiopia represents a type of hybrid, with devolution to the regional level of government and then a more conventional delegation of authority down to woredas and kebeles (in some regions, there is an ongoing process of further devolution to zonal government, which sits between regions and woredas, but not in all cases). Finally, Uganda presents a decentralized framework, with delegation of functions of government down to the sub-district and parish level, both with elected representatives and, uniquely, a direct political representative of the president's office in every district.

Several of the models operate in contexts with challenging water resources, which can impact the viability of maintenance models. For example, interviewees from the models in Tigray, Ethiopia, estimate that about 10 percent of non-functionality instances are related to water source constraints or seasonal yields dropping in boreholes. Kwale County in Kenya, where the FundiFix model operates, is in a coastal area with rainfall variability and sea water intrusion, which can affect viability of water points. Conversely, in more water-rich environments, such as parts of Uganda and the CAR, seasonal access to “free” alternative sources acts as a disincentive for users to pay regular tariffs, which limits the capacity of water committees to finance maintenance services.

All the models operate in rural administrative areas, but range across contexts in terms of population densities, relative wealth, transport networks, and water resources, all of which can affect market viability. Population densities range from an extreme low of 5.2 people per square kilometer (p/km²) in one prefecture of the CAR, where WfG works, to a high of 259 p/km² in Kabarole District, Uganda, where the HPMA model operates. Population density, as well as the extent of road infrastructure for access to communities and markets for movement of service providers and spare parts, has been flagged as critical to the viability of some models. Notably, in Ethiopia, PLSPs find it financially unviable to serve remote communities and in the CAR access constraints drive up transport costs.⁷ Conversely, in Kenya, there are relatively good transport networks, tarmacked roads, and even internal flight connections.

Although imprecise in terms of distortions caused by wealth distribution disparities within a country, using gross domestic product (GDP) at purchasing power parity per capita can illustrate generalized differences in living standards between country contexts, taking into account the relative cost of living and inflation rates. Using this measure of GDP, contexts for the maintenance models range from a low

⁷ By way of illustration, in the CAR there are only 700 km of asphalted roads in a country with a surface area of 622,984 km² (World Food Programme; accessed 2019).

of \$725.24 for the CAR to a high of \$3,285.91 in Kenya. Both Uganda and Ethiopia sit around the \$1,850 level, although Tigray is relatively poor compared to other regions, with 29 percent of its population living below the poverty line as compared to 22 percent nationally.

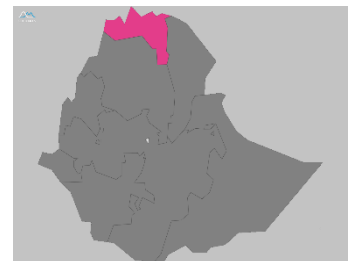
Of the seven cases under review, the WfG circuit rider model in the CAR is clearly facing the most challenging operating environment, with very low population densities, poor transport networks, and a relatively poor population, some of whom are living in virtually cash-free economies. Continuing volatility in parts of the CAR, also makes the environment for the provision of maintenance services extremely challenging.

Type of Maintenance Services Provided

Five of the seven models are primarily geared toward corrective maintenance but use different mechanisms for triggering services: both Whave and FundiFix work under a guaranteed service approach, whereas the HPMA model in Kabarole and the PLSP model in Tigray provide services on an ad hoc, demand-driven basis. Some preventive measures are undertaken, alongside corrective maintenance, under the WfG circuit rider model and the Wahis Mai program, which includes one annual visit to communities with schemes funded by the donor, Charity:Water. IRC is piloting a modification under the HPMA model to introduce Pay-As-You-Fetch (PAYF) as a basis of tariff collection to improve revenue streams. This pilot, confined to a small number of water points to date, includes a preventive element whereby the hand pump mechanics also make an annual check of the below-ground components. It is important to note that some of the models include other activities beyond maintenance. Whave is explicit in stating that it is not purely a maintenance organization. Rather, it provides rehabilitation and construction on the condition a community enters into a long-term maintenance servicing agreement to demonstrate the endemic problem of poor-quality installations can be avoided by this type of conditionality. The HPMA in Uganda can also take on rehabilitation contracts, which are classified as major repairs, or capital maintenance. Individual hand pump mechanics under the umbrella of the association can carry out both types of repairs and provide corrective maintenance on a demand-driven basis from communities.

4.1 Government-Led Kebele Technicians: Tigray Region, Ethiopia

Tigray region follows the national policy set out in the first One WASH National Program (OWNP, 2012), which defines responsibilities for local government staff at the woreda level. What makes Tigray unique is that it is the first region in the country to have established water technicians at the kebele level, which is the lowest administrative unit below a woreda or district. Following a first phase in which technicians were responsible for a cluster of approximately four kebeles each, the regional government has now recruited technicians in all kebeles who are accountable to the Woreda Water Office. The water technician is the secretary of the kebele WASH team, which typically has seven members and includes health extension workers, a school principal, civil society, community representatives, and a woman nominated by the kebele council. In Tigray there are 34 woredas, 698 kebeles, and

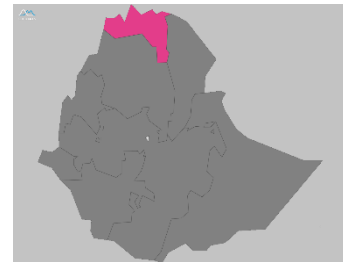


approximately 17,000 water points in total. The average population of a woreda is around 120,000 people.

In this model for support to rural communities, each village or scheme WASH committee (WASHCos) retains the primary responsibility for day-to-day operation and minor maintenance and administration. The role of the kebele water technician is not to carry out maintenance or repairs directly — although in practice this still occurs — but rather to act as the first point of contact for communities and as a liaison and coordination point with the Woreda Water Office. Where there is no alternative provider, the kebele and/or woreda staff still carry out maintenance services, albeit with limited resources, including constraints to reaching more distant communities.

4.2 Private Local Service Providers: Tigray Region, Ethiopia

The PLSP model is aligned with the federal government’s policy to encourage the involvement of private sector stakeholders in the provision of goods and services for water supply and sanitation. It is designed to build on, and complement, the “base layer” of the kebele-level water technicians outlined in Section 4.1. The regional Water Resources Bureau supports the establishment of PLSPs throughout Tigray. PLSPs are essentially small private businesses, registered with the woreda agency for the Ministry of Micro and Small-Scale Enterprises. In a sense, the PLSP and kebele technician model can be seen as a hybrid, because there are close linkages between the two and increasing coordination. Currently, Tigray is the most advanced region in the country dealing with the PLSP model, and it is being watched as an example for national scale-up. Based on earlier, less-successful experiences by bilateral donors in establishing technical service providers, mainly focused on new construction, the government included maintenance as a focus to make business models more viable and to increase the scope of revenues for small enterprises in 2013.



In Tigray, the PLSP model is supported mainly by the Dutch NGO SNV through its Inspiring Water Entrepreneurship in Tigray (iWET) program, which started in 2015 and is now active in 12 woredas after piloting the approach in three woredas. Other woredas are supported by a range of agencies including OWNPN, other NGOs, and the Finnish-funded Co-WASH program. The PLSP model is currently active in 22 of the 34 woredas in the region (see Figure 2). As the PLSP program in Tigray grows, the regional government has taken the initiative to integrate PLSP with the application of remote sensors that will be piloted in four woredas in collaboration with REST and Charity:Water to improve functionality of water schemes and ultimately ensure sustainability (see Section 4.3).

There is one PLSP per woreda, each with three to four members. Staff are drawn from technical graduates in electromechanical engineering or auto-mechanics from Technical Vocational Training Centers (TVET) and are given further training and orientation by the Regional Water Bureau and Woreda Water Office staff. PLSPs receive requests for maintenance through several channels, including WASHCos, kebele water technicians, and Woreda Water Offices. Irrespective of where the request comes from, the PLSPs are paid directly by the WASHCos for their services and any spare parts or

other consumables. It is also important to note that the PLSPs are mandated to maintain irrigation generators and solar and bio-gas systems, which represent another source of income.

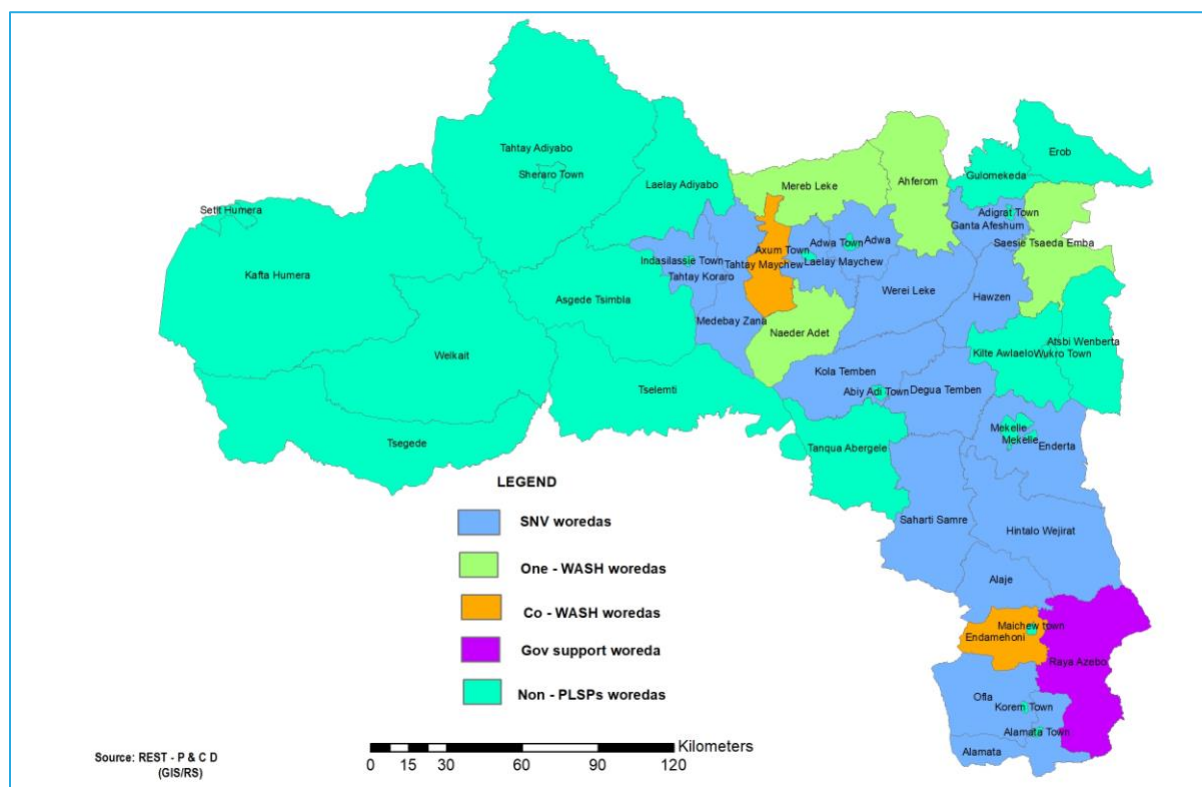
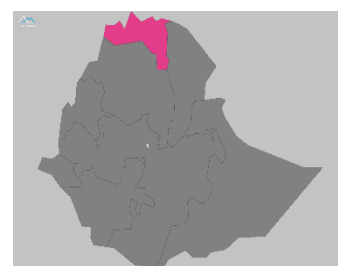


Figure 2 Map of PLSP Woredas by Supporting Agency

4.3 Wahis Mai REST Program: Tigray Region, Ethiopia

The Wahis Mai model began in October 2013 to address concerns related to the sustainability of water schemes implemented by REST with funding from Charity:Water of the USA. Although the approach has evolved over time, it is still focused on increasing functionality, reducing downtime, and informing program improvements through the use of data, including from remote sensors. Of the approximately 17,000 rural water points in Tigray region, 7,503 have been financed by Charity:Water, and the maintenance program now covers 6,240 of these. Wahis Mai technical staff are very well qualified and have historically provided a “rapid response” maintenance function. Although the program covers all woredas through a clustering approach, with six teams each covering around five or six woredas, it has to date only focused on infrastructure funded by Charity:Water (see Figure 3). However, its sensor pilot program includes all water points found in the focus woredas. Data from Charity:Water and REST for the period of October 2016 to July 2017 indicates that Wahis Mai completed 5,432 site visits to 2,860 individual schemes and facilitated 1,361 repairs.



The Wahis Mai program is also in the process of changing, and this model cannot be viewed in isolation. There is now pressure from the regional government to follow the strategy of a layered or hybrid maintenance model, with WASHCos supported by PLSPs. Where such private providers are active, the Wahis Mai cluster teams are being discouraged from carrying out repairs directly and are instead being encouraged to act in the capacity of facilitators and trainers. One of the targets is to increase stakeholder participation (ownership) of repairs. REST is therefore now re-orientating the program with the aim of increasing the participation of other stakeholders (WASHCOs or the woreda-licensed technician) by completing fewer direct repairs and doing more remote coordination, training, and facilitation. This transition is reportedly leading to some confusion at the woreda level because Wahis Mai technicians are being discouraged from making repairs in woredas where PLSPs are present. However, regional government is also encouraging Wahis Mai to provide a rapid response if other actors are not responding on time through improving their technical and management capability and supporting them in repair work beyond their capacity.

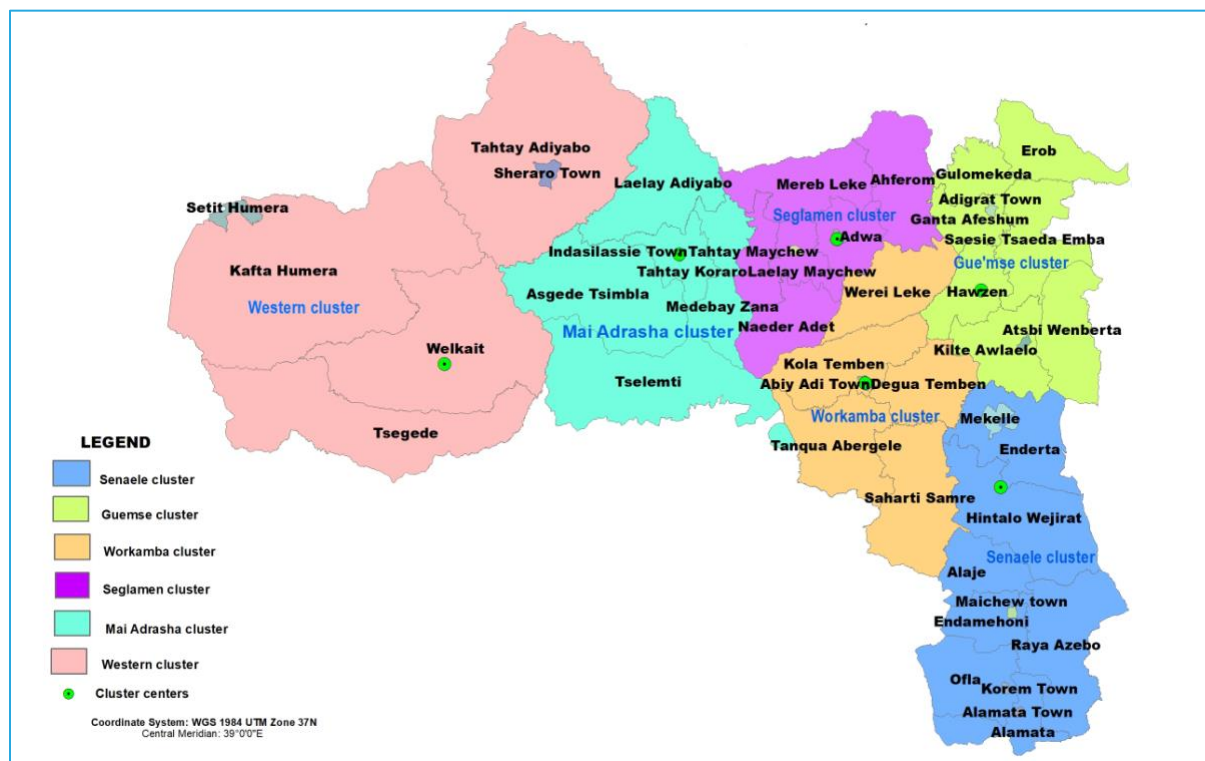
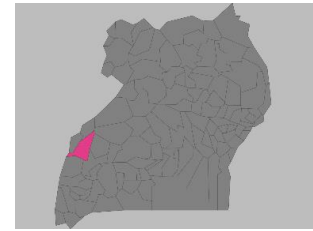


Figure 3 Map of Tigray Showing Wahis Mai Cluster Areas

4.4 Hand pump Mechanics Association: Kabarole District, Uganda

The aim of this model is to improve and formalize maintenance services for rural water points by forming HPMA at the district level, with member mechanics present in each sub-county. Each HPMA is legally constituted and approved by district-level government. The Ministry of Water (MWE) formally endorsed the HPMA model as part of the 2011 Joint Sector Review (JSR). MWE issued guidance on formation of the associations and, subsequently in 2013, on local government engagement with the HPMA (MWE, 2011; MWE, 2013). Individual hand pump mechanics are endorsed by the association as members but are free to provide services to communities on a demand-driven basis and are paid by individual water user committees (WUCs) on a job-by-job basis. In some instances, HPMA enter into contracts with district government to carry out capital maintenance or rehabilitation works with funding from the conditional grant for operation and maintenance (O&M).



Where there is significant external support (normally provided by international NGOs) the HPMA are starting to professionalize services by ensuring that member mechanics are experienced and trained in repairing water points and piped water schemes. This occurs through the monitoring and regulation of member hand pump mechanics (e.g., to avoid overpricing) and through connecting HPMA members to WUCs and district local governments. However, without such support, HPMA are a loose grouping of individual mechanics that generally struggle to provide any type of well-organized and routine preventive maintenance.

All hand pump mechanics in a sub-county should pay a joining fee and register with the HPMA, which in turn registers with local government. In theory, the District Water Office (DWO) signs an annual framework contract or memorandum of understanding that designates which rehabilitation and repairs of water supply schemes are for the HPMA. A single hand pump mechanic, selected from among the sub-county hand pump mechanic representatives, leads the HPMA. District HPMA representatives are encouraged to form regional HPMA and meet to discuss common challenges and share lessons. Most HPMA have legal status by forming a community-based organization (CBO). Some HPMA go a step further and establish themselves as limited companies with bank accounts.

The government facilitated a first round of establishing HPMA in 30 districts following the JSR agreement, and currently HPMA have been registered in 112 of Uganda's 127 districts; however, not all of these are fully active. Although this is a national model, the case study under review focuses on the HPMA from Kabarole District, which is receiving support and documentation from IRC Uganda and is providing maintenance services to approximately 325,000 people, or around 78 percent of the entire district's population.

4.5 Water for Good Circuit Rider Program: Central African Republic

WfG is an NGO working in the CAR to implement a circuit rider program that provides maintenance services to 1,400 hand pumps serving 500,000 to 600,000 people. WfG grew out of a for-profit drilling

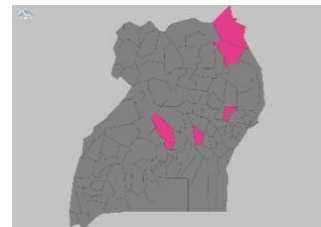
company founded in 2004 when the company that transformed into an NGO. The demand for maintenance services led the WfG program to dramatically expand between 2007 and 2011. The approach largely follows the circuit rider model developed in the United States in the mid-1970s. Under this model, small teams of qualified technicians rotate through a pre-determined circuit of communities providing maintenance activities and advice on a wide range of issues. In 2011, the integration of electronic programming enabled WfG to properly evaluate the service, better manage supplies, increase the efficiency of routes, and significantly improve the functionality of rural water supply systems in a very challenging operating context.

Currently, WfG has four maintenance crews operating across nine of CAR's 16 prefectures (counties) at an annual cost of \$450,000 (2018). Each maintenance crew has at least two technicians who provide preventive maintenance and repairs on all the water points along a pre-determined route, which can take up to 3 weeks to complete. On average, each water point is visited twice per year. The approach is supply- rather than demand-driven, as the remoteness of many communities means that it is not normally cost-effective to respond to requests for assistance and diverge from the pre-determined route. The program operates two field offices that provide logistical and supply chain support and oversee the reporting of the technicians, providing management oversight and ensuring financial control.

