IRC Ethiopia

August 2021

Final report on action research to strengthen monitoring, infrastructure management and planning in rural water, Ethiopia

Sustainable WASH Systems Learning Partnership Concept 1 (Ethiopia)

Supporting water sanitation and hygiene services for life

SUSTAINABLE WASH SYSTEMS
A LEARNING PARTNERSHIP

USAID
FROM THE AMERICAN PEOPLE

As part of activities under the Sustainable WASH Systems Learning Partnership, local stakeholders in the Southern Nations, Nationalities, and People's Region (SNNPR) and Afar Region of Ethiopia prioritized action research on monitoring, infrastructure management and planning issues in rural water services. This report is the fourth report on these themes, building on earlier reports that shared interim findings. It covers the design of the planned research (including research questions, methodology, and data sources), the system strengthening activities that have been undertaken on these themes, and presents final results and lessons learned. Conclusions and recommendations are provided to guide future related activities in these focus areas and for projects undertaking a similar approach.

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ABBREVIATIONS

AfDB	African Development Bank
AMS	Asset Management System
ARWIEB	Afar Region Water, Irrigation and Energy Bureau
BCC	Behavior Change Communication
CapManEx	Capital Maintenance Expenditure
CLTSH	Community-Led Total Sanitation and Hygiene
EFY	Ethiopian Fiscal Year
ETB	Ethiopian Birr
IEC	Information Education Communication
IRC	International Rescue Committee
IT	Information Technology
Lowland WASH	USAID Lowland WASH Activity
LCCA	Life-Cycle Cost Approach
M&E	Monitoring and Evaluation
MoWIE	Ministry of Water, Irrigation and Energy (Electricity until 2018)
NGO	Non-Governmental Organization
NWI	National Water Inventory
O&M	Operations and Maintenance
WWMEO	Woreda, Water, Mines and Energy Office
SDG	Sustainable Development Goals
SLTSH	School-Led Total Sanitation and Hygiene
SNNPR	Southern Nations, Nationalities and Peoples' Region
SWS	Sustainable WASH Systems Learning Partnership
ToT	Training of Trainers
UCB	University of Colorado Boulder
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WASH	Water, Sanitation, and Hygiene
WASHCO	Water, Sanitation and Hygiene Committee
WDC	Water Development Commission
WUA	Water User Association
WWIEO	Woreda Water, Irrigation and Energy Office
WWO	Woreda Water Office (general)
ZFP	Zonal Focal Person
ZWMED	Zonal Water, Mines and Energy Department

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INTRODUCTION

This final research report was prepared as an input to the Sustainable WASH Systems Learning Partnership focused on testing approaches to strengthen the sustainability and performance of WASH service delivery systems.

Sustainable WASH Systems Learning Partnership

The Sustainable WASH Systems Learning Partnership (SWS) is a global United States Agency for International Development (USAID) cooperative agreement to identify locally driven solutions to the challenge of developing robust local systems capable of sustaining WASH service delivery. Led by the University of Colorado Boulder, SWS emphasizes partnership and learning for catalytic change in the water and sanitation sector. Coordinating with and facilitating interactions among partners in four priority countries (Ethiopia, Kenya, Uganda, and Cambodia), the project works to meet the rapidly increasing needs of USAID's partner countries for sustainable WASH activities.

There are four concept teams within the partnership. In Uganda and Ethiopia, Concept One is led by IRC WASH working with Tetra Tech and LINC. The team worked with stakeholders – in learning alliances - to strengthen decentralized woreda (district) and small-town level systems for water and sanitation services delivery. Comprehensive systems analyses provided a basis for action research to find new solutions to service delivery and sustainability challenges. Emphasis was placed on strengthening the WASH service delivery system as a whole, finding a balance between competing priorities to extend, improve and sustain services, and delivering the capacity development and communications activities that are needed at local, regional, and national levels to scale up successful innovations and outcomes.

The expected outcomes were stronger service delivery systems in the targeted woredas and small towns with strengthened building blocks contributing to better services delivery. At regional and national levels, Concept One sought to influence the sector agenda in systems strengthening with tools and approaches applied beyond the focus woredas and small towns. Concept One in Ethiopia addressed both rural water supply and small-town sanitation in different parts of the country. This interim report is limited to the rural water activities. During year one, with in-country activities starting in January 2017, a strategic partnership was developed with the USAID Lowland WASH Activity (Lowland WASH) led by DT Global (formerly AECOM) and involving the International Rescue Committee (IRC) and CARE as sub implementing non-governmental organizations (NGO) partners.

Lowland WASH was working in challenging lowland environments in Afar, Somali and Southern Nations, Nationalities and Peoples Regions (SNNPR) to develop, rehabilitate and sustain water supplies and improve sanitation. The partnership provided an opportunity for synergies between the systems strengthening and learning activities within SWS and the implementation of a package of new construction, rehabilitation, and improved maintenance for rural water supply schemes through Lowland WASH.

Two rural woredas where Lowland WASH operated were selected for SWS rural water supply activities: 1) South Ari Woreda, later divided into South Ari, Baka Dawla Ari, and Woba Ari woredas, part of South Omo Zone in the SNNPR (in the southwest of Ethiopia) where there is a focus on hand pumps and spring systems and 2) Mille Woreda in the Afar Region to the northeast of Ethiopia where there is a mix of systems including motorized boreholes pumping deep groundwater. Rural

water service delivery models are mainly community management for both the simple and more complex rural water supply schemes, with utility management only present in some small towns.

Theory of change

SWS is composed of four concepts, each exploring system approaches to increase the sustainability of WASH services at local levels. The main objectives are to improve understanding of local systems, to strengthen local systems, and to increase the likelihood of WASH services being sustained. These main objectives are the foundation for the SWS consortium's approach, the SWS theory of change, and the main learning questions. The SWS theory of change reflects how the partnership expects to accomplish its goals, through a series of intermediate results and associated activities. The theory of change at the consortium-level is defined as follows:

> "*If actors better understand the local systems for delivering sustained* WASH *services and are supported to undertake interventions that aim to improve the way in which actors coordinate or address* WASH *factors that influence service sustainability, then these systems will be strengthened. This in turn will lead to increases in the sustainability of* WASH *services at the national and sub-national level.*"

Concept One gave emphasis to promoting local innovation to improve systems working together with local actors through multi-stakeholder partnerships referred to as 'Learning Alliances'. Learning alliances were supported to develop understanding of WASH service delivery systems by local stakeholders and then execute a shared learning and action agenda. As a learning initiative, the creation of evidence at each intermediate result is fundamental. It was expected that if this evidence is generated and disseminated effectively, both on systems-based approaches and their resulting impacts on sustainable services, then it will result in changes that will increase the sustainability of WASH service delivery.

Action research experiments, defined as identifying, developing, testing, documenting, and adapting system strengthening innovations, directly addressed the needs identified by the learning alliance members through the presentation and discussion of systems analyses and service delivery baseline assessments. The learning alliances set priorities and engaged in the planning and implementation of action research with support from the learning alliance facilitator and Concept One team. Decision making was documented to support learning, and the entire action-research cycle is built around hypothesis testing, collective measurement, learning, and reflection.

Learning questions

Learning questions for each concept team were developed in 2018 to guide activities, monitoring of activities, and overall learning. For Concept One in Ethiopia, three learning questions were developed. This paper focuses only on learning question two (LQ2). LQ2 was:

LQ2: *How do identified (system strengthening) interventions actually influence, improve, and strengthen aspects of the system for sustainable* WASH *services delivery?*

LQ2 was further broken down into sub questions for monitoring and maintenance. The individual learning questions for these topics were:

LQ2.1.: *How can monitoring be strengthened in different contexts and scales (district and region scales), and is monitoring an effective entry point to advocate for, and support investment in the provision of maintenance services (monitoring building block)?*

LQ2.2.: How can rural water maintenance services be provided in ways that are sustainable and potentially scalable through innovations in demand, supply, and the enabling environment for maintenance services (infrastructure management building block)?

This report

Based on context analysis and baseline assessments to better understand the local water service delivery systems, local stakeholders in three woredas in South Omo Zone in SNNPR and in Mille Woreda, Afar Region prioritized solution finding and action research on two initial priority aspects of the rural water services delivery system: monitoring and infrastructure management. Later, financing WASH services was also identified by the learning alliances as a third WASH system component to be researched.

Part 1 analyses monitoring across all contexts: regional, zonal, and at the district level. Overall, monitoring has been strengthened in all, but systematic and sustainable updating has not been achieved hindering the ability for the data to be used. There are encouraging signs in both Afar and South Omo that indicate some form of monitoring will continue due to increased awareness and recognition of its importance, but the complexity of managing the tools coupled with the overwhelmingly complex challenges facing both areas hinders monitoring long term. More time and the restructuring of the government to allocate staff to and focus on monitoring may improve this, and is beginning, but, so far, under current conditions, sustainable use of the new monitoring tools is unlikely. That said, increased awareness and capacity for monitoring has been improved, despite the lack of additional finance or services.

Part 2 discusses the maintenance action research where improvement has been seen across the action research areas. Capacity building activities have improved organizations capacity, willingness to pay, financial management, revenues, preventative maintenance, and coordination between communities and the woredas, but sustainability of these improvements is uncertain as finance is still a major limiting factor and local government is unable to continue the support provided under SWS. Scheme level actors are capable of managing and maintaining their water systems, particularly low technologies like hand pumps, but are greatly dependent on higher level government actors for support and have limitations to their effectiveness such as the availability of spare parts.

Part 3 outlines the planning collaboration with the four districts (woredas). All four woredas completed fully costed master plans for community and institutional WASH. The achievability of the plan depends on availability of additional financing, but beyond the plans, much was learned throughout the process and the capacity for planning was improved. Collaboration between WASH sector offices increased in the planning process and discussions helped each district understand the opportunities and challenges. The need for coordination during implementation was also stressed during various workshops and the learning alliance supported in strengthening collaboration between planning team members. The data collection for the plans also helped the woredas update their water asset inventory and establish new baseline information for sanitation, hygiene, and institutional WASH. The plans were validated with the participation of learning alliance members and zone, region, and national sector representatives. The woredas have decided to use the plan for development of the government 10-year plan.

PART 1: MONITORING AS AN ENTRY-POINT FOR ADVOCACY ON FINANCING AND IMPROVED MAINTENANCE

Learning questions for monitoring and the hypothesis

Learning question two (LQ2) was further customized for the two monitoring contexts in SNNPR (woredas and zone) and Afar (woreda and region). As discussed later, the focus of monitoring work in Afar shifted during the activities from the woreda to the regional level.

> *LQ 2.1.1. In Mille and Afar, how does regional-level strengthening of the government-led monitoring system improve data management, updating and use (including use of sensors)? What are the outcomes in terms of investment and provision of maintenance?*

> *LQ 2.1.2. In South Ari, how does district-level strengthening of the government-led monitoring system improve data management, updating and use, and uptake at the zonal level? What are the outcomes in terms of investment and provision of maintenance?*

The hypothesis to both learning questions was:

> *Strengthening monitoring by government and use of its data will lead to changes in decision-making by government and other key actors, including increased funding and higher prioritization for the maintenance of rural water facilities.*

Summary of outcomes and insights

This section summarizes the findings for monitoring across all project locations (Table 1) and outlines the methodology for learning. Following this section, monitoring in Mille and Afar is discussed in full. The next section outlines and discusses monitoring in South Ari and South Omo. Part 1 concludes with analysis across all locations including recommendations.