WfG is piloting several innovations around the circuit rider model, including a rapid response model for more densely populated areas and a demand-driven model with a roving mechanic. Both approaches have modified tariff and financial models. Alongside the maintenance program, WfG continues to build new water points and constructed 80 new boreholes in 2018.

4.6 Whave Preventive Maintenance Service Area Provider, Uganda

Whave is a social enterprise, registered in Uganda in 2012. Whave is not purely an MSP model, as its core mission includes conversion of hand pumps to piped water supply and construction and rehabilitation linked to guaranteed long-term maintenance agreements. Whave signs a contract with each community it serves, stipulating the role of the community to operate the water point and collect tariff revenue, as well as the expected



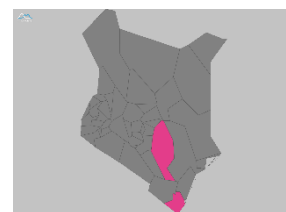
performance standards for maintenance, including response times. The model is recognized by government as an example of how maintenance services can be professionalized and is part of the transition to a rural utility approach. Whave operates in two modalities. First, Whave operates in an advisory role toward government regulation of rural water supply, governance capacity development, stakeholder coordination, and training. Such advocacy includes a focus on shifting toward preventive maintenance as a norm, build-operate-transfer (BOT) systems for construction and restoration, performance contracting of Service Provider entities by government water authorities such as Umbrella Utilities and districts, and performance-payment of local technicians to ensure daily functionality of water points. Second, Whave provides prototyping and benchmarking Service Provider roles and directly services over 400 hand pumps in seven districts, providing restoration and preventive maintenance to 150,000 people. It is currently conducting baseline assessment in an eighth district and has secured funds to expand to two more districts by late 2019. The focus of this prototyping is to

develop and demonstrate cost-efficient service that achieves fully functional water supplies in different climatic zones.

Whave encompasses four local service provider teams operating maintenance services in 10 districts in the central, eastern, and north-eastern regions. The Whave regional service provider based in Kampala supports these teams. Whave works with and trains local HPMAAs to become professionalized local service providers and all the local technicians it contracts and trains in preventive maintenance are members. At the community level, Whave operates two payment models, the PAYF hybrid and improved subscription. These are combined with direct collection and committee collection options, with the most appropriate model selected according to local conditions, preferences, type of community (whether it is a rural trading center or a farming community), and stage of development.

4.7 FundiFix Guaranteed Maintenance Service: Kitui and Kwale Counties, Kenya

FundiFix is a social enterprise that supports maintenance services in two rural Kenyan counties (Kwale and Kitui). It serves approximately 75,000 beneficiaries using 114 hand pumps and 28 piped schemes as of May 2019. The enterprise started from a collaboration between Oxford University and Kenyan partners in 2014, with initial funding from a UK research grant. The FundiFix model offers a performance-based approach to the rural water challenge. The FundiFix business rationale is that scale reduces risk and by pooling a larger number of water points under one maintenance framework, economies of scale are achievable. This model differs from the basic CBM approach in Kenya, with maintenance tasks being formally contracted between communities, schools, clinics, and the two FundiFix franchises. Annual contracts with FundiFix's service providers stipulate key terms, including monthly service charges, breakdown response times for repair (within 3 days), replacement of broken parts, and use of professional mechanics. For piped schemes, sub-county government is a party to the contract, responsible for performance oversight, asset replacement, and extension of piped networks.



As part of the financing arrangements, two Water Service Maintenance Trust Funds (WSMTFs) have been established in both counties to channel financing from donor organizations, public financiers, and other investors (e.g., philanthropists and private companies) for the exclusive purpose of supporting maintenance services.

Each FundiFix enterprise applies for O&M gap financing to the respective county WSMTF in 6-month cycles when applications are reviewed and contracts signed defining targets (response time, coverage, efficiencies, etc.) to be achieved by the FundiFix enterprise in the contract period. Progress is then reviewed or audited by the trust funds at the end of the financing cycle. The WSMTFs release funds to service providers based on the achievement of pre-identified performance targets.

5. Findings

This section presents a comparative analysis across the seven case study MSP models to identify common traits and elements, as well as to better understand the key factors within each model (e.g., institutional, financial, regulatory). Although limited in scope, the assessment also attempts to unearth the antecedents of each model, what the original drivers were for its establishment, and what dynamics are currently constraining or driving the success of the model.

5.1 History and Evolution of Maintenance Models

Three of the seven models were initiated by national governments as part of sector policy approaches, namely the HPMa model in Uganda, the PLSP model in Tigray, and the kebele level water technicians, also from Ethiopia. In the case of the Wahis Mai model in Tigray and the circuit rider program in the CAR, the institutions providing maintenance services are also part of the implementing entity that constructs the same water points (e.g., REST and WfG).

For the HPMa and PLSP models, international NGOs played important catalytic roles early in the process by documenting and promoting the models. For example, the evolution of the HPMas was in response to the policy of transitioning maintenance provision to private providers and built off the earlier public model of borehole maintenance units set up in the late 1980s to service the first generation of community-managed water points. Irish Aid supported early experiences with associations of mechanics, which were later picked up and documented by a number of international NGOs. This led to government adoption in 2011 and wide-scale implementation supported by the same NGOs and UNICEF (Nekesa et al., 2011).

The PLSP model in Tigray followed a similar trajectory, based on an original federal government policy to promote the role of the private sector in the long-term delivery of water and sanitation since the early 1990s. The government introduced the Technical Service Provider model, which was supported by donors including the World Bank and DFID. However, because they focused largely on implementation, business viability was limited during the rainy season and following construction. Based on these early experiences with the technical service provider, the government then introduced maintenance as a focus within OWNp to make the business model more viable and to increase the scope of activities. The Netherlands development agency SNV has worked closely with the Tigrayan regional government to support and expand the PLSP model, along with other donors and government-supported programs.

The remaining four models — FundiFix (Kenya), Whave (Uganda), the WfG circuit rider model (CAR), and the Wahis Mai program (Tigray) — were all largely initiated by external actors, either NGOs or research programs. FundiFix began with funding from the UK's Department for International Development as part of a research grant to test hand pump sensors. Whave was established by an expatriate expert in sustainable development with the drafting of its first business plans and financial models.

Each model engages and works with different government entities, from local to national levels, to address water service delivery. For example, FundiFix is in part driving, but also responding to, changes

in legislation that are opening the way for a broader range of stakeholders to be involved in service provision in Kenya.⁸ In Uganda, Whave takes part in local government annual planning and budgeting processes and holds regular quarterly meetings with district local and national government representatives to review its performance, as part of a process of developing capacity for the regulation of Service Providers by local government under a Public Private Partnership (PPP) arrangement. FundiFix and Whave were launched as new initiatives in 2014 and 2012, respectively. The Wahis Mai program began in 2012, building on REST's long-standing WASH programs, and the WfG maintenance program started in 2011, also building on the NGO's implementation work since 2004.

In addition to the underlying incentive to address non-functionality and improve water supply service levels, there are a number of **common drivers or triggers** identified for setting up MSP models. These include:

- Most of the case studies have responded, directly or indirectly, to policy positions or directives set by central government. In some instances, it has taken many years and several iterations to reach the current status of the model, but these can be traced back to an original statement of intent on the part of government. The primary policy position has been to involve private sector actors in long-term service provision and to professionalize service delivery at the local level.
- In all the case studies, external actors (e.g., international NGOs, research, or donor programs) have been involved in the model. In five of the examples, such non-state actors have played an instrumental role in establishing the model.
- A small number of examples were driven by the desire to improve administrative arrangements and strengthen the legal representation of existing maintenance providers (specifically the HPMA model in Uganda).
- In several instances, part of the reasoning behind establishing maintenance models was to address the flow, (fair) pricing, and access of community management entities to spare parts.

In several models, the role of monitoring, and specifically the use of new technology around the installation of remote sensors on hand pumps, was identified as an important part of the genesis of the models, or at least as a trigger to improve the institutional and financial arrangements for maintenance support. The use of remote sensing, and the data this can generate for monitoring and improved accountability, was a major feature in Wahis Mai, FundiFix, and the WfG circuit rider model.

These lessons illustrate that there is probably no single trigger or explanation as to why new and innovative maintenance models have been taken up, but rather a combination of context-specific factors and stakeholders.

⁸ Article 94 of the 2016 Water Act in Kenya specifies that water infrastructure may be managed by a "public benefits organisation or a private person under a contract with the county government." The national regulator, Water Services Regulatory Board, included FundiFix as a good example of the professionalization of rural water services in one of its annual impact reports.

5.2 Impact on Functionality Rates

Because of the varying contexts and inconsistency in available data, it is not possible to make a comparative assessment of performance across the MSP models under review in any comprehensive way. Functionality rates should not be taken as the only measure of performance and on their own do not reflect other important parameters such as cost-effectiveness, timeliness of repairs, or evidence of uptake of the model. However, by looking at the impact of such maintenance models on functionality rates, it is possible to draw some broad conclusions on general trends and the direction of travel resulting from the cases. As shown in Table 2, the following observations can be made from self-reported data:

- Five out of the seven maintenance models reviewed have had a substantially positive bearing on the functionality of the rural water systems they are supporting.
- The Whave model in Uganda achieved the highest average functionality rates, of 99 percent, by the end of 2018, and average functionality rates were above 98 percent for the previous 3 years.
- Under FundiFix, functionality rates are at 86 percent, again significantly above the average functionality rates of 60 percent in Kitui County, for example.
- The SNV-supported PLSP model in Tigray saw functionality rates increase from 76 to 93 percent in some pilot districts, and the Wahis Mai program also achieved functionality rates of 90 percent. Both of these cases far exceed the average government-reported functionality rates for Tigray region of 75 percent.
- WfG's circuit rider model in the CAR achieved functionality rates of 90 percent and higher in a very challenging context.
- The two MSP models that have not seen a substantial increase in functionality rates are the HPMA in Kabarole District, Uganda, where functionality is just over 59 percent against the national average of 76 percent reported by MWE, and the woredas in Ethiopia that do not benefit from an active PLSP.

The above data indicate that, in most cases, adopting maintenance approaches — and particularly those based on guaranteed service provision — results in significant improvements in functionality rates as compared to the national baselines.

5.3 Key Factors in Maintenance Service Provision Models

5.3.1 Institutional Arrangements

The study includes examples based on corrective maintenance only, as well as those that provide a combination of both corrective and preventive services. No model provides preventive maintenance services exclusively. The former grouping includes the smaller-scale, more ad hoc reactive approaches such as PLSPs in Tigray and hand pump mechanics in Uganda. The Wahis Mai program, also operating in Tigray, largely provides corrective services, except for an annual water point check-up. The rest of the cases provide a mixture of both preventive and corrective maintenance, with generally more than one channel for triggering a service visit, e.g., remote sensors flagging an issue or demand via phone or SMS. Table 3 provides a summary overview of the tasks and the way in which service provision is triggered (e.g., through a supply- or demand-based mechanism). Whave in Uganda provides a two-step service, involving an initial check and repair, which then forms the first stage of the longer-term preventive maintenance program (see Box 1). By applying the typology set out in Section 2, the institutions or enterprises across the different cases providing maintenance services can be divided into several distinct categories (see also Figure 4):

Box 1: Whave Uganda: Maintenance Services

Two types of service are provided under the Whave model:

Recovery rehabilitation: a one-off technology quality upgrade and repair that is the first action undertaken when a preventive maintenance and continuous rehabilitation agreements (PMCRA) is signed and paid for. Signing and paying for a PMCRA is a precondition for this initial intervention.

Preventive maintenance and continuous rehabilitation service: consists of quarterly visits to check on the water source, routine servicing, including replacement of worn parts, and an annual overhaul when the below-ground components are extracted and checked, with replacement of worn parts as required.

The service also includes a toll-free phone number and commitment by Whave and its contracted technicians to provide immediate attention in case of any breakdown. All service events and costs are recorded with duplicate logbooks kept up-to-date by technicians and water committees. It also records monitoring data on functionality, all breakdowns, and time taken to repair. All data and reporting are shared transparently with communities, and all terms of service are set out in the PMCRA signed with communities.

- I. A CBO, local business operator, or small enterprise established to provide maintenance services to end consumers and operating largely independently on a mostly demand-driven basis; examples include the PLSP and the hand pump mechanics, which are associated under the HPMAs and fall under the ad hoc reactive category of MSPs;

2. A more structured organization, with a management entity that operates through technicians that are either staff or sub-contracted companies, as is the case for Whave and FundiFix, which are both examples of the guaranteed service model; and
3. An organization or unit comprised of staff from an NGO or program that provides maintenance, operating on either a supply- or demand-driven basis and largely operating as a circuit rider or structure approach, as in the case of WfG and Wahis Mai.

In both of the guaranteed service delivery models, Whave and FundiFix, there is an additional **social enterprise** actor that sits between the local government and the direct provider level and that enters into agreements to set the parameters of the service. In the case of Whave, agreements have been signed with district governments setting out the division of roles among the government, the service provider, and communities, under a local partnership, with government acting as regulator of the service provider. Under such agreements, Whave has moved from purely maintenance to providing rehabilitation of water points that have been out of service entirely.

The final MSP model, of kebele-level technicians of local government in Tigray, is an anomaly in that it acts more as a facilitator or coordinator to liaise between higher levels of government and the other two models active in Tigray, namely the PLSPs and Wahis Mai.

The use of formal agreements or contracts between community management entities and the maintenance provider is standard in the two guaranteed service models (Whave and FundiFix). Whave in particular signs detailed legal contracts, similar to insurance contracts, with communities (the PMCR agreements) since 2013, as well as detailed performance-pay contracts with local mechanics. WfG is starting to introduce contracts with communities in the CAR, but this is challenging as there is no legal standing for well committees in the country. In Kabarole, the pilot PAYF model also includes a memorandum of understanding between the HPMA and the community stipulating the fees for water collection and the maintenance services that they can expect in return. Introducing contracts directly between the community and providers is a major step in increasing accountability and formalizing relationships. It also acts as an incentive for the service providers to improve performance efficiencies, as their payments are linked to these measurable key performance indicators (e.g., time to respond to request, functionality rates). For example, in the FundiFix model, the customers are entitled to a month's free service if a hand pump breakdown is not repaired within 3 days, creating an economic incentive for service providers to ensure high service levels. Clearly, such performance-based models require investments in monitoring and need substantive management oversight to enforce incentives or penalties, all of which implies higher overall costs.

Table 3 Maintenance Tasks, Triggers, and Staffing for Maintenance Activities

Model	Maintenance Service Provider	Maintenance Tasks	Triggers for Maintenance	Staffing	Ratio of Provider Staff to Water Points Served ⁹
WfG	Direct provision by NGO staff	Preventive and corrective	Supply driven: <ul style="list-style-type: none"> Pre-determined circuits on 2- to 3-week cycles Piloting new roving technician model 	<ul style="list-style-type: none"> Four teams of at least two technicians Two field offices providing logistical and supply chain support Country director and support staff 	1:275
Government-led kebele technician	Woreda and kebele staff	In theory no tasks carried out directly, but in practice corrective	Demand-driven requests from WASHCos to water technician at kebele level; kebele routes demands from WASHCos to PLSPs (or Wahis Mai, where no PLSP active)	<ul style="list-style-type: none"> 698 kebele water technicians 34 Woreda Water Office staff 	1:23
PLSP	Small enterprise registered with local government	Corrective	Demand driven: <ul style="list-style-type: none"> Requests from WASHCos Requests channeled via kebele and Woreda Requests channeled via Wahis Mai 	<ul style="list-style-type: none"> 142 staff across all PLSPs in 22 woredas 	1:77
Wahis Mai	Direct by NGO staff and with PLSP or local government	Largely corrective, but some preventive	Multiple triggers: <ul style="list-style-type: none"> From data reports via sensors on handpumps Call on freephone number Annual circuit rider visit 	<ul style="list-style-type: none"> 18 technical staff spread across six cluster teams Project management office at regional level 	1:225
FundiFix	Local private enterprise with support from social enterprise	Corrective and preventive	Demand driven:	<ul style="list-style-type: none"> Kwale: four full-time staff, including two technicians 	1:16

⁹ The ratio of staff to water points is an estimate based on the most accurate and comprehensive data but should be considered as indicative only.

			<ul style="list-style-type: none"> • Hand pump sensors previously used to flag technical issues and validate repairs; • Currently, users request maintenance by phone or SMS 	<ul style="list-style-type: none"> • Kitui: five full-time staff, one part-time and three draw-down technical specialists 	
Whave	Local service providers with support from social enterprise	Rehabilitation (corrective); preventive and continuous rehabilitation	Supply and demand driven: <ul style="list-style-type: none"> • WUCs can call in on toll-free number • Monthly or quarterly visits by Whave technicians 	<ul style="list-style-type: none"> • 23 WASH service technicians and 51 Whave full-time staff across four local service providers 	1:12
Kabarole District HPMA	CBO registered with local district government	Largely corrective based on demand (preventive under pilot)	Demand driven by WUCs (exception under PAYF pilot with quarterly checks)	<ul style="list-style-type: none"> • 18 Hand pump HPMs covering 15 rural districts 	1:60

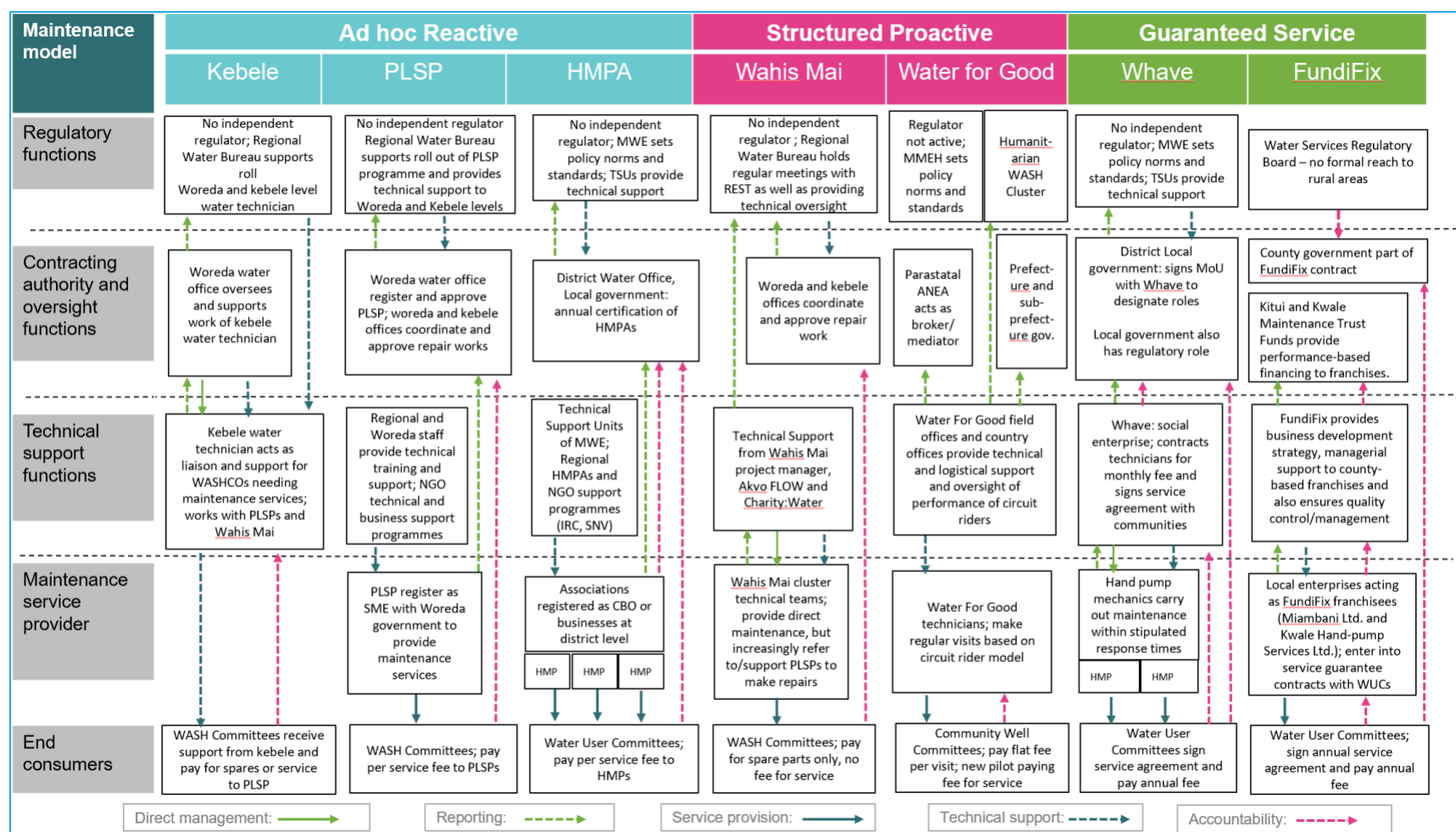


Figure 4 Overview of Institutional Arrangements for Case Study Maintenance Models

Ratio of Provider Staff to Water Points Served

As Table 3 indicates, there are significant differences between the seven models reviewed regarding the ratio of provider staff to water points served (noting that these are estimates made by the author based on the available information and should be seen as indicative only).