Table 1: Summary of findings

	Mille Woreda	Afar Region	Debub-Ari, Wub Ari & Baka-Dawla Woredas	South Omo Zone
Updating	• Consistent engagement at the woreda level, often equal to regional O&M team with a fraction of the schemes • Since June 2020, Mille WWO staff are the only users continuing to provide updates to the system	• 44 water systems, 141 water installations, and over 200 water points added to AMS since September 2019 • Low use by O&M team: 0 asset inventory forms and 1 functionality status update completed. Limited use of issue tracking • High use by ZFPs in Dec. 2019 and Jan. 2020 with significant drop off and no sustained use after (25 asset inventory forms, 180 functionality updates, and opened 50% of issues in Dec/Jan) • Main user was regional focal point embedded to support the region, but region never took on responsibilities of updating to the same level	• Throughout 2020, over 2,000 functionality status updates were reported, occasionally exceeded 300 unique scheme updates per month • Updates have continued into early 2021, and although these are now reported with slightly less frequency, there are still about 100 updates each month	• The zone has not directly updated the system but supports the woredas to update the system
Use	• Mille WWO staff have opened 13 of 15 issues in the woreda (2 opened by regional focal person) • Mille WWO staff have resolved 13 of 15 issues in the woreda, but records indicate support from the region in terms of spare parts. Two resolved by regional O&M staff • Mille WWO staff have closed all 15 issues in the woreda • Majority of issues resolved within a month indicating active use of the system	• Regional uptake was lower than expected and use of the data was also limited • The embedded focal person was the main user of the issues process. He undertook 70% of all system activities individually • Regional use was limited to a few users with one user managing 1/3rd of issues led by the region • The issues tool captured 192 total maintenance since implementation in September 2019. 45 are still unresolved • O&M staff resolved 52 issues (34%) since implementation in September 2019 and the	• Revising existing outdated woreda data for reporting purposes, following baseline in 2017 • South Ari baseline data used in WWO maintenance planning, and planning for new construction by development partners • Use of baseline data as evidence to support annual planning resulted in increases to the water sector budget in	• Use of evidence from monitoring data to evaluate WWO annual plans • Zone and woreda both having access to the same dataset strengthened trust and communication

		focal person resolved a total of 57 issues (37%) • The focal person closed 71% of issues further indicating issues are not being used by O&M leadership to manage the maintenance response • Two thirds of issues are either unresolved or are left open more than 2 months indicating less active use of the system • No use of data for planning or budget requests by the region, but data insights were used by SWS to provide evidence to support the increased maintenance and rehabilitation costs (although no additional funds were allocated)	EFY 2012, in addition to an increase for monitoring related activities • Ongoing use of functionality status reports to inform maintenance activities across the woredas • WWO use of data as evidence to support annual plans	
Data Management	• Data management in Mille Woreda has improved significantly and the WWO is engaging with all functions of the AMS through the mobile application	• The AMS has not led to improved data management for documenting assets as updating and use of the system is very limited and has not been integrated into regional processes where data can be collected such as in handing over ceremonies or when visiting and maintaining existing schemes • Processes to update functionality have not been fully operationalized or institutionalized • Although the issues tracking process is used more than other functions, it is not consistently used to document all maintenance activities, is not used to improve maintenance responses or coordinate staff, and is not used for long term planning to understand the number of activities completed or outstanding • The process for reviewing and approving incoming data via form approvals has not been implemented in the region and there is a constant backlog of data to be reviewed and approved • There is some uncertainty around the quality of updates from the staff and control of the data, resulting in a dataset that requires a major review and cleaning	• No observed improvement in data management	• No observed improvement in data management

		• Ownership of the AMS as regional IT infrastructure has not been accomplished and there is no certainty that the region will be able to undertake management of the system following the departure of implementing partners at the end of the project • Data collected during maintenance tracking in the AMS and outputs of the system do not well align with existing regional reporting processes, and the incompleteness of data makes it difficult to fully utilize the AMS for any support to reporting or to attempt additional data analysis		
Investment	• There has been no increase in finance in Mille directly related to SWS activities	• A minor increase in overall budget across the timeframe can be seen, but it is difficult to relate this with AMS, given the very limited use of AMS data in 2013 annual planning	• The WWO capital budget increased from less than 100,000 ETB in 2008 to 1,000,000 ETB in 2013 EFY	• No data
Provision of Maintenance	• There has been no significant increase in maintenance activities in Mille despite Mille using the system. Bottlenecks in the system particularly, finance, spare parts, and dependence on the region hinder improved maintenance	• From 2017-2020 the sensors show very little annual variation (between 64-67%) and no trend towards either increasing or decreasing functionality. We can conclude, based on the sensor data, that the rate of functionality has not been impacted as a result of the asset management approach • In late 2019 and early 2020 it typically took more than one week to resolve the issue. Longer periods of downtime appear to be reduced in late 2020 and early 2021. This could be a result of faster response times but could also be a factor relating to improved data management of the issue function • The region has begun to undertake a restructuring process with a greater focus on data and preventative maintenance	• Across the woredas, the level of scheme functionality changed from 60% at the time of baseline in 2017, to 65% in early 2021 • During the same period, the rate of schemes reported as partially functional has decreased from 13 to 3% whilst the rate of non-functionality has increased • The resulting share of schemes which are either functional or partially functional has decreased during the project timeframe	• The data has helped inform maintenance response but the result in maintenance outcomes has been limited, due to continued shortages of finance, transport, and other contextual challenges

Methodology / the way we learned

Learning in this project was based around action research where researchers and implementers led ongoing experiments while continually documenting changes and learning then reflecting and modifying the approach throughout the process to achieve the intended result. For the monitoring component, monitoring tools were the main implementation items being studied at trainings, meetings, and ongoing support was given to increase use of the system and improve monitoring in the focus areas where the tools were instituted. Two separate tools were built. Initial focus was at the woreda level with a basic system put in place in partner woredas, but in both areas the tool was expanded during the project to higher levels of government. In South Omo Zone in SNNPR, a simple tool for collecting basic asset data and functionality updates was built by IRC WASH, and in the Afar Region, where Mille Woreda is located, a more comprehensive and complex Asset Management System was built in collaboration with USAID Lowland WASH Activity, mWater, and IRC WASH which included an asset inventory, functionality updating, and maintenance and maintenance response tracking.