Both the WfG circuit rider model in the CAR and the Wahis Mai program in Ethiopia's Tigray Region have the lowest staff to water point ratios, of just 1:275 and 1:250, respectively. This can be explained partly by the nature of the maintenance service, which in the case of WfG is limited to pre-determined visits, and partly by the large population size covered by the model. For Wahis Mai, the high ratios may be explained by the fact that they are using remote sensing to trigger — or check — maintenance requests and that they have better transport and funding to mobilize, all of which may increase their efficiency.

The PLSP model in Ethiopia's Tigray region and the HPMA in Uganda's Kabarole District fall somewhere in the middle range, with ratios of 1:77 and 1:60, respectively, and the government-led kebele technicians in Tigray have one water technician for roughly every 23 water points, reflecting the fact that this model is fully integrated with the lowest level of local government and benefits from high staffing levels, effectively with one technician per kebele or sub-district.

The two social enterprise models, Whave and FundiFix, have much higher staff to water point ratios, estimated at around 1:12 and 1:16, respectively, which reflects the levels necessary to ensure quick response times and the human resource capacity to guarantee services. At least superficially, this also suggests higher staff and other related costs, which may in turn pose significant challenges for these models to be replicated and to scale up. However, staffing ratios can depend on several variables, including the business model, maturity, and growth stage, as well as the context. Therefore, simple comparisons may be misleading. There are other considerations when considering scaling up. For example, some of Whave's staff time is devoted to building the capacity of local government and HPMA members, resulting in more communities entering into service agreements, which in turn can free up direct Service Provider staff time as part of balancing fixed costs against an increasing revenue base.

Support and Capacity Building of the MSP Models

Technical support and business capacity development roles largely follow the origin and main players present in the model. Arrangements can be summarized as follows (see also Figure 4):

1. Support provided by the same organization that started and/or is currently running the existing model. Examples include WfG, Whave, FundiFix, and Wahis Mai/REST.
2. Support provided by a mix of the initiating organization and a higher-level government entity. For example, the PLSPs in Tigray are supported by woreda and regional water bureau staff (mostly on the technical side), as well as SNV and other NGOs on aspects such as maintenance skills, business planning, and access to financing. The HPMA's receive support and oversight from the ministry's technical support units and some technical training from the DWOs but are

heavily supported by international NGOs in many cases (and including the Kabarole District HPMA).

The kebele-level water technician in Tigray is somewhat of an anomaly in that, while started by the regional government, staff receive support not only through government channels but also from the Wahis Mai program, which provides on-the-job training and mentoring. Where maintenance providers have been established as small enterprises, such as the PLSPs in Ethiopia, the HPMA in Uganda, and the FundiFix company franchisees in Kenya, there is a greater emphasis on the development of business skills. In the case of SNV support to PLSPs, this has extended to address the issue of cash flow and access to working capital via loans from micro-finance institutions (MFIs), with the international NGO acting as a guarantor (see Section 5.3.2).

Integration with National or Local Policy and Government Institutions

Regardless of their antecedents (driven by national government policy initiatives or not) and current institutional setup, all models in this study have strong links and interactions with government institutions at all levels. As noted in Section 4, five of the MSP models were established as part of national sector policies or are formally recognized by the relevant sector agencies and policies (e.g., the HPMA, Whave, PLSP, and the WfG circuit rider model). Because many of these models include innovation and are testing new approaches in contracting, financing, and technologies, it is unsurprising to find that in a number of cases they are both influenced by and also helping to shape government policies and approaches to rural water service provision. Examples include:

- Whave, Uganda: Whave is piloting and documenting new approaches to PPP, including price regulation of tariffs and services, holding regular quarterly learning platforms to review progress with local government bodies, and the development a national O&M framework to promote the conversion from point supply to piped networks for rural areas.
- FundiFix, Kenya: FundiFix provided an example for government and the regulator for how private sector players can become involved in maintenance provision in a way that can be measured transparently. In both Kwale and Kitui, county governments support the role of FundiFix (but not yet financially) and actively encourage rural communities to join the scheme.
- Wahis Mai, Tigray: Because the regional government is driving the policy of expanding the PLSP model, REST and Charity:Water are adapting the strategy for Wahis Mai and evolving its role from direct technical provider to mentoring and training.

5.3.2 Financing

Financial data and information on revenue streams, funding sources, and certain costs were not available for all MSP cases researched for the study, making it difficult to draw firm conclusions about comparative performance. These limitations notwithstanding, the financial aspects of MSP can be broken down into two broad areas: (1) direct costs, or the operational transactions of maintenance between the service provider and the “consumer” (here usually meaning the water committee or similar CBM entity that represents the interests of the community in relation to its water scheme) and (2) the indirect or higher-order costs relating to running the entire model itself, meaning the costs of

administration, management, and oversight of the technical staff providing the services on the ground. Information regarding establishment costs was available for only some of the models. Table 4 provides a summary of the available information.

Table 4 Overview of Payments, Maintenance Costs, Tariffs, and Subsidies for MSP Models

Service Provider Model	Payment System	Cost to MSP of Providing Service	Tariff or Cost to Consumer (Water Committee)	Subsidy for Ongoing Provision of Services	Overall Cost of MSP Model
WfG	Cash fee paid per visit	\$186 per service visit (~\$0.40 per person per year)	\$40 per visit (only paid in full by ~25 percent of consumers)	Effectively up to 95 percent of all costs of model from donor funding	\$511,855 (2018)
Kebele water technician	Free (except cost of spare parts)	No data available	No data (based on spare parts used)	All salaries and operational costs paid by government	No data available
PLSP	Cash fee paid per visit plus cost of spare parts	No data available	No data (based on individual repair costs set by water bureau)	No data (SNV acts as guarantor for credit lines and provides business development services)	Average operating costs ~\$2,650 per year
Wahis Mai	Free (except spare parts)	\$38 per water point per year	No data (based on spare parts used)	Effectively 100 percent subsidized by Charity:Water and REST	~\$250,000 (2018)
FundiFix	Pre-pay (hand pumps) and post-pay (piped schemes) monthly using mobile payment	No data available	\$5 to \$10 per month for hand pumps Average of \$88.32 per month for piped scheme (varies, dependent on scheme size or water production)	Both franchisees receive ~80–90 percent subsidies from respective trust funds Kitui Trust Fund ~80 percent subsidy from donor funding Kwale Trust Fund ~80–90 percent subsidy from private companies	No data available
Whave	Cash subscription paid as regular tariff Volumetric tariff (PAYF)	\$310 per water point per year	Current average range of \$70–\$125 per year based on size of scheme and discounting ¹⁰	Initial discount of 76 percent in 2018 for piped schemes, dropping to 67 percent in 2019, then declining to zero	No data available
Kabarole District HPMA	Cash fee paid per repair Fee earned by contract from local government	No data available	No data on fees per repair Contract for major repairs from local government set at minimum threshold of \$107.50	No data available	No data available

¹⁰ Whave works with the concept of discounted fees and tariffs — as opposed to the concept of subsidies — to attract customers by offering services at an initially lower rate, then gradually moving to non-discounted rates. Whave has been progressively reducing discounts since 2013 and will continue to do so in forthcoming years; for example, a deep borehole under the preventive maintenance and continuous rehabilitation model has a base fee of 1,050,000 Ugandan shillings per year, with an initial discount of around 76 percent in 2018, dropping to 67 percent in 2019, meaning the fees paid by the community will be \$68 and \$95, respectively.

	Volumetric tariff (PAYF)		Average of \$2.67 per water point per month under PAYF		
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Direct Operational Costs of Maintenance Services

Several different modalities for charging for the costs of providing maintenance services can be identified across the seven examples in this study:

- **Essentially free service provision:** where there are no fees charged for the time of the technician or mechanic, with consumers paying for spare parts only, as seen in the Kebele water technician model, the Wahis Mai model, and around half of communities served by the WfG circuit rider model, which cannot afford to pay any part of the fee;
- **Variable fees paid per repair or per visit:** where consumers pay technicians or mechanics on a case-by-case basis, depending on the type of repair or maintenance task, and cover the costs of spare parts; this is the case for the PLSP, HPMA, and the balance of communities served by the WfG circuit rider model;
- **Regularized set tariff or fees:** normally paid monthly in return for a “guaranteed service,” employed by both of the social enterprise cases of FundiFix and Whave. Consumers pay an agreed-upon tariff in return for maintenance regardless of whether it is actually needed during the payment term or not. Under this system, hand pumps tend to be a set fee, whereas the amount for piped schemes will vary by overall population served, number of water points, scheme size, bulk volume of water supplied or abstracted, etc.;
- **Volumetric tariff:** based on the PAYF approach, which includes an element to cover the costs of maintenance services provided on a regular basis (e.g., quarterly visits), as is the case in the pilot by the Kabarole HPMA with support from IRC. Under Whave, a new hybrid system has been introduced that combines a flat fee for consumers such as schools and PAYF based on volume;
- **Income derived from maintenance contracts for specific works:** where the costs of the maintenance tasks are included in contracts between the maintenance provider and local government, as in the case of the HPMA and Whave in Uganda, which are able to bid on contracts, although these are largely for corrective maintenance and repairs or rehabilitation.

Without more detailed data on the operational costs for each model, it is not possible to determine whether any of these are viable at this level of direct service provision (i.e., the direct costs of salaries or other remuneration, transport, and any other consumables are met by the income received by the community). However, in some contexts there are constraints to the willingness of many householders to pay regular tariffs, which in turn limit the ability to pay for maintenance services. For example, in the HPMA model in Uganda, a recent survey carried out by IRC in Kabarole District found that only 2 percent of households were paying tariffs on a regular basis and that even when tariffs were collected, these averaged only between 500 and 2,000 Ugandan shillings (UGX) (\$0.14 and \$0.75) per household

per month (Watsisi, 2017). In this case, there are other confounding factors, including the fact that functionality rates have not improved markedly and that service levels are generally still poor in Kabarole District, thereby disincentivizing households from paying. A further disincentive to pay may be the fact that once water points fail, government (using Official Development Assistance funding) or another external actor such as an NGO or charity will eventually step in and pay for the costs of rehabilitation.

Conversely, experiences from some other cases would suggest that even in low-income communities there is scope to increase both the regularity of tariff payment and the absolute amounts paid, thereby supporting paid-for maintenance services (see Box 2). This is part of a “virtuous (upward) spiral” of improving service levels and reliability, which in turn drives more-regular tariff payments, part of which are then invested in more regular corrective and preventive maintenance. For example, SNV provided anecdotal evidence from Hintalo wejerat woreda in the south-eastern part of Tigray region, where there is now a much greater willingness to pay for repair services on the part of WASHCOs as they see functionality rates increase and down time shorten. They speak of a “change in mindset,” with WASHCOs no longer waiting for NGOs to come and make repairs, but instead increasing tariffs to pay for these. Now almost all WASHCOs in the woreda have a bank account with a surplus of funds, and because they know they will only get service on payment, this has actually led them to do more minor operational maintenance to avoid larger-scale and more-costly repairs. Similarly, Whave in Uganda reports that since starting the PMCRAs in 2013, willingness to pay has risen in communities from less than UGX 200,000 (\$54.40) to over UGX 450,000 (\$122.40) per year by 2018.

Several of the models apply a form of subsidy for maintenance fees, either for poorer households as an internal mechanism (as determined by WASHCOs in the PLSP example in Tigray, or the WUC in Uganda for Whave’s proposed lifeline tariff) or for inter-community subsidies, where poorer communities have a lower flat fee charged by FundiFix franchisees. For example, the standard monthly rate of \$10 per hand pump is lowered to \$1 for the poorest communities, although this is being phased out. WfG reports that it is providing an effective 100 percent subsidy to around half of communities, with one-quarter paying something toward the costs of maintenance visits and the remaining quarter paying the “full” tariff of \$40 per visit regardless of whether repairs or preventive maintenance were carried out. Revenue from communities covers only around 5 percent of the total cost of the WfG circuit rider program.

With the available information, it is clear that the models with significant external support, namely Whave, Wahis Mai, WfG, and FundiFix, all operate at a significant loss in terms of maintenance fee income earned versus operational costs. Both social enterprise models clearly identify and account for this in different ways. Under the FundiFix model, the franchise companies can apply to the trust funds for what is referred to as “O&M gap financing,” which is then paid on the basis of performance against pre-determined key performance indicators and targets. Whave currently works with the concept of discounting, in which the difference in the costs of providing a service and the revenue earned in fees is covered by donor funding.

Whave has a strong vision for a future in which grants will no longer be needed to fill this cost-revenue gap. As such, it works with communities under its agreements to establish the full price of service at an affordable level (with an integrated welfare mechanism) and then offers this discount, which it considers to be temporary. The important principle is that communities know they will eventually have to pay the full costs for a guaranteed service arrangement when grants are not available to fill the gap. Their strategy is to scale to full saturation within a district to socially normalize the payment of fees. Because of the time frames to reach this future scenario and the insecurity of donor funding, Whave is also building demand for a parallel payment modality of PAYF, which makes it easier to manage cash flow deficits and cross-subsidies between wealthier and poorer communities.

In summary, it is possible to identify several lessons around financing from households for maintenance approaches:

- Revenue from households can cover a significant proportion of operational costs of providing maintenance services and can be increased over time, as reliable services are guaranteed;
- Despite this, household behaviors and incentives for payment are complex and can be affected by externalities such as increased availability of nearby water sources during the rainy season and political electioneering;
- The action of donors, NGOs, and charities in consistently providing rehabilitation grant funding can also serve to undermine efforts of establishing more commercially viable maintenance services by distorting household decision making;
- It has proven difficult to cover even direct operational costs of maintenance from household tariff revenue alone; therefore, some level of subsidy will be required for the immediate to medium-term future to cover indirect costs.

Establishment and Indirect Costs of Maintenance Service Provision

As outlined in Section 5.2.1, MSP models have been established in different ways (i.e. as standalone micro-enterprises, associations, or social enterprises). It has been challenging to collect specific financial data on the establishment costs for most of the models. However, in the case of the PLSPs supported by SNV in Tigray, these costs are approximately 150,000 Ethiopian Birr (ETB) (\$5,300), a one-off investment for equipment, tools, office furniture, and one motorbike per enterprise.

In terms of the indirect costs of the MSP models, not including the staff costs and mobilization of technicians providing maintenance services directly in the community, WfG in the CAR was the only respondent to share information about this breakdown. In 2015 the indirect costs were \$127,835, representing 61 percent of the total program cost, and including management personnel, office costs, monitoring and vehicle repair, and depreciation. In 2018 the overall total cost of the WfG circuit rider was \$511,855 for a program supporting maintenance services to schemes with approximately 600,000 people. Of this total, around 37 percent was spent on spare parts, 35 percent on personnel costs, and the remainder on travel and mobilization costs. The Wahis Mai program in Tigray, funded entirely by Charity:Water, cost approximately \$250,000 in 2018, including both indirect and direct costs. SNV

reports that the total cost of running an average PLSP in Tigray is around \$2,650 per year, with each one active in one woreda with a population of about 120,000.

The WSMTF in Kwale County is the one example where private-sector funding has been successfully attracted from local businesses — in this case local companies engaged in mining and agriculture — to support rural water supply maintenance. Even though this does not represent private equity investment looking for a return on money, it shows what is possible when the governance and oversight mechanisms are in place through such a trust fund mechanism.

Market Viability and Business Planning

As part of the development of the models, a number of the supporting agencies have carried out willingness-to-pay studies and pilots on improving payment efficiencies (e.g., FundiFix is piloting the use of water “ATMs” to make payments more transparent and collection more effective, and IRC is providing support to the Kabarole HPMa on PAYF). Although it has historically been highly subsidized, the WfG business model is evolving, and while the circuit rider model continues to be operated in many dispersed rural areas, new business models are being piloted for areas with **higher density of water points** (e.g., rural hinterlands around urban centers). A new demand-driven and payment model has been introduced where communities are given a list of possible repairs and associated costs and have a mobile number to call. Essentially, they have a “menu” to choose from for different pump types and can ask for preventive maintenance or repairs when a pump breaks down (see Box 3). Lastly, a new model is being tested by WfG that is based on a guaranteed service approach, where there is both a preventive maintenance route and the option to flag down the same technician as he makes his rounds to carry out corrective maintenance. This is offered or repeated on a weekly basis, instead of every 6 months.

There are several cases where **business planning** has been carried out, although these vary from incomplete (IRC for the HPMa in Kabarole) to requiring further detailing, as in the case of SNV for the PLSP in Tigray, where only a rough assessment of market analysis has been done to look at the viability services in terms of market size, type of repairs, and distance or remoteness of communities. The most complete example of business planning is reported by Whave in Uganda. However, Whave considers itself not to be purely a maintenance service provider because its core mission is conversion of hand pumps to piped water supply within a build-operate-

Box 3: Example of Water for Good Pricing Menu for Repairs

Hydro-India 60		Nov 22, 2017
Frais d'intervention	CFA 5 000	
Remplacement Baudruche	CFA 156 000	
Boîte à Clapets Complet	CFA 141 000	
Boîte à clapet complet, entretouille sector 32, grille de serrage, bride de serrage		
Boîte à Clapets Simple	CFA 62 000	
membrane de remorçage, grille de serrage, entretouille sector 32, joint torique 21x4, joint d'arrêt, manchon de retenue, joint torique 77x5, bride de serrage		
Reparation tête complet	CFA 384 000	
bras de levier, entretouille, roulement à bille, piston, rondelle, ecran frein, emout a rotule, deflector, joint d'étanchéité, piston conique, joint calotte, axe de bras, couvercle de tête, cylindre de commande		
Reparation tête simple	CFA 44 000	
joint d'étanchéité, piston conique, joint calotte, rondelle de butée, ecran frein		
Reparation cadre simple pattes acier	CFA 12 000	
ecrou M14 Laiton, boulon, plaque d'étanchéité		
Reparation Cylindre de commande	CFA 148 000	
cylindre de commande, boulon 10x20		
Base Cylindre	CFA 200 000	
Bai Hydro-India		
Pêche	CFA 32 000	
Traitement de l'eau - chlore	CFA 22 000	
Clé Manuel - 3 entrées	CFA 17 000	

Reparation raccordement de tuyau	
Tuyau laché en haut	CFA 25 000
raccord haut droit m32 e FG2	
Tuyau laché en bas	CFA 170 000
pousseur, grille de serrage, entretouille sector, joint torique sector, corps supérieur de boîte à clapet	
Tuyau percé	CFA 139 000
raccord d'union	
Remplacement de tuyau	CFA 2 500
prix par metre	
Corde de sécurité	CFA 500
prix par metre	

Reparation Cylindre de corps de pompe	
Cylindre Simple - corps de pompe	CFA 191 000
cylindre, tirant, ecran frein fendu	
Clapet inférieur	CFA 29 000
Clapet inférieur, membrane d'aspiration, joint torique 77x5, crepine, vis poller	

transfer (BOT) modality, involving design, construction, and capital expenditure considerations. The business plan is based on the principle of full cost recovery, with all direct costs being recovered from service fees sourced from tariffs, although these are being progressively increased as the current discount is phased out. Several of the respondents have flagged the importance of **market viability** as one of the most critical elements of — and barriers to — the successful operation of the MSP model. Both FundiFix and Whave are clear about the need for scaling the consumer base to reach a viable or critical mass to allow for a break-even point in terms of the operational costs of service provision. In Uganda, Whave cites a target of around 1,000,000 people served by a Regional Preventive Maintenance Service Provider (RSP) - also referred to as a Rural Water Utility - operating through several LSPs or franchisees. For example, Whave calculates that five local service providers, each serving on average 200,000 people, is the point at which the model would start to be financially viable. This estimate assumes that the RSP has been granted a service concession area that includes both trading centers and farming communities. Other respondents have remarked on the current limits of markets, particularly when restricted to infrastructure maintenance for drinking water (and even more so when this is only for hand pumps).