In addition to formal interactions with the study participants, researchers also analyzed user data from the tools and conducted multiple rounds of interviews with users in group settings and individually during learning visits where support was provided, and feedback documented. Researchers from the University of Colorado also supported learning through data analysis, systems thinking activities, and model building.

Background and inputs to strengthening monitoring in Mille and Afar

In 2016, USAID commissioned a scoping study on the state of monitoring and asset management in Afar and Somali regions of Ethiopia. Monitoring of assets and their status was recognized as weak and overall performance of assets was poor. There was also a focus on new construction with little emphasis on asset management or maintenance. Mille Woreda in Afar was one of the locations studied.

After conducting an asset survey in Mille, it was recognized that changes in monitoring needed to be led at higher levels of government. SWS partnered with others working in the region to use similar tools and surveys for monitoring rural water assets. As synergies were found, USAID Lowland WASH led a region-wide approach supported by SWS and other partners. SWS and Lowland WASH supported baseline data collection, cleaning and data validation, establishment of a regional inventory of motorized boreholes, implemented approaches to support regular updating of the inventory through a network of remote sensors and simple telephone-based updates, operationalized tools designed and built specifically for the region to manage water supply assets, and delivered a package on ongoing capacity development and support.

The primary beneficiary of the USAID support for strengthening asset management was the Afar Regional Water, Irrigation and Energy Bureau (ARWIEB) and specifically the Operations & Maintenance (O&M) team. USAID Lowland WASH Activity were contracted to strengthen governance which included building a regional monitoring system and over time developing a strong focus on the use of sensors (which were a key target). The USAID SWS project partnered with Lowland WASH to support learning and documentation, seeking to support change and uptake through the engagement of local stakeholders.

Starting in 2016, Lowland WASH began installing remote monitoring sensors on motorized boreholes across the Afar region. An initial pilot of ten devices proved successful in providing daily reports on borehole runtime via SMS.

In 2017, a Memorandum of Understanding was signed between AECOM International Development, IRC WASH, the Ministry of Water, Irrigation and Energy (MoWIE), Afar National Regional State Water and Irrigation Development Bureau (AWIDB), the Mortenson Center of Global Engineering at the University of Colorado at Boulder (UCB), and SweetSense Inc. The parties sought to strengthen the functionality and performance of rural water supplies in Afar through improved asset management and maintenance, through the development and use of an asset management system for improved monitoring of rural water assets, their functionality and performance, and maintenance processes.

Lowland WASH contracted mWater for the design and development of the regional asset management system. In 2018, mWater began the process of designing the system through a consultation workshop in Semera, Afar, with participation from Afar Region and Mille Woreda staff. The resulting system, named the Afar Asset Management System, was initially comprised of a mobile application and a web portal. Further development enabled the automatic integration of sensor reports. There are four primary data inputs to the AMS: asset inventory surveys, functionality status updates, tracking operational & maintenance issues, and daily sensor reports. The AMS makes this data available to users via mobile devices and desktop computers which can provide a range of analyses and insights that have two main purposes: use in operational activities relating to maintenance and repair of water supplies and use in regional planning and reporting processes. Beyond maintenance and planning, the data is used in making decisions regarding siting of a new water system to ensure geographic equity, and decisions related to location where to get better water quantity and quality by the Study and Design Directorate.

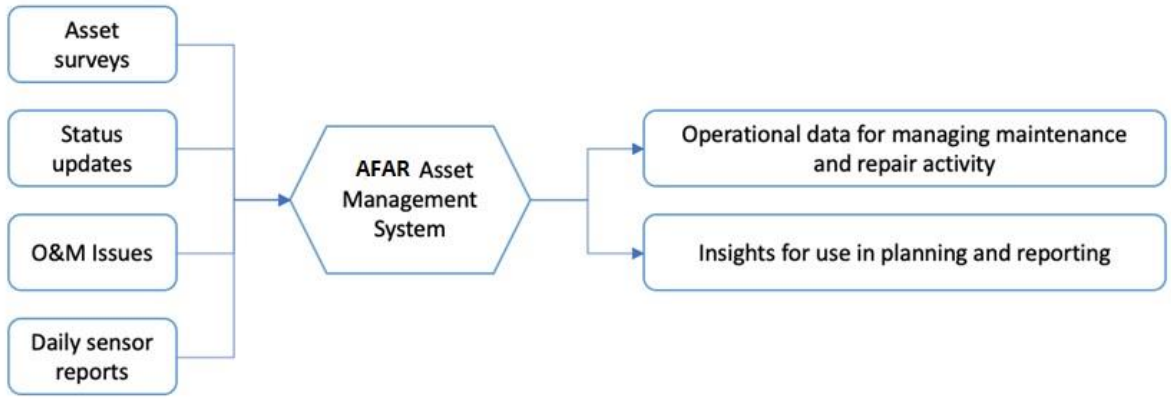


Figure 1: AMS data flow diagram

In a second wave, approximately 40 sensors were installed on motorized boreholes in mid-2017, and this was gradually increased to a total of 109 by early 2018. A period of software development and testing was followed by a pilot of the AMS in three woredas starting in June 2018. Training was provided to Woreda Water Office staff, who were also equipped with mobile devices and tablets, and remote support. The pilot provided insights useful for additional tool development and system operationalization.

At the beginning of 2019, a final round of installations brought the total number of sensors installed to 179, representing approximately 50% of the motorized boreholes in the Afar region. In April 2019, a small team was established to support the operationalization of AMS. A key component of the team was a focal point to be embedded within the regional O&M team. Following the integration of recommendations from the pilot and integrating more advanced features in

mWater, a comprehensive training for the full regional O&M team was conducted in August 2019. Training covered all operational aspects of AMS for data collection and management.

Following the training, the project focal point worked within the O&M team to facilitate the rollout and use of AMS. Day-to-day support from the focal point involved working alongside O&M staff and supporting their uptake and use of the AMS features and use of the data analysis and insights to support various regional processes and decisions. The operational team provided remote technical support and frequent support and learning visits.

During the second half of 2019 and throughout 2020, the operational team supported the rollout of the AMS with additional trainings, further refinement of the tools and user processes, and provision of additional hardware. In early 2021, as the USAID Lowland WASH Activity closed down, a final activity was an official handover of the AMS to the Afar Regional Water, Irrigation and Energy Bureau.

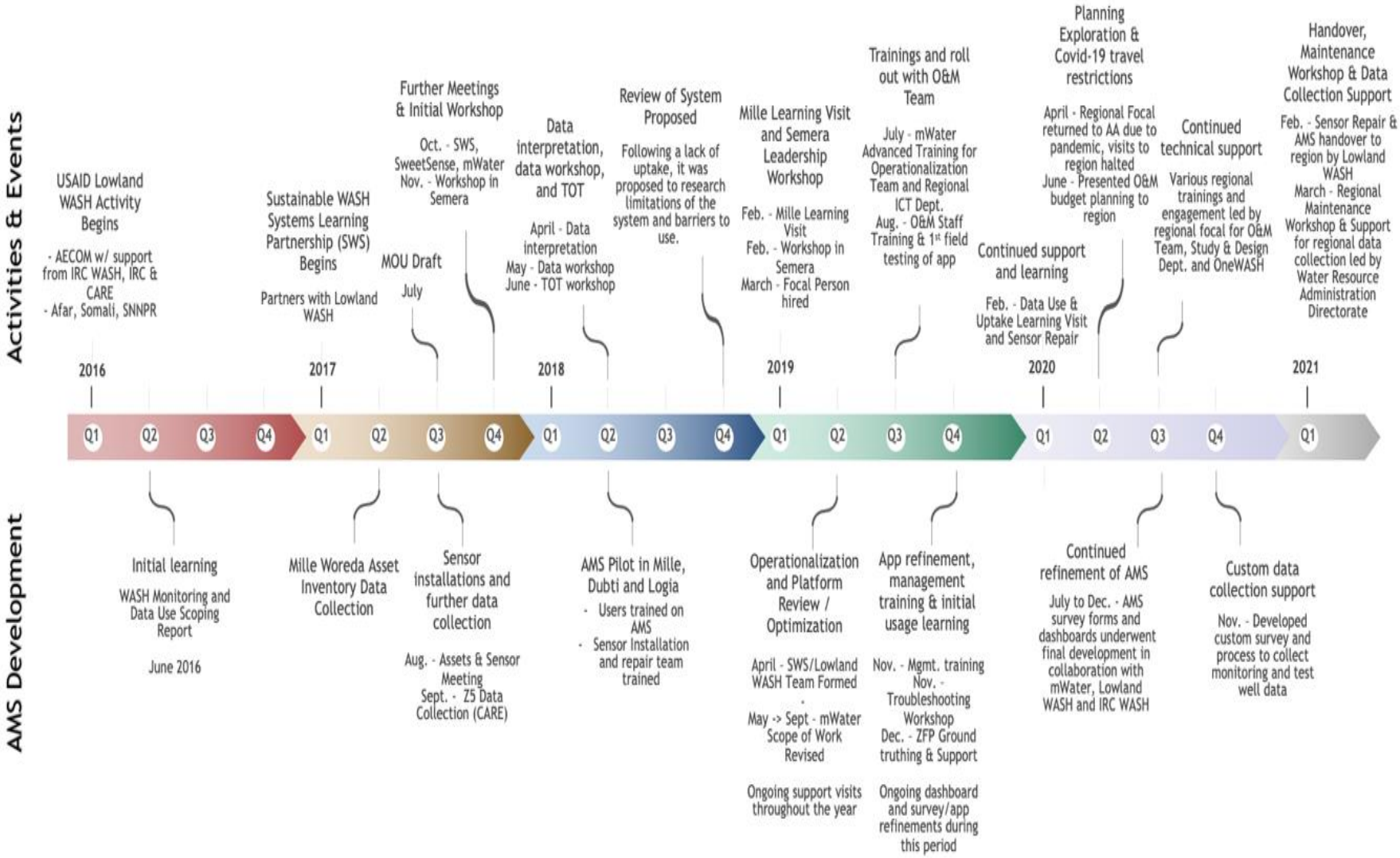


Figure 2: AMS implementation timeline

LQ 2.1.1.: In Mille and Afar, how does regional-level strengthening of the government-led monitoring system improve data management, updating and use (including use of sensors)?

Summary of outcomes on updating

	Results: Updating
Mille Woreda	• Consistent engagement at the woreda level, often equal to regional O&M team with a fraction of the schemes • Since June 2020, Mille WWO staff are the only users continuing to provide updates to the system
Afar Region	• 44 water systems, 141 water installations, and over 200 water points added to AMS since September 2019 • Low use by O&M team: 0 asset inventory forms and 1 functionality status update completed. Limited use of issue tracking • High use by ZFPs in Dec. 2019 and Jan. 2020 with significant drop off and no sustained use after (25 asset inventory forms, 180 functionality updates, and opened 50% of issues in Dec/Jan) • Main user was regional focal point embedded to support the region, but region never took on responsibilities of updating to the same level

Introduction to updating of the AMS

The first comprehensive training on the AMS for regional staff was undertaken at the end of August 2019. The training was comprised of 20 participants and included the full O&M team. Following the training, initial system operationalization was expected to begin through a small number of functions at the core of the system design: extending the number of assets recorded in the system to encompass all schemes across the region, using the system to track maintenance issues and repairs, and updating the functionality status of existing schemes in the inventory.

Starting from September 2019, maintenance issues were opened and updates on the functional status of schemes were submitted. However, other functions, such as adding new sites to begin completing the asset inventory, were not done and little progress was made to improve or extend the existing inventory. It also became clear from meetings with the focal point that the O&M team were less engaged than expected, and the system interaction was stemming from just two individuals: the focal point himself and the Mille Woreda Core Process Owner. The Mille Woreda Core Process Owner is one level below the Woreda Water Office Head and is responsible for maintenance, new scheme construction, planning, and reporting, as well as coordinating technicians. The core process owner also coordinates with the region and NGOs.