In response, in both the HPMA and PLSP examples, providers are expanding their markets beyond drinking water supply (hand pump) maintenance. For example, the PLSPs in Tigray are also mandated to maintain irrigation generators and solar and bio-gas systems, submersible pumps, and diesel generators. In the case of the HMPAs in Uganda, one option for diversifying income is being contracted by local government to carry out rehabilitation of entire schemes, although, as Box 4 illustrates, there are political and commercial interests working against the HPMAs. There are also cases where the provider is stepping out of maintenance altogether. For example, the HPMAs in Kabarole, Uganda, are being contracted by international NGOs and local governments to carry out mapping and general surveys (beyond the WASH sector) based on their intimate knowledge of rural communities in their respective districts.

Several MSP cases report **cash flow** and limited (or no) access to **affordable working capital** as a constraining factor. As a response to this, SNV, together with its partner Digital Opportunity Trust (DOT), has been working with different MFIs, testing financial products, negotiating with them to set up deposits, and establishing revolving funds to facilitate loans for the PSLPs. SNV and DOT are acting as guarantors by putting down a 20 percent deposit with MFIs based on a typical loan of ETB 200,000 to 400,000 (around \$7,000) for spare parts. It is still too early in this initiative to have lessons on PLSP performance, repayments, and default rates. In Uganda, there is one case of an HPMA accessing loans from the revolving fund of the mid-west umbrella regional body — two loans of UGX 5 million (\$1,360) — to pre-finance work contracted by the district local government. Again, this is a relatively recent experience, but the loan was reportedly repaid.

Despite incomplete financial data, it is possible to draw some broad conclusions or trends regarding experiences with the MSP case studies:

- None of the models are currently financially viable, in terms of covering both direct and indirect costs. They will likely require some form of subsidy to provide maintenance services. Whave is unique in setting the goal of being based on full cost recovery (not including recurrent costs incurred by government to carry out essential functions in support of the model). It views the initial building of the “maintenance system” (i.e., the costs of capital, training, and paying for the required [declining] discount) as investment costs, which should be considered as a one-off and are currently paid for by donor funding.
- Several models, including Whave and FundiFix, are improving financial performance, and it is possible for them to reach a break-even point for direct operational costs by gradually increasing tariffs, improving efficiencies, and pooling risk across larger service areas.
- Absolute poverty levels impact the financial viability of MSP models, along with high operating costs (i.e., in contexts such as the CAR). Such models will need to be subsidized.

Box 4: Financial and Political Barriers to Opening Up the Market for Local Government Contracting to HPMAs in Uganda

Based on concerns that maintenance alone is not a viable business for HPMAs, MWE introduced guidelines in 2013 advising local governments in their engagement with such associations and encouraging them to bid on contracts from funding set aside in rehabilitation budgets under the District Water and Sanitation Conditional Grant. The guidelines stipulate that local governments may use up to 13 percent of the Conditional Grant for major rehabilitation of boreholes and piped water supply systems that are beyond the community capacity to fully finance, which is on average around \$15,000 per annum for Kabarole District. HPMAs and member mechanics can bid for these funds for major repairs, considered to be above UGX 400,000 (\$109).

However, in practice the HPMAs face several obstacles to winning such contracts. While there are a handful of cases where HPMAs have accessed loans from commercial banks, because most are not incorporated as legal companies, they generally do not have access to commercial loans or other capital, leaving them exposed to cash flow constraints and often unable to compete with larger companies in the districts that can provide pre-financing for contracts. This is especially critical because disbursement of funds for local government contracts is often subject to delays. In addition, many of these larger companies are owned, directly or indirectly, by people with influence within or over local government, and there are reports of HPMAs being hampered from winning maintenance and rehabilitation contracts, undermined by local politicians and local firms that have these better connections.

[Source: written information provided by IRC, 2019]

- Affordability of subsidized or discounted water tariff does not appear to be insurmountable in most other rural areas, particularly where services can be demonstrated to improve over time with regular maintenance.
- For MSP models based on (small) local independent providers, it is likely that markets purely based on servicing drinking water infrastructure are not viable and will need a more diversified source of revenues to survive (i.e., the PLSP model includes a much broader range of water supply technology, as well as the production of sanitary slabs for rural latrine construction).

- Cash flow can present a barrier to entry and/or growth of providers. Providing access to affordable lines of credit, either from commercial banks (with a guarantor) or some alternative financing mechanism, would help with cash flow and overall financial viability.

Accepting that there is a need for subsidies, several of the MSP examples demonstrate that it is possible to structure financing, particularly mechanisms that can help to pool risks across larger service areas, and at the same time achieve better outcomes in terms of functionality. The FundiFix model shows that it is possible to attract and blend different sources of financing, including private corporate social responsibility investment, where the right institutional, monitoring, and governance oversight functions can be put in place.

5.3.3 Asset Ownership and Delegation

When examining the legal status of asset ownership and the authority to contract for provision of maintenance services, the case studies expose some common trends across countries and models. In most cases, respondents stated that ownership is not clear, or that there is de facto ownership by communities of the water supply infrastructure based on the following underlying situations:

- Lack of clarity in policy, as cited by FundiFix and Whave in Uganda, or lack of experience in asset management more generally, as is the case in the rural sub-sector, for example in Ethiopia (World Bank, 2017.b);
- Weakness or lack of capacity or reach of government to enforce policy (WfG);
- Differences in sources of capital investment, e.g., in the case of FundiFix in Kenya, which cited confusion in cases where water points funded through NGOs or donors are considered “community-owned infrastructure” but where government has funded piped schemes, which are (on paper) owned by government.

Interestingly, the respondents from the HPMA model in Uganda were clear that water supply infrastructure assets are the property of the state, regardless of capital investment source, and that local government has the devolved authority (under the Local Government Act of 2002) to provide, or ensure through delegation, O&M of water supply assets. In the case of Tigray, Ethiopia, the regional water policy states that communities own the assets and have responsibility for ongoing O&M costs but that woreda governments must ensure services.

Most of the maintenance providers maintain an inventory of assets under their own service provision areas, and these rely on digitalized mapping and in some cases smart sensors (e.g., FundiFix, Wahis Mai, and WfG). The PLSPs work with the Woreda Water Office and will have at least a written list of water points in their area of operation.¹¹ Although maintenance providers hold their own inventories, or can

¹¹ A first national WASH inventory was carried out in 2011, and a second, fully digitalized round was finalized in the early part of 2019, the results of which are yet to be fully validated.

rely on district-level information, few are implementing true asset management practices in terms of having comprehensive data on individual components of schemes and an investment plan based on projected lifespan. This is unsurprising, given that asset management is for the most part very limited to date in most rural water sub-sectors. Whave in Uganda has indicated that it is currently testing software for asset management that it intends to roll out in the future.

In terms of delegation for maintenance, all of the models recognize that local government is the legal **contracting authority** (e.g., county, district, or woreda authorities) and have entered into formal agreements or memorandums of understanding that stipulate the role and services of the provider, and in some cases stipulate performance indicators. For the HPMAs in Uganda, the district water office should sign a certification annually with the association of that district, which then acts as a framework contract for engaging in rehabilitation and repairs. One notable exception to these arrangements is in the CAR, where many prefectures have limited capacity and lack technical expertise in water (i.e., the General Directorate of Water does not have a presence or cannot support local government staff in all parts of the country).

In summary, there is a general lack of clarity on the legal status of asset ownership in most cases. This lack of clarity is significant and may be problematic when it comes to defining responsibility for rehabilitation and capital maintenance investment for water schemes that maintenance providers are supporting. There is greater clarity around local government as the legitimate and competent contracting authority, and indeed most providers have contracts or are registered with relevant local government bodies.

5.3.4 Regulation, Oversight, and Accountability

As shown in Figure 4, only two countries — the CAR and Kenya — have an independent regulator for the water sector, but in both cases these entities only cover urban centers and do not yet reach rural water schemes because they lack reach and/or resources. In all cases, local government staff (i.e., the DWO in Uganda and the Woreda Water Office in Ethiopia) play de facto regulatory roles with responsibility for water supply, largely based on norms, standards, and policies set by central line ministries. As such, in most cases, maintenance providers are in theory overseen or “regulated” by local government, with the exception of the Wahis Mai and WfG models, which carry out these functions internally through review of reports, data, and performance reviews by staff at higher levels within the organization.

Table 5 shows the details of how MSP models are regulated and mechanisms or channels for consumers who have complaints or want to register a grievance about the service provided. In the case of Whave and FundiFix, there is also a layer of direct monitoring and oversight provided by the two respective social enterprises, which track performance of the direct service providers against contracts and key performance indicators. As with the HPMAs in Uganda, this presents an additional channel for complaints or grievances by the consumers of maintenance services in cases where repair tasks are inadequate, parts fail, or parts are overpriced.

However, in practice the picture is more nuanced for local government oversight and tends to be influenced by their capacity and ability to enforce the rules concerning performance of MSP models. This is related to funding constraints on local government budgets, the ability to travel and make checks, and institutional behaviors. For example, one respondent from Tigray, Ethiopia, noted that woredas are not ensuring service delivery and overseeing the functions of the WASHCos and the private sector (e.g., the PLSPs). Rather, they are still “stuck” in supplying maintenance and spare parts services and responding directly to the maintenance requests of WASHCos, instead of facilitating this process by others. Even though it is clearly stipulated in policy, many woreda staff have not yet let go of their previous role and still provide essentially free maintenance, which causes confusion and presents mixed messages to rural communities about the need to pay for such services. To counterbalance this, iVET is working with woreda and regional stakeholders to put in place more robust monitoring mechanisms for PLSPs with performance indicators.

Respondents noted that part of this apparent intransigence and lack of awareness of roles and mandates is due to the rapid turnover of staff at the woreda level. Several cases of interventions by politicians were reported, including a case in Kabarole, where a local politician took an individual hand pump mechanic to task for poor performance, as well as interference by members of county assemblies in Kenya reported by FundiFix.

Table 5 Summary of Regulation of MSP Models and Accountability Mechanisms for Consumers

MSP Model	Regulation and Accountability Mechanisms	
	Oversight and Regulation	Mechanisms for Consumer Complaints
WfG	<ul style="list-style-type: none"> In theory, the parastatal National Water Supply and Sanitation Agency (ANEA) should monitor the work of WfG, but capacity is very limited and not done systematically; only happens if ANEA is working on active (donor-funded) projects. WfG’s two operational centers and country office oversee reporting of technicians, providing management oversight and ensuring financial controls. 	<ul style="list-style-type: none"> Consumers in rural communities have limited recourse other than WfG, because the prefecture and sub-prefecture governments have limited capacity.
Government-led kebele technician	<ul style="list-style-type: none"> Woreda Water Office is expected to provide oversight to work of kebele technicians, with higher-level technical support from Regional Water Bureau. 	<ul style="list-style-type: none"> Recourse is challenging for consumers because the kebele technician is the first point of contact, but in theory they could approach the Woreda Water Office.
PLSP	<ul style="list-style-type: none"> Kebele water technician checks repair work of PLSP and checks that pricing guidelines are followed. The technician must approve the services. PLSPs maintain logbooks of repairs and issue receipts to WASHCos that can be traced. Woreda Water Office staff have close working relations with the PLSPs (which are often hosted in the woreda office space) and have a direct role in monitoring service agreements. There is limited capacity of regional water office staff to provide oversight. 	<ul style="list-style-type: none"> Consumers can report poorly performing PLSPs to kebele water technicians and can escalate to the woreda level, but there is no easy mechanism to assure quality of works of private sector by WASHCos. Efforts are now underway to introduce “guarantee cards” for services offered by PLSPs.
Wahis Mai	<ul style="list-style-type: none"> Internal spot checks by managers and visits by Charity:Water. 	<ul style="list-style-type: none"> Consumers can report concerns about Wahis Mai technicians to kebele water

	<ul style="list-style-type: none"> • REST carries out feedback sessions to report back and discuss performance. • Data are held and first assessed by Charity:Water. There have been some issues or complaints over availability of data and access by the local government. 	technicians and can escalate to the woreda level, but there is limited capacity to respond.
FundiFix	<ul style="list-style-type: none"> • FundiFix oversees operational and financial performance of franchisee company. • Maintenance trust funds review monthly performance of the franchises, in line with requirements of the performance-based funding. • FundiFix uses remote sensor data and logbooks of breakdown reports and repairs, including consumer satisfaction reports. 	<ul style="list-style-type: none"> • Consumers can call FundiFix on the care number provided at each hand pump or piped scheme; complaints are filed by the local manager. • Consumers can note if a fault is not repaired within stipulated period (3 days) and are then entitled to a month of free service. • Consumers can also escalate complaints to the county government.
Whave	<ul style="list-style-type: none"> • Whave enters into performance agreements with district local government. • Quarterly review meetings are held to review key performance indicators with each local government. • Service agreements with communities stipulate the expected levels of service and response times for attending breakdowns. 	<ul style="list-style-type: none"> • Consumers with complaints can use the toll-free number provided to express their concerns, and they are free to withhold payment. • Community WUCs can approach district local government and the DWO.
Kabarole District HPMA	<ul style="list-style-type: none"> • District local government and technical support units provide oversight function for HPMA, but because they are a private entity, formal sanctions are difficult; in some cases, individual mechanics or an entire HPMA can be backlisted. • HPMA can expel member mechanics who misbehave (e.g., overpricing of work). 	<ul style="list-style-type: none"> • For any private supplier, poor or faulty services can be challenged; communities can also report an individual mechanic for poor performance. • Consumers at the community level can escalate complaints to either HPMA or the DWO.

In summary, the arrangements for regulation of MSP remain weak, fragmented, or entirely absent. This reflects the fact that in two of the four countries there is no formal sector regulator, and where these do exist (i.e., Kenya and the CAR) capacity is too limited to reach rural areas or is still being defined for the rural sector. Where regulatory and oversight functions are carried out by local government (i.e. in Ethiopia and Uganda), this is being constrained by a combination of lack of funding and resistance to change in roles and functions.

5.3.5 Technology

To date, the majority of schemes serviced by the case study MSP models are water points, normally consisting of boreholes fitted with hand pumps, which are imported models including India Mark II, Afridev, and Vergnet (in the case of VfG). Several of the cases do include piped schemes, but these are limited in number and/or were only recently introduced to the service areas or contracts. For example, in April 2017, FundiFix introduced piped networks into their maintenance contract provision and is now supporting 28 such schemes. Whave in Uganda has a commitment to supporting the government's vision of transitioning rural water services from hand pumps to piped supplies for rural populations but still provides maintenance to hand pump-based technology.

The transition from hand pump maintenance to piped network maintenance presents several important opportunities for the MSP models. In terms of technical capacity and competency, moving to more

complex maintenance services, especially for reticulated networks relying on pumping, will enable technicians to expand their business offering. For example, in Tigray, some of the PLSPs are now trained to the level where they can already carry out maintenance on surface pumps, and the plan is to steadily increase their skill base to tackle much more complex repairs to electromagnetic pumps. Linked to this technical expansion is the increased market opportunity this can present. For example, once FundiFix started to include piped networks into its service area, there was a series of substantive jumps in population served, rising from a few thousand prior to April 2017 to 15,000 by the end of that month and a further jump to over 40,000 by March 2018.

Spare Parts and Supply Chains

The availability of affordable and quality spare parts is an issue for all of the MSP models. FundiFix, Whave, and WfG are overcoming this challenge to avoid delays and negotiate pricing directly with spare parts suppliers. In Kenya, FundiFix has a spare management system in place and deals directly with importers of spares in country. In the CAR, WfG takes this one step further and deals directly with Vergnet because of the almost-complete lack of commercial markets and supply chains in the country. By their own admission, this takes up a large amount of management time and effort and is costly, but it is the only solution to ensure spares are available. In Uganda, Whave has the capability to procure quality parts at optimum prices (for example, by importing shipping containers at bulk prices) and is able to disassemble packaged assemblies so that only optimum part replacement is done, rather than wasting resources on unnecessary replacement. Whave technicians can also recondition parts for re-use.

For the remaining cases, spare parts constitute an ongoing barrier to improved performance and a gap in the maintenance system. An absolute lack of parts, delays in supply, fake parts, and profiteering by local outlets or shops all undermine the ability of providers to work effectively. Even with the formation of HPMA in Uganda, the lack of local suppliers at the district level limits their ability to benefit from the economies of scale of forming associations.

In Ethiopia, the Tigray regional government has established a revolving fund for water supply and sanitation spare parts. In theory, the fund buys a stock of spare parts based on the demand from woredas, which is aggregated at the regional level. Parts are sold to the woreda with a 3 percent margin, and the woreda in turn sells the parts at a further 3 percent mark-up directly to WASHCos and PLSPs. However, this system is commonly viewed as being slow and a bottleneck to repairs being undertaken in a timely fashion. As one member of a PLSP from Raya Alamata Woreda in Tigray commented: “However, these PLSPs couldn’t hide the challenges they have, which are attributed to lack of readily available spare parts. These are spare parts that are unavailable from revolving fund shop at woreda center.”

As part of its support to the PLSP program in Tigray, SNV is undertaking a pilot to assess demand and review the procurement and supply of spare parts. The aim is to transfer it from the government-hosted revolving fund scheme to the PLSPs or other private entities, with parts supplied free of subsidy and at cost. At least for now, PLSPs can stock spare parts that are not available in the government’s revolving fund scheme. Wahis Mai has also attempted to bypass the slow government revolving fund supply chain,

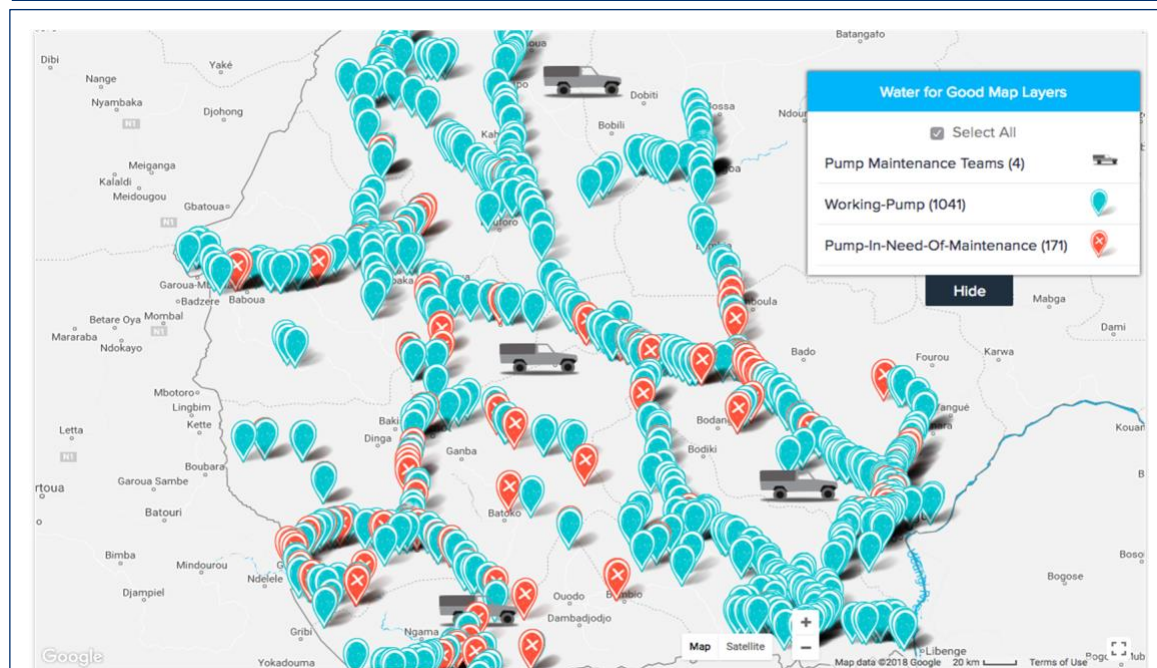
with REST establishing its own spare parts outlets and selling these via Wahis Mai teams to WASHCos based on government-approved prices.

Smart Monitoring and Reporting Technology

Several of the MSP case studies include the use of smart technologies, either remote sensing for monitoring water flow and consumption or for payment of tariffs. FundiFix hand pumps are fitted with remote sensors that provide managers with data on use (and indirectly on functionality), thereby facilitating more rapid responses and avoiding costly visits to schemes where the pumps are functioning well. The technology has been improved since the first generation of sensors, and a new design is being installed in 2019. Under Wahis Mai, with the support of Charity:Water, 3,000 water points have been installed with Afridev sensors with a further 2,000 additional sensors planned to be installed by the end of 2018. The sensors estimate the volume of water taken from each borehole. Sensors can be set up to take continuous measurements or at pre-set intervals. Each sensor, including the transmission cost, is estimated at \$250. Each one is expected to last for about 10 years.

In Uganda, Whave investigated the option of installing sensors on hand pumps but found that the on-site monitoring and phone call system is more cost-effective and reliable in rural contexts. According to Whave, direct on-site monitoring combines several other functions, so costs are rationalized, and is followed with a series of cross-check calls with different parties. However, Whave is currently collaborating with an international NGO, British companies, and a European utility to develop an innovative sensor technology that promises to be low cost and reliable in this operating context. WfG has not installed remote sensors on its hand pumps but introduced digital reporting in 2011 with technicians monitoring data directly onto handheld computer tablets during visits to individual water points. Once the circuit rider teams return from their 3-week tour, they upload reports on each pump. Each waterpoint has an ID tag and maintenance report that details the pump status, well age, total number of maintenance visits, parts used, estimated water usage per person, and time needed to access water. The report also documents the community population, GPS location of the pump, pump model, and a current photo of the pump (see Box 5). What started as an exercise mainly aimed at reporting back to donors has since built the largest and most comprehensive data set in the sector nationally and allows for assessment, monitoring, and a constant improvement of the model.

Box 5: Example of Water for Good's Functionality Monitoring in the CAR



In summary, the use of remote sensing and associated data has reduced monitoring costs, made physical visits more efficient, and increased the transparency of performance. The FundiFix model is piloting pre-payment “water ATMs” for piped schemes, which would help to increase payment efficiencies and financial management accountability.

5.3.6 Environmental

Several respondents flagged constraints to water sources that supply the water points or piped networks as being of concern. In Uganda, where Whave operates, ground water is reportedly available near communities in most areas, and where there is insufficient yield there is almost always an alternative within reach that can be exploited. In the specific case of the Kabarole HPMA, it is reported that some of the piped water schemes have flow issues in the dry season, which has consequences for the work of mechanics in dealing with requests for repairs. Likewise, in Tigray, all three MSP models highlight constraints due to drought and water stress, particularly in the drier zones of the region. The FundiFix model operates in two different physical environments. Kitui County is semi-arid with high rainfall variability and two distinct rainy seasons (March to May and October to November). Kwale County is located in a coastal area with rainfall variability and sea water intrusion in the coastal strip; there is a high density of hand pumps, which can pose problems with salinity and the taste of groundwater.

More broadly, water quality is not monitored on an ongoing basis in any of the models, except for Whave in Uganda, where testing is done for the presence of fecal coliforms. Whave wishes to demonstrate to local government that this can be done at low cost and that it is essential for proper regulation of rural water supplies. In other cases, where the maintenance provider is also part of an

implementing entity (e.g., the kebele technicians in Tigray, Wahis Mai, and WfG) water quality testing is done at the commissioning of boreholes. The Wahis Mai program also relies on REST to carry out annual disinfection of water points (e.g., boreholes or wells) without testing water quality as a matter of course.

5.4 Dynamics, Behaviors, and Incentives

Organizations supporting or operating maintenance models were asked about the different actors involved and their relative importance in the maintenance system at the local level (i.e., which institution, organization, or set of individuals has the most influence or is the least connected or powerful). It should be noted that not all MSP case studies responded and that the following is a simple analysis, not based on the application of any more rigorous systems-mapping tools. Nonetheless, the responses provide some insights into the dynamics and incentives MSP models experience across a range of contexts.

It is interesting to note that three of the four respondents answering the question about stakeholders explicitly mentioned **locally and nationally elected politicians**, as well as line ministries (for water) — and even in one case the Ministry of Finance — in relation to the impact of donor behaviors on maintenance provision. Negative examples included cases where local councilors interfered in decision-making processes around maintenance, particularly during electioneering, when politicians are viewed as a “massive constraint” when they attempt to win votes by giving away repairs and promising to stop tariff increases. Conversely, respondents cited engaging and harnessing local politicians as an important positive force. In Uganda for example, Whave has spent much time and energy in engaging with local-level officials (i.e., district councilors, parish chiefs, local councilors, and community development officers) to engage them in mobilization and support functions for the government resolutions underpinning its PMCRAs.

Whave also cited **corruption** as a significant problem in undermining efforts to establish a professionalized maintenance service approach. Poor-quality construction due to insufficient materials, use of sub-standard parts, and false reporting all have consequences for early breakdowns and premature failure of water supply schemes. Further grant funding by donors and charities to rehabilitate such failed schemes indirectly reinforces the cycle of failed infrastructure and disincentivizes communities to pay for regular maintenance, which could help to break the negative cycle.

Other respondents cited the **front-line maintenance provider** — the hand pump mechanic, technician, circuit rider, or PLSP — as one of the most important stakeholders because they interface with community consumers (e.g., water committees) and can promote or undermine the model by providing a good service or, conversely, by “cheating” communities by over-pricing in the sale of spare parts. Interestingly, it was noted that the Whave model acts as an incentive for these technicians because they have a more stable income (as contracted providers), rather than having to rely on communities for direct payment as a hand pump mechanic. In the case of the HPMA model, it was noted that individual hand pump mechanics do other work on top of this and that it is not a full-time job (as an estimate, this can provide as little as one-third of income), which means repairs and response times may not be the top priority.

In Tigray, all three models recognized the pivotal role of **government institutions** and staff — at woreda and regional levels — as having a central role in the functioning of the models. This was especially true of the Regional Water Bureau, which is powerful and is setting the agenda in terms of promoting the PLSP model and slowly transitioning Wahis Mai from an operational response team to a more facilitation and training role of the same PLSPs. Some tensions seem to exist between regional government and Wahis Mai because the program maintains its own cloud-based data system fed by remote sensors, which makes the regional government uncomfortable.

In the specific context of the CAR, security constraints and the limits on government reach and capacity have led to the humanitarian WASH cluster (and its members, including international NGOs and UNICEF) emerging as a key player, even though in theory this group is led by government. In turn, the focus, level of activity, and influence of the cluster is heavily dependent on donor-funded projects. The normal pattern in the CAR is that reporting goes from NGOs up through the system to the UN Office for the Coordination of Humanitarian Affairs CHA and on to the relevant international donors, thus largely bypassing national government entities, which further undermines their ability to be informed and to coordinate.

The role and influence of **donor aid** was cited in several cases as being significant to the dynamics of the maintenance system at the local level. For example, in Uganda, large donor funds injected into the sector can serve as a disincentive for the MVE and other government stakeholders to address long-term inefficiencies and are a source of “income” for the ministry, which then generates internal competition between different divisions and departments. While helpful, such impacts can also delay or displace a meaningful focus and effort to address systemic reforms. In addition, across all country contexts the provision of grant funding for rehabilitation in an uncoordinated way by donors, NGOs, and charities undermines willingness to pay and acts as a disincentive for regular payment of services, especially in the two cases of guaranteed service provision (FundiFix and Whave).

Interestingly, none of the respondents mention the community water committees — the end consumers of maintenance services under CBM — as having influence. Instead, in at least two cases they are cited as being the least-influential stakeholders in the local maintenance system.

Incentives for Providing Maintenance Services

Respondents highlighted operational incentives, such as the obvious improvements in service quality, less frequent and shorter downtimes, and more regularized and predictable income for technicians under some of the models. But they also mentioned other, more strategic and organizational, reasons for engaging with MSP, including:

- Alignment with government and sector policy to address long-term service delivery challenges;
- Responding to a political agenda in supporting solutions for improved service delivery and solving a problem that everyone is very conscious of and suffering from in rural constituencies; and

- A focus on sustainability as a way to strengthen the organizational brand and improve the “offer” for fundraising purposes (particularly on the part of NGOs).

In the case of the two guaranteed maintenance service models, FundiFix and Whave, part of the long-term goal is to demonstrate what is possible in terms of professionalizing services, as well as providing examples for government as a route to scaling up. Some form of duplication of maintenance provision is already occurring in Kitui County but in an unplanned way, whereby former water department staff have set up informal repair and maintenance services to rural schemes in adjacent sub-counties not served by FundiFix. However, they are not adopting the performance-based contract approach, instead negotiating fees and terms with communities every time a breakdown happens and operating under the ad hoc, reactive typology. In Uganda, Whave is explicit in its goal of supporting government in the transition from hand pump maintenance to establishing rural utilities and operating and maintaining piped networks, even where realistically this is a long-term outcome.

6. Emerging Lessons and Recommendations

6.1 Common Lessons, Challenges, and Success Factors

In different ways, and through different entry points and levels of scale, all of the models studied for this assessment seek to improve community-based management by professionalizing maintenance services and making these services affordable at the point of delivery. Some have been driven with significant levels of donor support and have successfully tested approaches at the level of a pilot, whereas others, most notably the PLSP and HPMa models, have gone to scale by being integrated into government systems but still suffer from poor performance and lack of commercial viability. Interestingly, despite these differences, the cases share common lessons, and many of the challenges to establishment and growth of an MSP model also hold the key to potential solutions. The following illustrates some of the main lessons emerging from this comparative study:

- **Getting the institutional arrangements right and having good governance in place are critical.** Maintenance providers must be able to do their job professionally and efficiently. But having the right institutional frameworks in place that can ensure oversight and accountability, particularly for transparency in financial management, is key for the establishment and expansion of a maintenance service provider. Conversely, a lack of clear policies and mixed messages around roles and responsibilities for provision and payment of maintenance services undermines trust, including at the community level. Communities are reluctant to pay for services where there is effectively “free” maintenance provided in the same geography. And investors — both public and private — are unwilling to put money into a model without clarity of policies and accountability mechanisms, even when operational or technical aspects of the model work well.
- **In broad terms, the maintenance models can be considered as progressing along a spectrum,** from basic responsive approaches that do not rely on performance-based indicators and are relatively simple to establish to more sophisticated arrangements under the guaranteed service approach typology, requiring more robust and regular data for management and financial incentive structures to be in place. Indeed, the guaranteed maintenance service approach can be seen as a precursor to the ultimate step of utilization, whereby rural populations are treated in much the same way as urban settings, with one utility carrying out all functions, from new construction and extension of networks to O&M. The selection of model, therefore, must be informed by the context and by factors such as general economic conditions, average incomes, access to communications technologies, and adequate management capacity.
- **Despite improved financial performance, MSP models require subsidies in the short to medium term, both at the operational level and to cover indirect costs of operating the overall enterprise.** Even operating in areas with significant levels of poverty, several models have proven that it is possible to increase funding revenues from tariffs by improving service quality. There is also emerging evidence to suggest that, where well structured, MSP models can attract both public and private financing, as an alternative to the aid funding that currently covers the deficit between tariff income and direct and indirect costs.

However, it is likely that to operate successfully, MSP models will require some level of subsidy over time.

- **Establishing an MSP model is challenging if the market is dominated by infrastructure that is already in disrepair and requires upgrading.** Several of the models, in particular the guaranteed-service type, carry out initial technical surveys of water points to determine the current status and requirements for repair; such an up-front “renewal” of the capital assets is an expensive first step. Although it is an obvious pre-condition, where the potential market requires significant capital investment any newly established maintenance model is likely to struggle in terms of commercial viability, even where an insurance “pooling” principle is considered to reduce risks of working across rural areas.
- **To succeed, MSP models need the right markets to operate within, in terms of both diversification and scale.** Although operating under different business models, there are common lessons around the need for the right market conditions to enable providers to not only survive but also grow. For the larger, more professionalized guaranteed-service models, this means achieving the right volumes and economies of scale of operation, which have not yet been met. For the local, small enterprise or operator model — such as the PLSP or HPMA — this means diversifying revenue streams beyond only a market for drinking water (hand pump) maintenance, which limits commercial viability.
- **Access to financing, through lines of credit or alternative funding sources, is critical to success.** Diverse examples in this study indicate the importance of getting the finance piece of the maintenance puzzle right. Whether this is in the form of the new Water Maintenance Trust Fund arrangements under the FundiFix model with robust governance in place, or by facilitating access to loans from MFIs to solve operational cash-flow challenges in the case of the PLSPs in Tigray, without access to financing, maintenance providers are unlikely to be able to survive, let alone grow as a business. Facilitating financing requires the right institutional arrangements and, if necessary, policy or legal frameworks, to be in place in order to give confidence to the providers and potential creditors or funders.
- **Investing in monitoring and data collection can help to drive efficiencies, but it is as — or perhaps more — important for accountability purposes and for providing robust evidence to inform policy debate.** Several of the MSP models have embraced “smart” technologies such as remote sensors, metering, digital monitoring, and electronic payment by SMS. All these innovations have helped managers to improve efficiencies, reduce downtimes, and drive the evolution of the models. However, beyond these obvious benefits, such technologies, where managed well, have allowed much greater transparency in reporting to local government and, in some cases, back to communities. Over time, such data can provide valuable evidence about what works well and what doesn’t and, when linked with financial information, can be key to inform learning and policy reform.

- **Politics — and the politics of aid — matters for maintenance services.** Water is an emotive topic and easily gets hijacked by local politicians, especially before and during elections. Long-term progress, built up by painstaking steps to improve services and trust between providers and communities, can be undone at a stroke with the offer of “free water.” Current incentive structures, including corruption, can be perverse and actually encourage the “build, fail, and rehabilitate” cycle, which provides benefits to local stakeholders but stifles attempts to create a new paradigm based on reliable water supply and high-quality, professionalized maintenance services. Donors and aid agencies, large and small, can also influence the behavior of governments, which may defer the more complex and challenging decisions around addressing maintenance in a more systematic way but accept short-term offers of large aid funding. A plethora of operational NGOs and aid programs with differing approaches to maintenance provision can also undermine localized efforts to improve sustainability of service provision.

Taken collectively, these cases of professionalized MSP (and other similar examples not included in this study) present emerging evidence of what is possible in terms of improving rural water service delivery. They provide insights and point to alternatives to the business-as-usual approach to maintenance typified by loosely trained CBM entities largely left to their own devices, or at best given patchy support from an under-resourced and disincentivized local government. The lessons from these and other examples,¹² with concrete evidence of performance, results and outcomes (in terms of improved functionality), and costs, will be increasingly important for informing policy debate with both governments and donors alike. With a limited set of financing available from both public and ODA sources, such evidence will be critical for selecting the most appropriate pathways for rural water maintenance as countries transition from low service levels and voluntary arrangements to more reliable, continuous supplies maintained by professional providers.

6.2 Practical Interventions to Establish and Scale Maintenance Models

The models studied for this assessment are all relatively well established and have, to a greater or lesser extent, a positive track record in terms of their performance, impact, and costs. Although taking different pathways, they face similar challenges related to sustainability and scaling that center on financing, diversifying markets, or expanding them to achieve greater economies of scale, as well as in some cases improving spare parts supply chains and logistics. From a systems perspective, perhaps the most important message this comparative analysis highlights is that overcoming the barriers to establishing successful MSP requires a holistic approach — to understand the entire system and address gaps and capacity needs that go far beyond technical skills and services only — including governance, business models, training, monitoring, (access to) capital, market linkages, and, critically, the capacity of government to engage with and oversee or regulate such services. Understanding the politics of water, especially at the local level, is an important first step. Therefore, for those organizations interested in

¹² For example, the proposed approach adopted by the French private sector company UDUMA, a subsidiary of the Odial Solutions Group, in Mali provides services under the framework of affermage contracts signed with local public authorities. These contracts grant UDUMA the right to maintain and operate water services in selected areas and to charge tariffs for a 15-year period.

starting up a new MSP model, or growing an existing one, the following practical recommendations are given:

- **Map the maintenance system** early on to understand who the stakeholders are and how they relate to one another and use these insights to ensure the most appropriate institutional and governance frameworks. This mapping should include understanding local politicians and how they currently engage with the water (maintenance) system, what their incentives are, and how to harness them in support of improved maintenance as political capital.
- Assess the **sector policy and regulatory and legislative environment** to determine the current status and any gaps or gray areas before establishing a maintenance model in order to increase the chances that the model will be appropriate and can go to scale with minimal barriers.
- Work to **educate, inform, and lobby donors and development partners**, including NGOs and charities, about the potential benefits of well-organized and professionalized maintenance services, as well as the distortionary effects of grant funding that can undermine willingness to pay for services. Large and influential donors operating in any given country, including USAID, should be encouraged to improve the coordination of funding and enforce the actions of grantees to avoid undermining attempts to establish maintenance programs. The same messages and lobbying should be directed at **national- and local-level politicians** to change the negative impacts of electioneering, which can undermine household and community payment behaviors.
- Carry out a thorough **market analysis**, using the relevant tools and approaches to understand demand, costs, and likely revenues or capacity to pay and market saturation. Tools such as the Business Model Canvass can assist in understanding different market segments, costs, and revenue streams. It is advisable to seek specialist input into such market analyses because the organizations (public or aid-supported) working in WASH are not necessarily well equipped to understand business models.
- Wherever feasible and affordable, integrate **smart technologies** that enable data collection and collation with regard to scheme functioning (e.g., source production, metering of use, functionality status), as well as for payments, in order to minimize or eliminate risk of corruption and to increase transparency and accountability.
- Support and link MSP models with **financing** institutions and help to increase their creditworthiness to overcome cash-flow barriers and to provide capital for business growth. This can include working on internal business planning and production of the required evidence to enable access to loans or, where this is not possible, to provide small capital grants or loans or to act as a guarantor.