Following a period of observation, the operational team began working to better engage regional leadership and senior management. It was thought that better understanding, engagement and buy-in from regional leadership would result in greater internal support for using the system. A workshop was held in Afar in November 2019 for senior management staff from across the ARWIEB departments with the goal of increasing awareness and understanding of the system and gain high-level commitment to the adoption and use.

The workshop was well received, department heads declared commitments to adopt the system, and there was greater engagement from several departments, including the Operation & Maintenance, Planning, and Water Resource Management Departments. Greater engagement included leadership participation in regular update meetings, advocacy for integration of the system in regional processes, engagement in discussion on extending the inventory and network of sensors to cover all boreholes, instruction for technical staff from various departments to undertake training, and the establishment of a network of zonal focal persons (ZFP), who were each assigned one of five zones in Afar Region and tasked with the responsibility of updating

system functionality, reviewing sensor data, using these processes to follow up on potential breakdowns, review incoming messages to confirm problems and create maintenance issues, and close resolved issues. The ZFPs consist of staff from different departments with one member from the O&M team, one from OneWASH, one from Water Resource Management, and two from Study & Design. Utilizing staff from other departments was intended to allow for better understanding of the system and its data across the ARWIEB and allow for increased uptake or use outside of O&M. Leadership also recognized the O&M team's previous low use.

At this time, other users' roles were also better defined. The O&M Head was tasked with assigning issues to technicians to undertake repairs, supporting closing of issues, and approve new data coming into the system from forms, new systems, and components. Technicians were to update issues as the maintenance progresses and resolve issues when repairs were completed. Other O&M staff were to create systems and update. Finally, the ICT Department was supposed to help add and remove users and help support the portal functions of the AMS.

All users of the AMS have the same system access levels and all have received instruction and training on the full suite of functions, but there was understanding that different teams have different responsibilities for updating data. The primary design focus of the AMS is the O&M team, who are expected to lead in all aspects of system updating. The establishment of the ZFPs was supposed to lead to regular functionality updates and to opening and closing of issues. Then the O&M team had to do less functionality updating and could focus on updating and resolving of issues, and increased asset inventory form completions. Mille Woreda was to continue to submit functionality updates and support the issues process for issues they open and may potentially close, following a repair and the issue being resolved. For the purpose of understanding how the different teams engaged with updating the AMS we have provided an analysis based on the following user groups:

Adding water systems and components

Limited progress was made in extending the asset inventory. In total, just 44 new water systems were added since the rollout in September 2019, far below the target of capturing all systems across the region. A larger number of water installations were added, 141 in total, but this figure is also far below the anticipated frequency. Many of the new systems and installations were added by the focal point, but a gradually increasing number were submitted by the O&M team. Engagement by Mille Woreda was low, but that was expected, since the inventory in Mille was already complete prior to September 2019, and only newly constructed systems needed to be added.

mWater Data Types for Asset Management

Water System: A collection of components in a distributed scheme.

Water Installation: An individual component such as a generator, borehole, or reservoir.

Water Point: Access points where water is obtained.

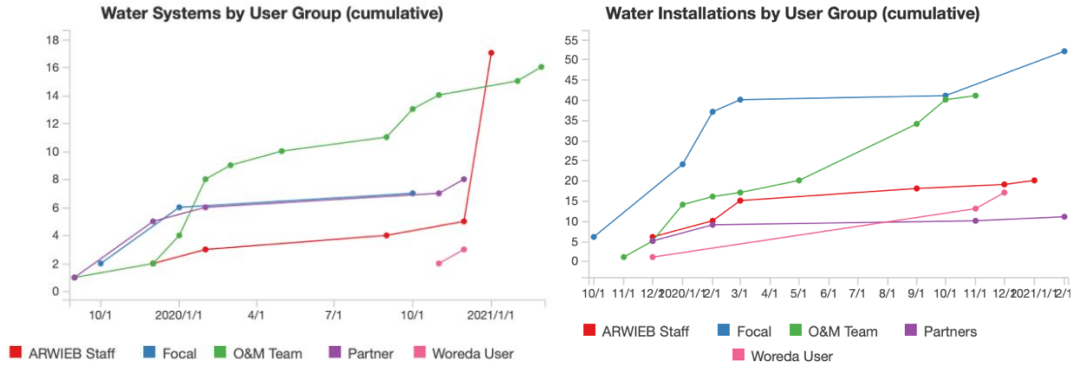


Figure 3: Water systems (left) and installations (right) added by user groups

The number of water points added was similarly very low throughout the project period, except for a notable increase in January and February 2021. This was due to a regional initiative of the new bureau head to map and collect information on monitoring and test wells in the region that are not currently used for water supply but may be able to be used depending on proximity to residents and water quality. For this purpose, the AMS was used to collect this information, and the test wells were added as water points in order not to skew the water system or water installation data with these boreholes. A separate survey was developed by the partnership to support the region in this data collection effort but only eight have been fully completed with the rest pending the information from the drilling logs. This second step has not been completed because most staff do not have access to a laptop so this data is all in soft copy.

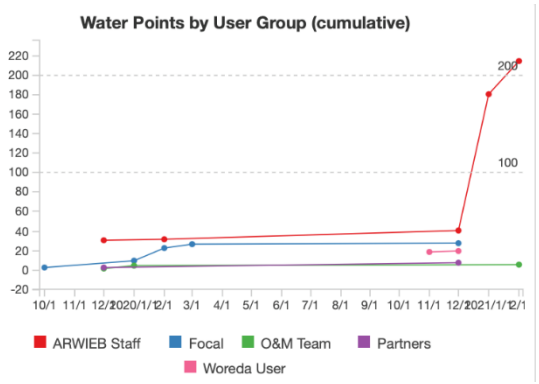


Figure 4: Water points added by user groups

Adding asset inventory data

Although there were some additional water systems, installations and points added to the system, the detailed component asset data as well as functionality and condition data were not added to new systems or system components. So, the O&M team completed zero asset inventory surveys since implementation in September 2019. The O&M team only completed one status update in this time period. as well with the majority of updates outside the focal person being done while the ZFPs were active and updating functionality in December 2019 and January 2020 via sensor data and phone calls. But once these users became less active, there was little asset, functionality, or condition data added apart from May 2020 when the focal person supported updating from home during the pandemic travel restrictions knowing there was limited engagement with the system following his departure. During this time period, regional travel was limited, but some regional O&M staff were conducting maintenance. Via phone calls, the focal person supported the woreda

and one ZFP to update functionality in their respective locations. The focal person also used sensor data to update functionality of schemes with sensors installed.