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Annex I: Key Informants

Case Study	Key Informant Name
Government-led maintenance services (Ethiopia)	<ul style="list-style-type: none"> • Lemessa Mekonta, Associate Consultant, IRC Ethiopia • John Butterworth, Country Director, IRC Ethiopia
Wahis Mai program (REST, Tigray, Ethiopia)	<ul style="list-style-type: none"> • Lemessa Mekonta, Associate Consultant, IRC Ethiopia • Noah Mccoll, Charity:Water • Zelealem Fisseha, Head of the Wahis Mai program at REST
PLSP model (Tigray, Ethiopia)	<ul style="list-style-type: none"> • Yemane Gebree'gziabher, iWET Project Manager, SNV Tigray Region Representative
HPMA (Kabarole District, Uganda)	<ul style="list-style-type: none"> • Jane Nabunnya Mulumba, Country Director, IRC Uganda • Martin Watsisi, Regional WASH Advisor, IRC Uganda
Whave (Uganda)	<ul style="list-style-type: none"> • Adam Harvey, CEO, Whave
FundiFix (Kenya)	<ul style="list-style-type: none"> • Johanna Koehler, Researcher and Program Manager, Water Program, University of Oxford • Cliff Nyaga, Director, FundiFix, Kenya
Water for Good (Central African Republic)	<ul style="list-style-type: none"> • David DeArmey, Director of International Partnerships, Water for Good • Adrienne Lane, Chief Strategy Officer, Water for Good

Annex 2: Desk Study Overview of Maintenance Providers

Examples	Entity	Year of Initiation	Population Served	Scale	Main Technology for Water Supply	Fragility	Decentralization Status of Rural Water	GDP Per Capita (USD)
Government-led maintenance services (Ethiopia)	Local government (woreda) and strengthened sub-district government (kebele)	Starting with decentralization	Average rural population of woreda 120,000	District (woreda); applied nationwide	Ranges from hand-dug wells to multi-village reticulated schemes; only 1% rural piped on premises	99.6 (15 th - alert)	Devolved federal system, with responsibility for rural water supply decentralized to local government level in 1995	\$767.56
Municipal Water and Sanitation Units (Nicaragua)	Local government (municipality)	Starting with decentralization	Average municipal rural population 17,000	District (municipality); applied nationwide	37% served by piped schemes, 33% by hand pumps, and 20% by springs	75.3 (75 th - warning)	Responsibility for water supply is devolved to local governments (153 municipalities)	\$4,790.00
Water Users and Sanitation Committees (Nepal)	Local government	Starting with decentralization	Average rural district population ~312,000 (2017)	District; applied nationwide	Piped water systems account for 50% of access, covered wells 40%, open wells and other unimproved sources 18.7%	87.9 (39 th - alert)	Recently (2015) switched from a centralized governance structure to federal system, with seven fully autonomous provinces with new rural municipalities	\$835.08
District Water Departments of Metropolitan, Municipal, and District Assemblies (Ghana)	Local government (MMDAs)	Starting with decentralization	Average rural district population ~80,000 (2017)	District (MMDA); applied nationwide	Predominantly boreholes with hand pumps, 11% public standpipes, and 5% household connections	68.1 (108 th)	Responsibility for rural water supply decentralized to local government in 1993	\$1,641.49
Gram Panchayat with support from multiple institutions	Local government (Gram Panchayat)	Pilot 2004, scaled up 2012 after major hardware investment	151,495	Region; applied nationwide	Hand pumps, tap stands, and piped schemes	76.3 (72 nd - warning)	Devolved federal system to individual states, and responsibility for rural water supply	\$1,939.61

(Morappur, Tamil Nadu, India)					with household connections		decentralized to local government	
Jalabandhu Hand pump Mechanics (West Bengal State and Bihar State, India)	Private operators pilot supported by donor (Water for People)	2006	Average population of Gram Panchayat in West Bengal 2,532	District (Gram Panchayat)	Predominantly hand pumps	76.3 (72 nd - warning)	Devolved federal system to individual states, and responsibility for rural water supply decentralized to local government	\$1,939.61
Water Service Providers (Cambodia)	Private operators or companies	No data	Estimates of 423 active WSPs in around 600 communes, serving 1.3 million people	Individual community or sub-district; applied nationwide	Piped schemes; most schemes are relatively small, with less than 1,500 connections (70%)	84 (53 rd)	Responsibility for rural water supply decentralized to the local rural district and commune governments	\$1,384.42
PLSP model (Tigray, Ethiopia)	Formalized private operators supported by a range of donors	Based on earlier Government of Ethiopia economic policy, PLSP model started in 2015	Average rural population of woreda 120,000	District (woreda)	Hand pumps	99.6 (15 th alert)	Devolved federal system, with responsibility for rural water supply decentralized to local government level in 1995	\$767.56
HPMA Uganda (Kabarole District)	Government-backed associations supported by several donor organizations	Government policy to have HPMA in every district issued in 2011	Kabarole District population 181,200 (2017)	District; applied nationwide	Mix of hand pump and piped supplies with shared water points	95.1 (24 th - alert)	Responsibility for rural water supply decentralized to local government in 1997	\$604.04
Association of Water User Groups (A-GMFs) (Timor-Leste)	A-GMFs pilot with support from external aid agency (WaterAid)	Likisà municipality in 2010, Manufahi municipality in 2014	Likisà population 73,000, Manufahi population 52,250	District (municipality)	Predominantly gravity-fed piped supplies	88.3 (38 th)	New decentralization law passed in 2016, gives local government responsibility for rural water supply	\$2,279.25
Integrated System for Rural	Government-led federation	Mid-1990s	435,000	Region	Predominantly piped water on premise	68.7 (106 th)	Federal system, responsibility for rural water supply	\$9,821.41

Sanitation (Ceara State, Brazil)							decentralized to local government in 1997	
Circuit Rider Program - Center for International Water and Sanitation (CIWAS) (Chile, Honduras, Ghana)	Governments, private companies, or implementing organizations with support from CIWAS	Based on USA model from mid-1970s	No data	Sub-region	No data	Ghana: 68.1 (110 th); Chile: 40.7 (150 th) Honduras: 77.3 (64 th)	Responsibility for rural water supply decentralized to local government	Ghana: \$1,641 Chile: \$15,346 Honduras: \$2,480.13
The Salvadorian Water Services Association (El Salvador)	Association, largely dependent on International Rural Water Association	First introduced by IVRA into El Salvador in 2001	170 communities	District (municipality)	Piped supply and hand pumps	71.2 (96 th)	Responsibility for rural water supply decentralized to local government in 2007	\$3,889.31
Tecnico en Operacion y Manetenimiento - National Water Supply and Sewage Company (Honduras)	Government model but subsidized by donor support from USAID for operational costs	Pilot 1993–1995, scaled up to national level in 1995, scaled back in mid-2000s	2 million	District (municipality); applied nationwide	Piped supply and hand pumps	77.3 (68 th)	Responsibility for rural water supply decentralized to local government (policy change since 2003, into practice by 2008)	\$2,480.13
Water for Good (Central African Republic)	Water for Good; informs local, regional, and national government and WASH Cluster headed by UNICEF	2011	~500,000 to 600,000	District (municipality); applied at scale	Boreholes with hand pumps	111.1 (5 th - high alert)	Responsibility is delegated to Rural Water Agency (parastatal), but largely ineffective or no presence	\$418.41
Wahis-Mai program (REST, Tigray, Ethiopia)	REST-funded program	2013	Supports maintenance in 2,860 projects	Regional	Service wells (hand-dug wells and drilled well) with hand pumps	99.6 (15 th - alert)	Federal system, responsibility for rural water supply decentralized to local government in 1995	\$767.56

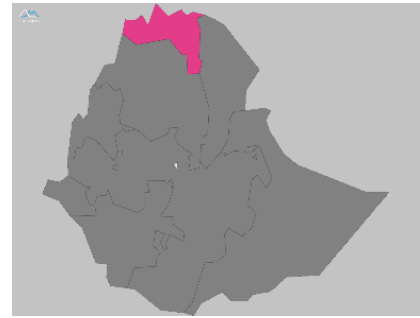
FundiFix (Kenya)	Donor-funded pilot for social enterprise	2014	75,000	County or district	Predominantly hand pumps, expanding to pipe schemes	97.4 (17 th - alert)	Devolved power to 47 newly created counties in 2013, including rural water; decentralization previously occurred with the Water Act of 2002	\$1,507.81
Whave (Uganda)	Local non-profit pilot social enterprise with external donor support	2012	1.1 million	District	Hand pumps	95.1 (24 th - alert)	Rural water supply decentralized to local government in 1997	\$604.04
Vergnet Hydro - UDUMA Project (Mali)	Private company, relying on user contributions and donor funding to subsidize operations	2017	560,000	Region (Sikasso region in Southern Mali)	1,400 hand pumps	93.6 (27 th - alert)	Rural water supply decentralized to local government in 1999 (policy decided on in 1992), but local government must delegate for piped schemes	\$824.52
Specialized agency under contract to central government (Mali)	Private operators contracted via the National Water Department	No data	No data	Individual community or sub-district; applied nationwide	No data	93.6 (27 th - alert)	Rural water supply decentralized to local government in 1999 (policy decided on in 1992), but local government must delegate for piped schemes	\$824.52
Malutsi GSM Consulting Engineers (South Africa)	Private company funded by national government	Alfred Nzo District Municipality 2003–2005, Chris Hani District Municipality 2006–2009	67,400 households	District; applied nationwide	Mainly communal standpipes	72.9 (85 th)	Rural water supply decentralized to local government with the National Water Act of 1998	\$6,160.73

Annex 3: Case Study Overviews

Government Kebele Water Technicians (Tigray Region, Ethiopia)

Overview

Tigray region follows the national policy set out in the first One WASH National Programme (OWNP) in 2012 which set out responsibilities for local government staff at the *woreda* (district) level. What makes Tigray unique is that it is the first region in the country to have established water technicians in place at the sub-woreda or *kebele* (ward or neighborhood) level, in addition to having the conventional Woreda Water Office. Following a first phase where technicians were responsible for a cluster of around four kebeles, the regional government recruited technicians in all kebeles, who are accountable to the Woreda Water Office. The water technician is the secretary of the kebele WASH team, which typically has seven members and includes health extension workers, school principals, civil society, community representatives, and a woman nominated by the kebele council. In Tigray there are 34 woredas, 698 kebeles, and approximately 17,000 water points. The average population of a woreda is around 120,000 people.



According to policy, the kebele water technician should be the first point of contact for communities, acting as a liaison and coordination point with the woreda and local private sector providers. However, the water technician is not necessarily expected to carry out maintenance support directly. In practice there is a mixed model in place in Tigray with communities in some woredas and kebeles still relying on the government for maintenance services because of a lack of alternative providers. Therefore, the government model should be considered along with the Inspiring Water Entrepreneurship in Tigray (iWET) private local service provider (PLSP) and the *Wahis Mai* maintenance program of the Relief Society of Tigray (REST). Where there is no alternative provider, the kebele and/or woreda staff still carry out maintenance services, albeit with limited resources, including constraints to transportation to reach more distant communities.

Functionality

The average national functionality rate in Ethiopia is around 74 percent. Data from Tigray indicates the region is in line or slightly above this average at 79 percent, with about 10 percent of non-functionality related to water source constraints or seasonal yields dropping.

Operating Context

Tigray region has a range of topographies and climate zones, including some that are arid and prone to regular drought. The region has a total population of just over 4.5 million and a density of 91.2 people per square kilometer, which is slightly higher than the national average of 83.

GDP per capita (based on purchasing power parity) in Ethiopia is \$1,899.20 (World Bank 2017), but Tigray is relatively poor compared to other regions with 29 percent of its population living below the poverty line as compared to 22 percent nationally.

Institutional Arrangements

The primary responsibility for day-to-day operation and minor maintenance still rests with the community WASH Committees or WASHCos, who are also responsible for collecting revenue from users and maintain funds in a bank account. For many years, WASHCos had no legal recognition; however, the Government of Ethiopia, through OWNP, is now promoting the legalization of committees across the country. The kebele water technician and WASH committee oversee and support WASHCos. The technician is the first point of call if WASHCos cannot solve a problem or make a repair. In turn, the Woreda Water Office supports the kebele-level technician and, in complex cases, support can also come from the Regional Water Bureau. Typically, WASHCos only apply for maintenance support once a scheme fails or breaks down, so maintenance tasks tend to be mostly corrective and preventive maintenance is a recognized gap in the government model, beyond very minor activities done by the WASHCos. Demand for services is expressed directly at the kebele level to the water technician or through other members of the kebele WASH committee.

The national implementation framework stipulates a range of roles and activities, including support for technical assistance and coordination. The water technician has more of an oversight and general support function for the WASHCos. However, where there are no viable alternative providers, the woreda office and/or kebele technician will carry out repairs and rehabilitation of schemes which have broken down. In 2015, the national regional government of Tigray established a revolving fund for spare parts by proclamation (regulation No. 95/2009 August 2017). Stock is purchased at the regional level and dispersed through a network of woreda-level spare part suppliers (with a capped profit margin). This stock is then sold to private sector providers and WASHCos based on a regulated pricing list. WASHCos can opt to buy on credit with a 25 percent deposit repayable over 2 years. The system for spare parts is reportedly slow, and often parts are not available for lengthy periods.

Financing

Salaries for woreda and kebele water technicians and operational costs are paid for by the regional government as part of the standing budgetary allocations. More broadly in Ethiopia, the trend is to direct a large proportion of funding for rural water to capital investment, rather than for ongoing maintenance or direct support costs (cited at 81 percent; World Bank, 2017). This is a significant proportion compared to other sectors. The rural water sector also faces more challenging rates of budget utilization of about 61 percent.

While woreda or kebele technical staff engage with maintenance tasks in communities, the WASHCos are not charged any fee. Their services are essentially free, which is causing some tension and difficulties for the other models in Tigray (PLSP and Wahis Mai), as they try to introduce the concept of payment for services. WASHCos do pay for spare parts, even when work is done by government staff.

Technology

Most rural communities in Tigray rely on groundwater with hand pumps or simple gravity-fed piped schemes with public standpipes. In general, there are very low rates of rural water supply based on household piped supply, which only accounted for 1 percent in rural areas in 2016 (JMP 2016). As of 2018, the government is seeking to move away from shallow boreholes to larger reticulated systems

with deep boreholes fitted with submersible pumps. The federal ministry has recently released guidance for a new management model for rural water utilities to build on and aggregate community-based management.

Government Support and Integration

The situation in Tigray represents a tiered approach to providing maintenance services, with the government model as the base layer. This follows government policy, as set out in the OOWNP. The goal is to move from an essentially free and supply-driven model of government response to a demand-driven approach with a growing role for local private sector providers. At the regional level, the Water Resource Bureau commitment is very high, and many Woreda Water Offices are active in Tigray. This high level of government commitment is linked to the political liberation movement in the region, which still galvanizes public service. There is no independent regulator for water in Ethiopia. Oversight and monitoring are, in theory, the responsibility of regional, woreda, and kebele government.

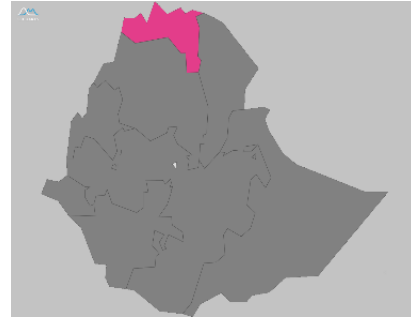
Monitoring and Accountability

In the absence of any independent regulator, oversight functions for rural water rest with the woreda and kebele water office and technician, respectively. The kebele WASH team and administrator also play a role. This includes responsibility for overseeing the work of local private sector providers, where these exist, and the work of REST, which runs the large-scale Wahis Mai program. In practice, the oversight role is limited by lack of resources and constraints to mobility. There are also reports the woreda staff are not focusing on this role and are still providing direct maintenance support. They will need to make this shift to improve the monitoring of maintenance services.

Private Local Service Providers (Tigray Region, Ethiopia)

Overview

The PLSP model is part of the federal government's OWNPN, which encourages the involvement of private sector stakeholders in the provision of goods and services for water supply and sanitation. Currently, Tigray is the most advanced region in the country dealing with the PLSP model and an example for national scale up. Earlier, less successful experiences establishing technical service providers by bilateral donors focused largely on construction implementation. In 2013, the government's OWNPN included maintenance as a focus to make the model more viable and increase the scope of business.



The regional Water Resources Bureau is supporting the establishment of PLSPs throughout the region. PLSPs are essentially small private businesses registered with the woreda and with the regional office of the micro and small enterprises. In Tigray, the PLSP model receives support mainly from the Dutch NGO, SNV, through iWET, which is active in 12 woredas and expanding to another three. Other NGOs, the African Development Bank, and the Finnish-funded Co-WASH project support seven additional woredas. The PLSP model is currently active in 22 of the 34 woredas in the region. iWET's PLSP support runs from 2017 to 2022. As the PLSP program in Tigray grows, there is increasing coordination with the Wahis Mai maintenance program of REST, which developed a network of maintenance teams with funding support from the non-profit Charity:Water.

Functionality

The average national functionality rate in Ethiopia is around 74 percent; data from Tigray indicates that the region is in line or slightly above this average at 79 percent, with about 10 percent of non-functionality related to water source constraints or seasonal yields dropping. There are indications of lowering of non-functionality rates under the PLSPs. For example, in Hintalo Wejerat woreda of south-eastern Tigray, this declined from 24 percent to 7 percent in a year.

Operating Context

Tigray region has a range of topographies and climate zones, including some arid zones prone to regular drought. The region has a total population of just over 4.5 million and a density of 91.2 people per square kilometer, slightly higher than the national average of 83.

GDP per capita (based on purchasing power parity) in Ethiopia is \$1,899.20 (World Bank 2017), but Tigray is relatively poor compared to other regions with 29 percent of its population living below the poverty line as compared to 22 percent nationally.

Institutional Arrangements

Community WASHCos continue to be responsible for the day-to-day operation and maintenance of their water points. As small private businesses, the PLSPs are registered and accredited with the relevant ministry and with woreda authorities. Staff come from technical graduates in engineering and/or

electromechanical engineering. They are given further training and orientation by the regional Water Bureau and Woreda Water Office staff. Each PLSP has three to four members and there is one PLSP per woreda. PLSPs receive requests for maintenance through several channels: WASHCos, Kebele water technicians, or the Woreda Water Office. Irrespective of where the request originates, the WASHCos pay PLSPs directly for their services. PLSPs perform a wide-range of corrective maintenance tasks and rehabilitation work. The entity that initially approves the request, which is often the kebele water technician, also approves the quality of maintenance. Currently, the vast majority of maintenance tasks are repairs that are corrective in nature and based on demand from WASHCos.

The services PLSPs provide include supplying drinking water, hand pump repairs, maintenance and installation of irrigation pumps and biogas components, and selling spare parts for hand pumps (with prices set by government and disseminated transparently), as well as supplies of chemicals for water treatment and in some cases sale of hygiene materials and latrine slabs.

Capacity building for PLSPs varies and is largely dependent on donor support. However, the long-term aim is to increase their technical capacity for maintenance from hand pumps to working with more sophisticated repairs to control panels and switch boards and repairing and rewinding submersible pumps. SNV supports capacity development in areas such as business planning and linking them with loan services to improve operating cash flows. The expectation over time is for PLSPs to take over the spare parts supply currently managed by the government through its established revolving fund.

Financing

Costs to establish a PLSP at the woreda level include an initial in-kind subsidy provided by SNV in the form of motorbikes, tools, and some office furniture to set up as a small business. These costs are estimated at around 150,000 Ethiopian Birr (ETB) (\$5,300). SNV also provides training, technical support, and business coaching and management. Additionally, the Regional Water Bureau and Woreda Water Office provides training and other support. In theory, the salaries and operating costs of PLSPs come from the fee income generated by WASHCos from the sale of services, spare parts (with a government-controlled mark-up), and other goods. SNV estimates the ongoing operating costs of an average PLSP to be about 75,000 ETB (\$2,650) per year. Several challenges exist for the successful operation of the PLSPs, including:

- Cash flow and the ability to access working capital to cover fast moving spare parts and ensure financial viability. SNV is working with different micro-finance institutions with various financial products and negotiating with them to set up deposits and establish revolving funds to facilitate loans for the PLSPs. To facilitate this, SNV is acting as a guarantor by putting down a 20 percent deposit with micro-finance institutions based on a typical loan of 200 to 400,000 ETB (approximately \$7,000) for spare parts. It is still too early to have lessons on PLSP performance, repayments, and default rates.
- Initial challenges faced by PLSPs included unwelcoming Woreda Water Office staff who viewed them as competitors. In addition, subsidized maintenance services provided by some NGOs undermine the fee-for-service model. Another constraint on WASHCo funds is low household payments of tariffs, despite the monthly minimum of 10 ETB per household tariff. Overcoming

culture and expectation of government-subsidized or free maintenance is also a challenge. However, the regional government work with Woreda Offices has partly overcome these issues by circulating official letters to institutions working in the region requesting they do not provide free or subsidized maintenance services. Woreda Water, Mining, and Energy Office technicians are also aware of the roles of PLSPs and are now more supportive.

There are recognized challenges to the PLSP model in reaching the most remote – and therefore costly to serve – rural communities. However, anecdotal reports from SNV indicate there is now a much greater willingness on the part of WASHCos to pay for repair services as they see functionality rates increase and downtime shorten. They speak of a change in mindset with WASHCos no longer waiting for NGOs to come and make repairs but having increases in tariffs and funding to pay for them. Now, almost all WASHCos have bank accounts with a surplus of funds. Because they know they will only receive service on payment, this leads them to do more minor operational maintenance to avoid larger, more costly repairs.

Technology

Most rural communities in Tigray rely on groundwater with hand pumps or simple gravity-fed piped schemes with public standpipes. In general, there are very low rates of rural water supply based on household piped supply, which only accounted for 1 percent in rural areas in 2016 (JMP 2016).