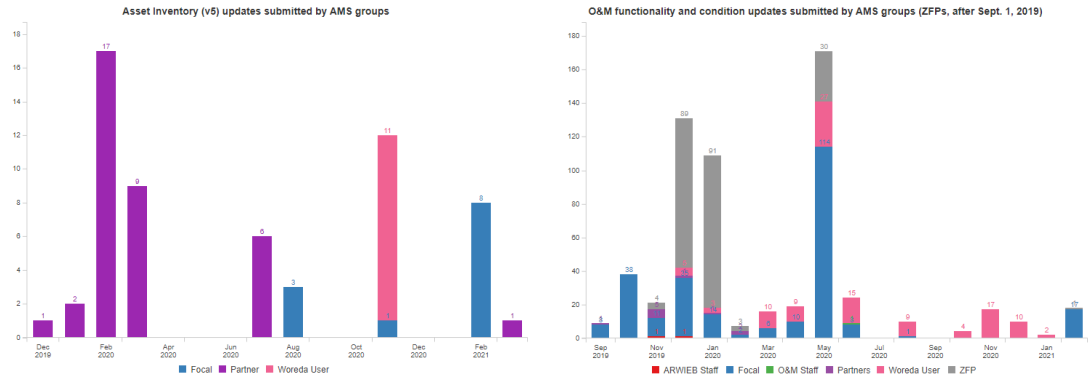


Figure 5: Asset inventory (left) and functionality updates (right) by user group

Updating by ZFPs

Data shows the significant contribution of ZFPs to updating the AMS for a short period following the group's formation in November 2019. The combined efforts of the five ZFPs led to a significant increase in the number of functionality status updates and O&M issues opened. Between December 2019 and January 2020, the ZFPs submitted 180 functionality updates to the AMS, which was by far the most significant period of functionality updating throughout the project. In the same timeframe, the ZFPs opened about half of all submitted O&M issues. However, following this two-month period, ZFP engagement dropped as the structure dissolved due lack of incentives and support to complete duties and general dissatisfaction with the tasks, which was then further exacerbated by the COVID-19 pandemic. Since February 2020, the ZFP updates have been done exclusively by Muhammed Hussain, an appointed ZFP and electro mechanic in the O&M team. This is true for the large number of functionality status updates in May 2020 as well as the periodic O&M issues being opened in the latter half of 2020 and beginning of 2021.

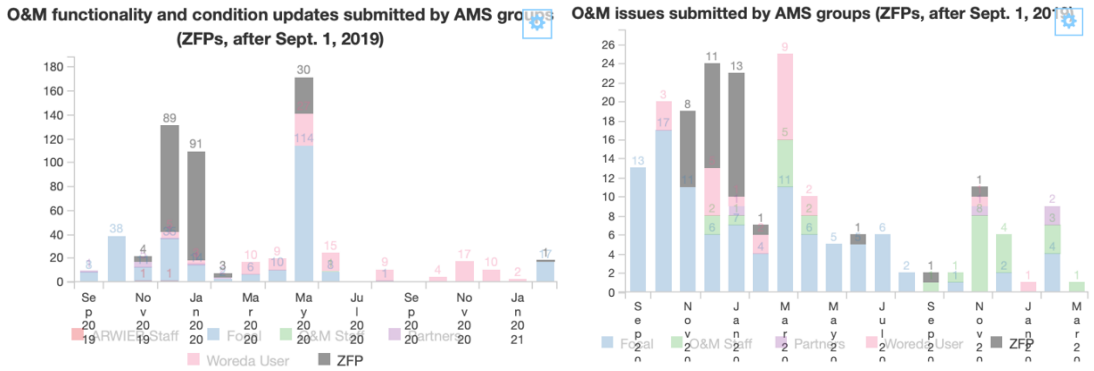


Figure 6: Functionalty updates (left) and maintenance issues submitted (right) highlighing ZFPs use

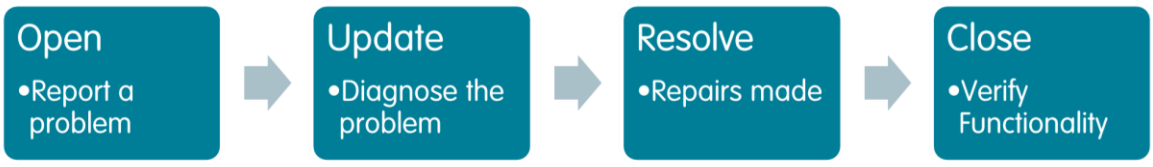


Figure 7: Issues process in AMS

Opening and closing O&M issues, as part of the issues process in Figure 7, was one of the responsibilities given to the ZFPs with the O&M team tasked with updating and resolving issues in the AMS throughout the maintenance process and following repair. However, the ZFPs continued to support tracking of maintenance activities. In total, ZFPs opened 23% of maintenance issues, updated 25%, resolved 15% and closed 8%. Closing only 8% is unexpectedly low but may be due to the short time period that ZFPs were active. And many issues were never closed.