Some PLSPs have the technical capacity to carry out maintenance on surface pumps. The plan is to steadily increase their skill base to tackle much more complex repairs to electromagnetic pumps. For the most part, the majority of PLSPs still work on above and below ground hand pump maintenance, replacement of foot valves, pump rods, valves, sealing rings, etc.

Government Support and Integration

The push toward greater private sector involvement came after the regional government and the Tigrayan regional Water Bureau commissioned SNV to conduct a survey on maintenance challenges. Government commitment is very strong, linking the PLSP model to government policy and institutions. Almost two-thirds of the woredas have PLSPs, but the regional Water Bureau wants to expand this model to all 34. There is no independent regulator for water in Ethiopia, making oversight and monitoring the responsibility of regional, woreda, and kebele governments.

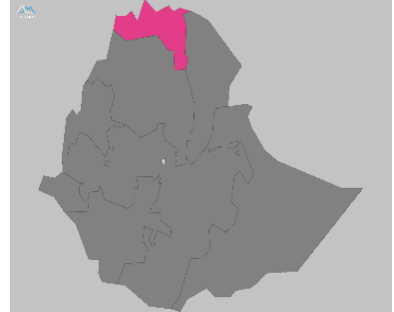
Monitoring and Accountability

The PLSP and the woreda authorities have a signed service agreement stipulating a menu of allowable charges for services and spare parts the PLSPs can charge to the WASHCos, the response times after receiving a request from a community, and a warranty that has to be honored within a set time period if the repair or maintenance work fails. Following a repair, the kebele water technician makes a check to ensure the PLSP has completed the task and charged a fair price. The technician then approves the services in consultation with the WASHCo or other entity initiating the request. The communities and WASHCos have the local contact numbers for the PLSP providers and can route complaints via the kebele water technician or Woreda Water Office who, in theory, act as arbitrators between them and the provider.

Wahis Mai Maintenance Program (Tigray Region, Ethiopia)

Overview

The Wahis Mai model started in October 2013 to address concerns related to the sustainability of water schemes implemented by the Tigrayan NGO, REST with funding from Charity:Water. Although the approach evolved it still focuses on increasing functionality, reducing downtime, and informing program improvements through the use of data, including remote sensor information. Of the approximately 17,000 rural water points in Tigray, 7,503 have been financed by Charity:Water and the maintenance program now covers approximately 6,240. The program covers all woredas through a clustering approach, with six teams each covering five or six woredas, but to date it only focuses on infrastructure funded by Charity:Water. Its sensor pilot program, however, includes all water points found in the focus woredas. Data from Charity:Water and REST from October 2016 to July 2017 indicates Wahis Mai completed 5,432 site visits to 2,860 individual schemes and facilitated 1,361 repairs.



As with the iWET initiative, supported by SNV in Tigray, this model cannot be viewed in isolation. There is political pressure to build on the government strategy of a hybrid maintenance model. Where WASHCos receive support from active PLSPs the Wahis Mai cluster teams are discouraged to make repairs directly.

Functionality

Despite an aging water supply infrastructure, functionality levels are 90 percent, in a context where national functionality is at 75 percent (Ethiopia's National Water Point Inventory).

Operating Context

Tigray region has a range of topographies and climates, including some arid zones prone to regular drought. The region has a total population of just over 4.5 million and a density of 91.2 people per square kilometer, slightly higher than the national average of 83.

GDP per capita (based on purchasing power parity) in Ethiopia is \$1,899.20 (World Bank 2017), but Tigray is relatively poor compared to other regions with 29 percent of its population living below the poverty line as compared to 22 percent nationally.

Institutional Arrangements

WASHCos continue to be responsible for the day-to-day operation and maintenance of their water points, including tariff collection. The Wahis Mai program uses cluster teams comprised of three staff, including a generalist WASH expert, a social expert addressing legal and organizational issues, and a mechanic with high-level training such as repair of electro-mechanical pumps. Each cluster team operates from a central office and has motorbikes, a vehicle, and advanced tools and equipment provided by Charity:Water. Wahis Mai's role is shifting from one of direct repairs to training of woreda and kebele water technicians and coordination of demand for repairs received from the communities. All hand pumps installed with Charity:Water funding have remote sensors, which provide information on flow

rates and are constantly monitored by REST, the Wahis Mai teams, and remotely in the United States by Charity:Water. Staff also have Android tablets and manual GPS. Where they continue to provide direct maintenance support, they have targets of over 93 percent functionality at any given time and broken water points repairs are occurring within a maximum of 30 days. There are three different channels to receive maintenance requests:

- Weekly updates sent to cluster teams from the remote sensors.
- Direct requests from WASHCos through the free phone numbers at all water points.
- Through a more supply driven approach through annual Wahis Mai team visits to all projects on a circuit rider basis.

The cluster teams also have the contact details of the kebele water technician and woreda staff, as well as the PLSPs where they are active. Wherever possible, the Wahis Mai teams will coach others to make the repairs. If coaching others is not feasible, they will directly make repairs.

Financing

The Wahis Mai program is entirely financed by Charity:Water, with current estimates at \$250,000 annually. REST covers the regular salaries and operational costs. This funding pays for regular monitoring and facilitation of repairs, including visits to around 6,400 water points each year. The estimated cost of each visit is approximately \$38 per water point or community per year. This annual financing does not include the original start-up costs of equipping offices and purchasing tools, equipment, trucks, and motorbikes, all of which are also covered by Charity:Water.

In terms of community contributions, no fee is payable by the WASHCos and communities for the maintenance support provided by Wahis Mai technicians, beyond the cost of the needed spare parts. These parts are paid for through funds accumulated from household tariffs. In this respect, the Wahis Mai model is at odds with the strategy of the regional government to wean WASHCos off the expectation of “free maintenance,” encourage greater tariff contributions from households, and have savings in place to meet these kinds of maintenance costs. REST and the Wahis Mai program recognize this potential to undermine the PLSP model and are planning a transition period to move communities toward paying for services. The expectation is it will take time for communities to adjust to paying more regular tariffs.

Technology

The majority of schemes funded by Charity:Water are based on water points with hand pumps. To date, 3,000 of these have been installed with Afridev sensors and an additional 2,000 sensors will be installed by the end of 2018. The sensors measure water flow rates and the quantity of water taken from each borehole. Sensors can be set up to take continuous measurements or at pre-set intervals. Each sensor is estimated at \$250, including the transmission cost, and is expected to last for about 10 years.

WASHCos can purchase spare parts from the government’s revolving fund supply chain. Because the restocking by the government is very slow, REST has its own spare parts outlets and sells these parts through Wahis Mai teams based on government-approved prices.

Government Support and Integration

REST is an NGO, but its origins are as a humanitarian affiliate of the Tigray People's Liberation Front. Because of this history, the organization has very close relations with the regional political leadership. This relationship leads to questions about the role of REST, the resources it receives from the government, and the overall extent of accountability. The regional government's Water Resource Bureau has endorsed the Wahis Mai program but is encouraging the transition from direct maintenance and repair to one of facilitation, training, and coordination working with woreda and kebele water office staff and the PLSPs. REST is responding by basing Wahis Mai on the government strategy to support or fill the gaps in the layered maintenance approach. Wahis Mai still provides a response service in the absence of other maintenance providers with capacity to respond. As the PLSP approach expands to cover all woredas in the region, there is some doubt about the eventual role the Wahis Mai cluster teams will play.

Monitoring and Accountability

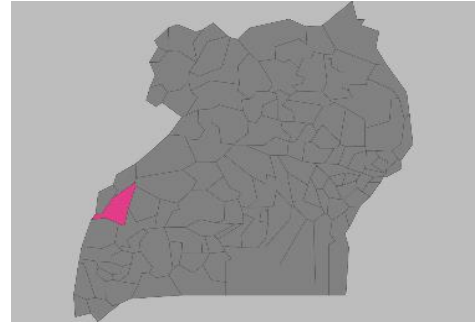
Wahis Mai includes a project manager who coordinates and monitors the cluster teams. The manager also monitors information from the remote sensors and digital reports generated by the teams to assess performance and the quantity of work completed. In addition, the project manager and representatives from Charity:Water carry out spot checks to assess the quality of repairs. REST holds team meetings to review performance and provide feedback and analyze the underlying causes of breakdowns. At the regional level, REST holds regular meetings with the Water Bureau to review activities, issues arising from maintenance activities, and ongoing challenges. Individual WASHCos can still address any grievances through the network of kebele water technicians and Woreda Water Office staff, who have the formal mandate from the government to oversee water supply services in the absence of any regulatory body.

Hand Pump Mechanics Associations (Kabarole District, Uganda)

Overview

This model aims to improve and formalize maintenance services for rural water points by forming Hand Pump Mechanics Associations (HPMAs) at the district level, with member mechanics present in each sub-county. Each HMPA

is legally constituted and approved by district-level government. With proper implementation, HPMAs help professionalize services. HPMAs ensure member mechanics are experienced and trained in repairing water points and piped water schemes, monitor and regulate members (e.g., to avoid overpricing), and create a clear link between members, WUCs, and district local governments.



The concept grew out of early experiences with area mechanics. A forerunner of the HMPA existed in Uganda for several years, but was only active in two districts, Kibaale and Adjumani, before the Netherlands development organization, SNV, documented the approach in 2007. Subsequently, and with the continued support of SNV, WaterAid, and IRC, the Ministry of Water and Environment (MWE) formalized the concept of HPMAs in the Joint Sector Review of 2011. The concept was institutionalized, and guidelines were issued by MWE to govern the first round of HPMAs in 30 districts. Currently, registered HPMAs are operational in 112 of Uganda's 127 Districts. With significant external support, mostly from international NGOs, some of the HPMAs are becoming professionalized. However, without such support, many remain as loose groupings of individual mechanics and struggle to provide any well-organized, routine preventive maintenance. In the case study of Kabarole HMPA, there are 18 hand pump mechanics serving 1,077 water points across the district.

Functionality

Significant disparities exist in the effectiveness of HPMAs to improve functionality. Notably, in Kasese District the establishment of an HMPA led to a rapid increase in functionality from 61 percent between 2008 and 2009 to 74 percent between 2009 and 2010. However, in Kabarole District, water point functionality is just 59.1 percent.

Operating Context

The HMPA model operates in 112 districts across the country. The population density in Kabarole is 240 people per square kilometer which is higher than the national average of 207.

GDP per capita (based on purchasing power parity) in Uganda is \$1,863.83 (World Bank 2017).

Kabarole District is comparatively wealthier than average, with a connection by road to other districts and the financial benefits of tea growing zones.

Institutional Arrangements

Under this model, WUCs and a caretaker carry out the day-to-day operation and minor maintenance and checking of their water point, as well as basic administration and tariff collection. When an HMPA is established in the district, they are introduced to WUCs and communities as a resource for conducting

maintenance activities. However, in many instances WUCs become dysfunctional or abandoned, which can limit the market for HMPAs (for example, a recent study in Kabarole found active WUCs in only 40 percent of communities with water points).

All hand pump mechanics in a sub-county should pay a joining fee and register with the HPMA, which in turn registers with local government. In theory, the District Water Office (DWO) signs an annual framework contract or memorandum of understanding that designates which rehabilitation and repairs of water supply schemes are for the HPMA. A single hand pump mechanic, selected from among the sub-county hand pump mechanic representatives, leads the HPMA. District HPMA representatives are encouraged to form regional HPMAs and meet to discuss common challenges and share lessons. Most HMPAs have legal status by forming a community-based organization. Some HPMAs go a step further and establish themselves as limited companies with bank accounts.

HPMAs primarily focus on major repairs above a financial threshold, with more minor corrective or preventive maintenance performed by community caretakers. Requests for services are generally based on demand from WUCs once a problem arises or the pump fails. In Kabarole district IRC is supporting a pilot with the Pay-As-You-Fetch (PAYF) payment model, which guarantees a regular visit every 3 months and an annual check of the below-ground components by the HPMA. This only applies to eight boreholes out of 1,077 water points mapped in the district in 2017.

Financing

The individual hand pump mechanics at sub-county level may undertake small repairs with the WUCs and receive payment directly. In turn, there is an expectation the hand pump mechanics will contribute an annual membership fee set by the HPMA, which is usually around 20,000 Ugandan shillings (UGX) (about \$6.00). Any repair valued above UGX 400,000 (\$107.50) is defined as a major repair. Above this threshold, maintenance tasks can be contracted to HPMAs by sub-county boards or in a repair request to the District Water Office. Another route for HPMAs is to conduct an inventory of all water points in the sub-county and then present this to the District Water Office for remedial action for those in disrepair. The District Water and Sanitation Conditional Grant finances major repairs, of which 15 percent should go toward maintenance. In 2017, this represented UGX 45 million (\$15,000) in Kabarole, with part routed to sub-counties. HMPAs face several challenges with the current arrangements for financing from the DWO, including:

- Conditional Grant financing is often delayed or directed to other priorities,
- Major repairs can take a long time and extend from one financial year to the next, making financing complicated and causing lengthy delays,
- The more lucrative rehabilitation and repair contracts are often outsourced to larger contractors with greater access to capital resources and the ability to outbid the HPMAs, which they see as the “competition,”
- Local contractors often have political links and influence with local government and can use this to win rehabilitation contracts.

In a more limited number of instances, HMPAs can bypass the district and contract directly with WUCs, but it is rare for communities to raise larger sums of cash to pay. A recent survey by IRC in Kabarole found that, except for communities working with the PAYF approach, most households do not pay regular tariffs. The survey cited only 2 percent of households surveyed as paying with tariffs ranging from \$0.14 to \$0.57 per household per month.

Apart from a limited number of cases implementing new financing models with the support of donors or NGOs, there is a very limited revenue stream for the HPMA model, and it has not changed users' willingness to pay. The limited income and low cash-flow to HPMAs is undermining the model and leads to high dropout rates of hand pump mechanics, who often go back to their previous jobs or only hold their position in the HPMA as a second or third job. Some HMPAs are looking to alternative markets to survive. Among the ways they are innovating is by taking on construction of new schemes with contractors and manual drilling. HPMAs are increasingly supplementing income derived from maintenance by working to support NGOs and the government with survey work and monitoring because of their intimate knowledge of rural areas and communities.

In Kabarole District, with support from IRC, the HPMA is piloting the PAYF tariff model where users pay per jerrycan of water collected and WUCs must reserve UGX 30,000 (\$8.00) every 3 months to channel to the HPMA for repairs and inspection of the infrastructure every 3 months. Although the PAYF tariff is currently only applied for eight boreholes, it is providing important financial resources to the HPMA while also creating a tariff mechanism users can easily understand and believe to be fair and transparent.

Technology

HPMAs predominantly work on hand pumps (India Mark II), but some also work on piped schemes. Currently, HPMAs and hand pump mechanics do not utilize technology such as remote sensors or digitalized reporting to maximize the effectiveness of maintenance activities.

Spare part supply is a recognized gap in the maintenance system with limited spare parts suppliers and available stock. This gap limits the capacity of hand pump mechanics and HPMAs to negotiate and access spare parts and tools, as they rely on local shops with insufficient capacity. The limited capacity impacts the ability of HMPAs to benefit from some of the economies of scale of forming associations.

Government Support and Integration

At the national level HPMAs benefit from the MWE's support as part of its core policy to involve the private sector. In addition to the formal policy on HMPAs, 2013 guidelines outline how local governments engage with HMPAs for contracting and financing. However, at the local level, there are reports of HPMAs hampered from winning maintenance and rehabilitation contracts and undermined by politicians and local firms with much better connections, cash flow, and capacity to win larger contracts from local government.

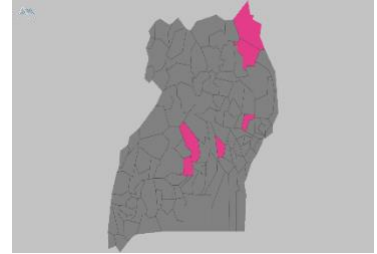
Monitoring and Accountability

As with any private supplier, if service is poor or faulty parts are installed, the WUC can bilaterally challenge them. WUCs can report an individual mechanic to their HPMA for internal discipline if they do not perform well. However, HPMAs are not formal stakeholders at the district level and there is limited information flow between WUCs, HPMAs, and local government. Consequently, WUCs often struggle to hold hand pump mechanics and HPMAs accountable and the restricted information flow undermines the planning of both the DWO and HPMA/HPMA.

Whave Preventive Maintenance Service Area Provider Model (Uganda)

Overview

Whave is a social enterprise registered in Uganda in 2012. It operates under two modalities:



- **Advisory role** toward government regulation of rural water supply, governance capacity development, stakeholder coordination, and training. Advocacy includes a shift to preventive maintenance as a norm, build-operate-transfer (BOT) systems for construction and restoration, performance contracting of service provider entities by government water authorities such as Umbrella Utilities and Districts, and performance-payment of local technicians targeting reliable 100 percent functionality of water supply, all aimed to achieving Sustainable Development Goal (SDG) 6.1.
- **Prototyping and benchmarking** the service provider role. Whave directly services over 400 hand pumps in seven districts providing construction, restoration, and preventive maintenance under a BOT model. It is currently conducting baseline assessment in an eighth district and has funds to expand to two more districts in late 2019. The focus is on generating evidence of costs of full functionality in different climate zones. Whave encompasses four local service provider teams operating in 10 districts in central, eastern, and north-eastern regions. The Whave regional service provider based in Kampala supports these teams. Whave works with and trains local HPMAAs to become professionalized local service providers and all the local technicians it contracts and trains in preventive maintenance are members.

Whave is not purely a maintenance service provider as its core mission includes improvement of hygiene and sanitation conditions, through conversion of hand-pumps to piped water supply to achieve SDG 6.2 to improve hygiene and sanitation. This is done using a BOT approach optimizing design, construction, and maintenance expenses within a full life-cycle cost-efficiency perspective, with reliable daily functionality as the key performance indicator.

Functionality

Over the past 3 years, Whave consistently maintained 100 percent functionality in Kumi District, 99 percent in Kamuli, and 98 percent in Nakaseke, serving 340 communities and 100,000 people (as of December 2018). These rates compare with national averages reported by MWE of 85 percent.

Operating Context

The Whave model operates in seven districts, with an expansion in 2019 to 10 districts. The average population density in Uganda is 207 people per square kilometer. Transport networks away from national highways are often poor with limited connectivity. GDP per capita (based on purchasing power parity) in Uganda is \$1,863.83 (World Bank 2017).

Institutional Arrangements

Whave works in public-private partnerships (PPPs) with district local governments, following Performance Contract memorandums of understanding. Quarterly PPP review meetings are held to share Key Performance Indicator results with central and local government. A key component of the PPP institutional design is devising tariff price plans in agreement with the local and central government, ensuring the tariff balances the service cost at government-approved affordable levels.

Whave is working with local governments on the pilot PPPs to scale the model, so, it complements structures developed by MWE for water supply in small towns. This will ensure the Whave model accelerates progress toward achieving SDG 6.1. The expectation is the MWE regulated regional “umbrella” utilities can absorb the full functionality PPP structures initiated by Whave, as and when appropriate. Whave is using the evidence on costs it generates to help the central government determine the cost of national replication.

At the community level, Whave operates two payment models, the PAYF hybrid and improved subscription. These are combined with direct collection and committee collection options, with the most appropriate model selected according to local conditions, preferences, type of community (whether it is a rural trading center or a farming community), and stage of development. These options are part of an institutional transition process that brings all rural communities, progressing at different speeds, eventually to the same end-goal of universal access to reliable water supply financed through regulated tariffs.

Financing

Direct and Indirect Service Costs are distinguished from Investment Costs: Whave is focused on full cost recovery with all recurrent Direct Service costs incurred by the Service Provider being recovered from service fees paid by water users. **Direct Service** costs are, for example, procurement and replacement of worn components (including both major and minor parts), local technician labor, and management by both local and regional service providers. Recurrent costs incurred by the government include regulation of Service Providers, environmental resource management, and mobilization of communities. These are **indirect service** costs and are not recovered from tariff revenues.

Investment costs are distinguished by not being permanent and recurrent; these are temporary system-building and capital costs. This includes the conversion of hand pumps to pipes, equipping unserved areas, and “PPP building” or the process of establishing capability for regulation of Service Providers by government. An example is Recovery Rehabilitation, which is the cost of restoring water supply installations that have sub-standard materials or construction. Whave offers Recovery Rehabilitation to communities on the condition they sign Preventive Maintenance and Continuous Rehabilitation Agreements (PMCRAs) that require them to pay service fees either through Improved Subscription or through PAYF hybrid modalities. The PMCRA requires the Service Provider to cover all future technology wear and replacement costs. In this way, the model establishes a financial incentive for life-efficient construction, restoration design, and material selection, and cost-efficient maintenance. This approach removes the need for the government to finance rehabilitation, which is currently a system weakness.

Discounts as a method of building a self-financing structure. The PMCRA specifies the service fee required to balance cost, assuming economies of scale. In the case of hand pumps, the charge is currently \$310 a year, including local and regional service provider management, technician earnings, and hardware. This is generally affordable, with community committees ensuring exemptions for needy members who cannot pay. However, a strategy is needed to overcome the initial unwillingness to pay among some community members. Most local leaders recognize that ad-hoc gifting by politicians and NGOs does not provide the reliable functionality offered by the PMCRA. To help them address recalcitrant members, Whave offers a declining discount for some early adopters. In 2018, under the Improved Subscription modality for hand pumps, Whave discounted 70 percent of the annual \$310 full-service fee and reduced that to a 60 percent discount in 2019, with communities and local government aware the discount will continue to decrease. In the case of the PAYF/Hybrid modality, a PPP partnership agreement has been reached that provided an early adopter discount of 50 percent in 2019, with reductions to follow. The finance needed to pay for this declining discount is an important component of Investment Cost. It is categorized as Investment because it is a temporary system-building cost.

The government has started to regulate the price of water collected from tap stands in rural areas. The current regulated price of 50 UGX (approximately \$.01) for a 20-liter jerry can is a major step toward affordability. This price is significantly less than the trading center prices, which are commonly 200 to 1,000 UGX (about \$.05 to \$.27) and too costly for poorer community members. Tap stands are socially and financially acceptable in farming communities because they are seen as providing a higher level of service. The government does not yet regulate hand pumps, so Whave's initiatives are designed to address this. One reason hand pumps are less desirable is they are expensive to service per capita. Whave estimates the PAYF tariffs they require are approximately 40 UGX (\$.01) for a 20-liter jerry can for domestic consumers to have the water they need to meet the daily lifeline consumption volumes. The district governments where Whave is applying the PAYF/Hybrid modality are supporting a stepped tariff price plan with the declining-discount approach to reach 20 UGX (less than \$.01) per 20-liter jerry can for all users. As an incentive, hand pump communities in compliance are prioritized in the queue for piped conversion.

Understanding subsidy and cross-subsidy. The division of cost into Direct Service, Indirect Service, and Investment helps clarify the question of subsidies. Simply put, water users pay for Direct Service, Government pays for Indirect Service, and Development Funds (or "Transfer") along with in-country tax revenue pays for Investment. This approach allows coordinated progress to take place during a transition period while a coherent O&M (and BOT) framework is established. Once the framework is well understood and has had time to mature, adjustments can be made. For example, urban water revenues may generate a surplus that can be used by the government to pay part of its Indirect Service and Investment Cost. The government may find it can charge license fees to Service Providers, so effectively drawing part of its Indirect Service and Investment Cost from tariffs. Whave does not recommend the converse option of using subsidies to compensate for below-direct-service-cost tariffs. This is believed to be a bad option because service providers operate both in trading and farming communities with piped and hand pump water supply that are charging uniform prices approved by the

government. They are effectively cross-subsidizing because revenues in trading centers and from piped supply tend to generate surpluses, which are used to reinforce service in the smaller farming communities with hand pumps. Within communities, there is also “community-subsidy” whereby community water committees ensure some members are exempted from tariff-payment in times of need. Therefore, the Whave PPP approach remains a community-based monitoring system (CBMS) approach, with rationalized implementation it is called CBMS+ or Improved ICBMS.

Whave makes use of development funds to pay the Investment cost, which includes the early-adopters discount, PPP-building, and capital such as Recovery Rehabilitation. These are all temporary costs and not direct service costs and are entirely met by tariffs. Service, including capital maintenance expenditure, is not subsidized.

Technology

Whave is working with NGOs and a British consortium to look at low-cost functionality sensors for hand pumps. Currently, Whave finds on-site monitoring and cross-checking by phone to be cost-effective. It is also prioritizing investigating the reliability and cost of automatic water ATMs to reduce management costs both for hand pumps and piped systems in the coming years. It is embarking on solar-powered pumping for both domestic water distribution and irrigation.

Government Support and Integration

The government recognizes the model as an example of professionalizing maintenance services as part of the transition to a rural utility approach. At the national level, the initiative is part of the MWE’s policy to involve the private sector in service delivery. Whave works closely with MWE on the design and evolution of the model and contributes to the reform and development of a national O&M framework.

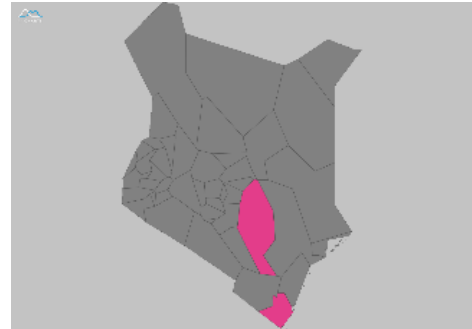
Monitoring and Accountability

Under the Whave approach, the public sector — represented by local government — audits the performance of Whave; can pass and implement resolutions, bylaws, and ordinances; and sets tariffs and fees. A team from Whave’s headquarters in Kampala monitors the performance of services provided. Whave also issues a quarterly performance report to local government and the MWE, with details of performance in each sub-county. Accountability is also strengthened through service agreements signed by communities and Whave. Communities with complaints can use a toll-free number provided to route concerns about a local service provider and are free to withhold payment until the complaint is resolved. Ultimately, WUCs can approach local government to act as an arbitrator with Whave.

FundiFix Guaranteed Maintenance Service Model (Kenya)

Overview

FundiFix is a social enterprise that supports maintenance services in two rural Kenyan counties (Kwale and Kitui). It serves approximately 75,000 beneficiaries using 114 hand pumps and 28 piped schemes as of May 2019. The enterprise started from a collaboration between Oxford University and Kenyan partners in 2014, with research grant funding to test hand pump sensors from the United Kingdom's Department for International Development. UNICEF and the United States Agency for International Development (USAID) provided further funding.



FundiFix operates a franchise model with locally staffed and equipped county-based companies. Two FundiFix enterprises currently provide repair and maintenance service to communities and schools operating water infrastructure in Kwale and Kitui counties. These maintenance service providers market their services and sign agreements with community Water User Committees (WUCs), schools, and clinics. They operate under performance-related contracts designed to encourage quality and timely preventive maintenance and repair service.

FundiFix's primary goal is to reduce service downtimes from over a month to a maximum of 3 days for hand pumps and less than 5 days for piped schemes, which is the stipulated response time. Having demonstrated this approach can produce high levels of functionality, the model is now focusing on scaling up to serve more beneficiaries and ensure sustainable sources of funding through Water Services Maintenance Trust Funds (WSMTFs) by leveraging the support of national and local government actors.

Functionality

Functionality of water infrastructure contracted under the FundiFix model is close to 100 percent, as compared to an average rate of 60 percent in Kitui and Kwale counties.

Operating Context

The FundiFix model operates in two distinct physical environments. Kitui County is semi-arid with high rainfall variability and two distinct rainy seasons (March–May and October–December). Kwale County is located in a coastal area with rainfall variability and sea-water intrusion in the coastal strip. It has a high density of hand pumps.

The population density in Kwale County is 101 people, just below the national average. Kitui County, with only 33.21 people per square kilometer, is relatively low by comparison.

Gross domestic product (GDP) per capita (based on purchasing power parity) in Kenya is \$3,285.91 (World Bank 2017). However, Kitui County is relatively poor, with 47.5 percent of the population living below the national poverty line, compared to a national average of 36.1 percent in 2016.

Institutional Arrangements

The FundiFix business rationale is that scale reduces risk and by pooling a larger number of water points under one maintenance framework, economies of scale are achievable. The FundiFix model includes the use of sensors for monitoring hand pump usage and functionality, locally registered and owned maintenance service providers, and a financing element in the form of county-based WSMTFs. Two privately-registered Kenyan maintenance companies were set up as franchisees trading as Miambani Ltd. and Kwale Hand Pump Services Ltd. There are also two WSMTFs (one per county) currently operational in Kenya.

Under the model, WUCs remain responsible for the day-to-day operation of water infrastructure, including tariff collection from community members and administrative tasks. Where this model differs from the basic community-based management approach in Kenya, is maintenance tasks are formally contracted to FundiFix's service providers. At the county level, local government is involved in sensitization of WUCs through community meetings on the importance of maintenance in relation to its policy direction and sub-sector priorities. At the community level, WUCs and schools sign an annual contract with FundiFix's service providers, which stipulates key terms including monthly service charges, breakdown response times (e.g., within 3 days for hand pumps), replacement of broken parts, and use of professional mechanics. For piped schemes, local government is a party to the contract, being responsible for asset replacement and extension of piped networks.

FundiFix is primarily concerned with the performance of minor and major corrective maintenance. However, preventive maintenance and rehabilitation are included. For the most part, maintenance services are based on demand, generated through phone calls to a specified number. Nevertheless, there is also a more informal, limited supply-driven component for preventive maintenance of water supply systems (predominantly solar panels and generators).

Financing

FundiFix is not operating on a full cost recovery model at the current scale of operations. The goal is to rely on subsidies until reaching a much bigger operation scale. To pool risk and attract entrepreneurs and other investors, FundiFix designed a sustainable financing model based on user service charges combined with the WSMTF that channels government, donor, and other sources of private finances as a form of subsidy.

- *Service charges:* WUCs and schools pre-pay a monthly service charge using mobile payments regardless of the maintenance tasks performed in any given month. Customers are guaranteed repairs within 3 to 5 days of any breakdown. If the service provider falls short on this promise, the customer is entitled to a free month of service – creating a clear economic incentive for FundiFix service providers to maintain high service levels. Customers pre-pay on a monthly basis using SMS-based payments, which provide a convenient, low-cost, and transparent service, allowing for oversight and targeted support based on objective information.
- *WSMTFs:* WSMTFs have been established in Kwale and Kitui counties and channel financing from donor organizations, public financiers, and other investors (e.g., philanthropists and private

companies) for the sole purpose of supporting maintenance services for rural water infrastructure.

Each FundiFix enterprise applies for operation and maintenance (O&M) gap financing to the respective county WSMTF in 6-month cycles when applications are reviewed and contracts signed defining targets (response time, coverage, efficiencies, etc.) to be achieved by the FundiFix enterprise in the contract period. Progress is then reviewed or audited by the trust funds at the end of the financing cycle. The WSMTFs release funds to service providers based on the achievement of pre-identified performance targets.

Technology

The FundiFix enterprises predominantly provide maintenance services to hand pumps. In April 2017, they began to include piped schemes. Most hand pumps maintained under the model have previously been fitted with a smart meter, which provides service providers with real-time data on use and indirectly functionality, thereby facilitating the design of the rapid response. Each FundiFix service provider has a direct relationship with spare parts suppliers, and in Kwale and Kitui counties spare parts are stored in the local offices, ensuring mechanics have easy access to spare parts with no real delays. The FundiFix model also operates pre-payment water ATMs for the piped schemes, which helps to increase payment efficiencies.

Government Support and Integration

Kenya has a relatively well-organized WASH sector. In 2013, the Government of Kenya devolved power to 47 newly-created counties, including for the provision of drinking water and sanitation services. FundiFix has gained the support of both national and local government. The national regulator, the Water Services Regulatory Board (WASREB), highlighted FundiFix as a good example of the professionalization of rural water services. The sector, in general, is now moving to recognize the limits of community management by introducing new legislation that permits a broader range of stakeholders to be involved in service provision. Article 94 of the 2016 Water Act specifies that water infrastructure may be managed by a “public benefits organization or a private person under a contract with the county government.” At the county level, local governments are aware and supportive of communities and schools joining the scheme. In Kitui County, an ongoing policy development process aims to provide the required enabling environment, including financing of maintenance moving forward.

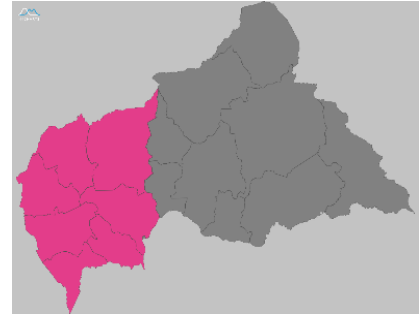
Monitoring and Accountability

While Kenya’s national water regulator, WASREB, faces constraints in regulating water services outside formal service provision areas (around 42 percent of the Kenyan population), the local (sub-county) government office for water and the county trust funds monitor the operational and financial performance of the FundiFix enterprises and service providers. Satisfaction information is collected after each repair and there is a FundiFix “care number” on all hand pumps. Consumers can note if a fault is not repaired within 3 days. In those cases, they receive a month of free service, which builds a clear financial incentive for providers. Additionally, FundiFix service providers use regular SMS service to send payment reminders and confirmation, thereby increasing accountability to users.

Water for Good (Central African Republic)

Overview

Water for Good (WfG) is an NGO working in the Central African Republic (CAR) to implement a circuit rider program that provides maintenance services to 1,400 hand pumps serving 500,000 to 600,000 people. WfG grew out of a for-profit drilling company founded in 2004 when the company transformed into an NGO. The demand for maintenance services led the WfG program to dramatically expand between 2007 and 2011. The approach largely follows the circuit rider model developed in the United States in the mid-1970s. Under this model, small teams of qualified technicians rotate through a pre-determined circuit of communities providing maintenance activities and advice on a wide range of issues. In 2011, the integration of electronic programming enabled WfG to properly evaluate the service, better manage supplies, increase the efficiency of routes, and significantly improve the functionality of rural water supply systems in a very challenging operating context.



Currently, WfG has four maintenance crews operating across nine of CAR's 16 prefectures (counties) at an annual cost of \$450,000 (2018). Each maintenance crew has at least two technicians who provide preventive maintenance and repairs on all the water points along a pre-determined route, which can take up to 3 weeks to complete. WfG is piloting several innovations around the circuit rider model, including a rapid response model for more densely populated areas and a demand-driven model with a roving mechanic. Both approaches have modified tariff and financial models. Alongside the maintenance program, WfG continues to build new water points and constructed 80 new boreholes in 2018.

Functionality

The program has achieved functionality rates above 90 percent in all nine of the prefectures where it operates. There is a lack of reliable data available on the performance of water points in the remaining seven prefectures that only receive support from the government.

Operating Context

The WfG model operates in an environment with extremely challenging conditions. The CAR has minimal transportation infrastructure and very low population densities, on average only 7.37 people per square kilometer.

Private markets for spare parts outside of the capital city and any major towns are non-existent, and there are still many parts of the country subject to active conflict and insecurity. CAR ranks fifth highest on the Fund for Peace Fragility Index. GDP per capita (based on purchasing power parity) in the CAR is \$725.94 (World Bank 2017).

Institutional Arrangements

Day-to-day operation, cleaning, and minor maintenance is the responsibility of the community well committee, though such committees have no legal status in CAR. Clinics, hospitals, missions, and schools operate and manage their water points. WfG's circuit rider program has three levels. At the

operational level, WfG employs 10 to 12 technicians and assistant technicians. These long-term, full-time employees receive training and work in four teams. Over these teams, two field offices provide supervision and ensure financial controls by providing logistical and supply chain support and managing technicians' reporting and providing oversight. At the highest level, WfG has a country director and various international program staff who allocate part of their time to administer the whole program and conduct supply chain management with Vergnet in France, which manufactures the most common pump used by WfG.

WfG's technicians work in four teams – made up of at least one technician and an assistant technician – that are responsible for maintaining around 275 water points. Technicians travel to perform preventive and corrective maintenance on pre-determined circuits that can take 3 weeks to complete. On average, each water point is visited twice per year. The approach is supply, not demand, driven because it is not normally cost-effective in many of these remote communities to respond to service requests off of the pre-determined route. This means if the hand pump breaks down, the community must wait until the next time the technicians pass through their area.

The fragile nature of the country adds an institutional layer to the sector in the form of the WASH Cluster, which is nominally led by the government, but receives significant support from UNICEF and other NGOs. WfG coordinates and provides data to the WASH Cluster.

Financing

The total costs for WfG's circuit rider program in CAR were \$317,269 in 2017, of which \$209,342 were staffing and direct costs. In 2018, each service visit cost \$186, and annual per capita costs were \$0.40 per serviced water point users. Financing for the model comes from two sources:

- *Service charges:* Only about 5 percent of funding comes from revenue generated by service contracts with communities. Up until recently, WfG charged a flat monthly fee to communities, but this changed to a fee per visit of \$40 regardless of the service type or whether a repair is made. As a result of the civil war — which ended in 2015 — and the extreme poverty, low levels of payment are not surprising. WfG still provides services for free, or for a nominal contribution, to around 50 percent of all waterpoints. About 25 percent of water points can pay something, but not the full \$40 fee, and the remainder can pay in full. In 2017, WfG carried out a Willingness to Pay (WTP) study and is introducing contracts with communities along with limited sanctions on those known to have financial resources that are not paying. These measures are slowly increasing the proportion of communities paying something toward maintenance. However, WfG will likely need to refine the cost recovery model and keep an external subsidy in place indefinitely given the wide range of communities — hunter-gatherers, dispersed, and peri-urban.
- *Grant funding and individual donations:* The overwhelming majority of the financing for the program is through grants and fundraising contributions channeled by WfG.

While the circuit rider model continues to be supply driven in rural areas, WfG is piloting a new demand-driven and payment model in a smaller group of 62 water points. Under this scenario, communities are given a list of possible repairs and spare part costs and have a mobile number to call in to request preventive maintenance or repairs when a pump breaks down. Based on the WTP, a third model will launch in the immediate rural hinterlands of Bamari, which has a higher density of water points (about 100 within a day's ride by motorbike). This model will use a roving mechanic with no pre-set route who can be flagged down to carry out on-the-spot repairs.

Technology

The program uses hand pumps fitted to boreholes (66 percent Vergnet pumps, 33 percent India Mark II pumps, 1 percent other pumps). In 2019, WfG is planning to install solar pumping tanked systems with piped distribution and multiple distribution kiosks. These solar systems will also be part of the maintenance program. Technicians use iPads for digital reporting during each visit to hand pumps. This gives WfG the most comprehensive database on the functioning of rural water systems in the country, which improves planning, reduces costs, and makes each circuit visit more efficient.

Nevertheless, because of the challenging operating context— the sparsity of rural populations, lack of key infrastructure, absence of a well-functioning private sector, difficulty doing business, etc.— spare parts supply chains are a significant challenge to WfG. Readily available spare parts are only in the capital, Bangui. Because of this, WfG spends substantial amounts of time, logistics, and resources to ensure spare parts are available in the country.

Government Support and Integration

Reform of the water sector is still underway. The parastatal Agence Nationale de l'Eau et de l'Assainissement (National Water Supply and Sanitation Agency or ANEA), established in 2007, has the mandate for rural water supply. But because of a lack of resources, poor transportation, and security constraints, ANEA does not have a presence in all prefectures of the country and is limited to implementation around the capital and secondary urban centers. However, ANEA formally recognizes WfG's circuit rider model as a private sector option and one of two legitimate models in CAR for maintenance support. ANEA is supportive of the program and acts as a broker or mediator when called upon.

Monitoring and Accountability

Although ANEA is, in theory, responsible for monitoring the circuit rider program, there is no systematic monitoring in place and limited accountability to government. There are anecdotal reports that ANEA can play an effective role as arbitrator in cases of conflict or tension between communities and technicians. WfG implemented internal monitoring systems and when each team returns from a circuit, they upload functionality reports on each pump that detail its status, total number and frequency of maintenance visits, repairs conducted, and spare parts used. Managers use this information to evaluate the performance of technicians.

Annex 4: Further Resources

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