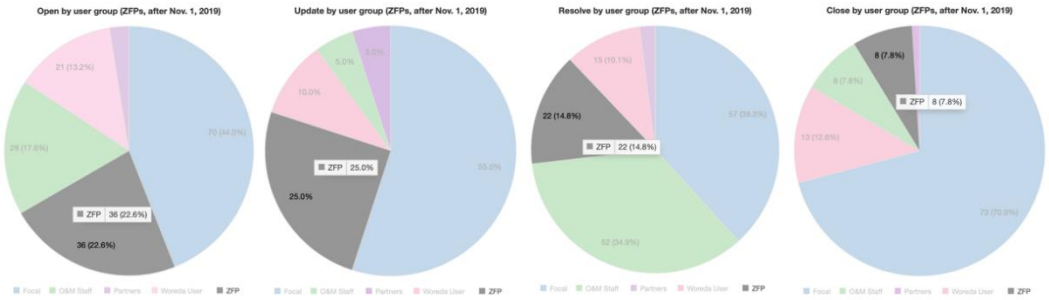


Figure 8: Issues proccess (open, update, resolve, and close from left to right) highlighting ZFP use

Updating by O&M team

Despite the O&M team being the intended primary users of the system, and the primary focus of the SWS presence and support, very little updating was done by the O&M team. Despite an increasing number of water systems included in the AMS, there has not been a corresponding increase in the number of asset inventory surveys completed, and O&M team members have not submitted a single asset inventory survey.

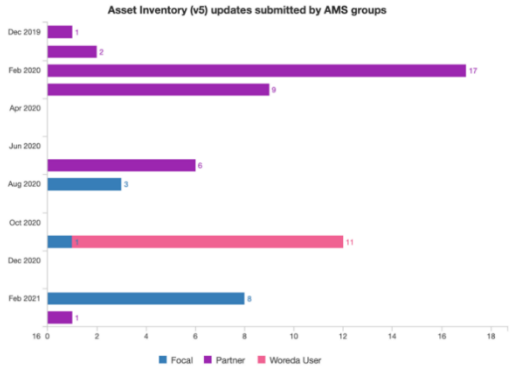


Figure 9: Asset inventory updates by user group

In total, O&M team has submitted just one single functionality status update to the system. Initially, the O&M team did not engage with the O&M maintenance tracking function, but there have been two periods of updating activity: a small number of monthly updates in early 2020 and then a slightly larger number of monthly updates in the second half of 2020 and into 2021. The O&M team's greatest engagement with the AMS was in resolving issues with a total of 52 issues resolved. Although small in number, often smaller even than the Mille Woreda contributions, the trend appears to show increasing level of updating.

A deeper dive into the O&M team updating activity shows that all updates come from just two individuals. Neither the previous or current O&M Head have submitted a single issue or update, and in total the O&M team closed only eight issues during the duration of the project. No updating by the O&M Head is very surprising considering all opened issues were assigned to the "O&M Issue

Management Team", a team consisting of the focal person and the O&M Head which was created in mWater to manage issues. It was expected that this team would coordinate the maintenance response through organizing and assigning of issues to staff to be resolved. The fact that this did not happen further indicates the lack of interest or use of the system for managing maintenance.

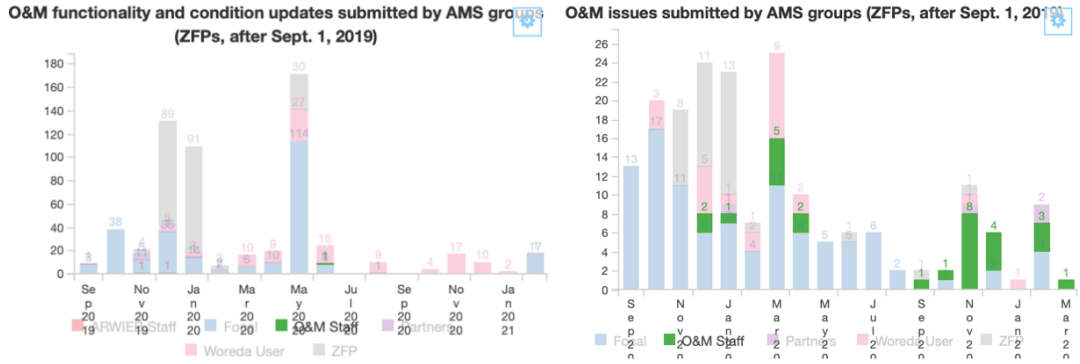


Figure 10: Functionalty (left) and maintenance issues (right) submitted by O&M team staff

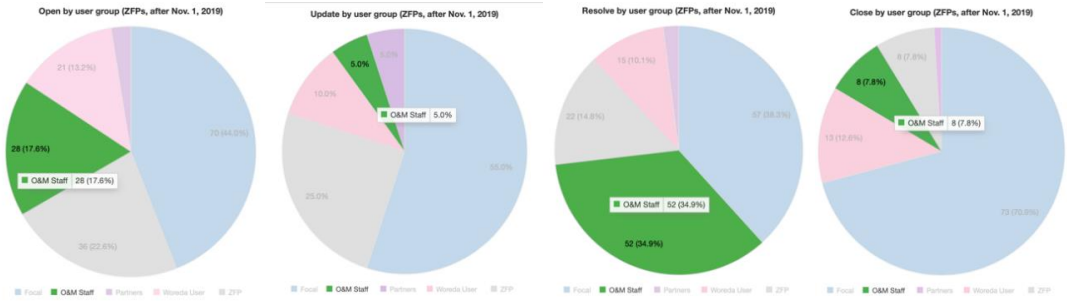


Figure 11: Issues proccess (open, update, resolve, and close from left to right) highlighting O&M team use

Updating by Mille Woreda

Mille Woreda's updating of the AMS has been consistent throughout the project timeframe. The woreda engaged in various monitoring activities since 2017 and was first introduced to the asset management system approach during the pilot in 2018. Following the September 2019 rollout of the AMS, Mille Woreda proceeded to submit a small number of functionality and condition status updates most months, and since June 2020 Mille WWO are the only users providing functionality updates to AMS. Although total updates by Mille are small in number, the updates represent a significant proportion of the schemes within the woreda, and the status of all Mille schemes were updated in 2020. The woreda also engaged in the O&M issues tracking process, particularly in the months following the rollout, but with inputs trailing off by May 2020.

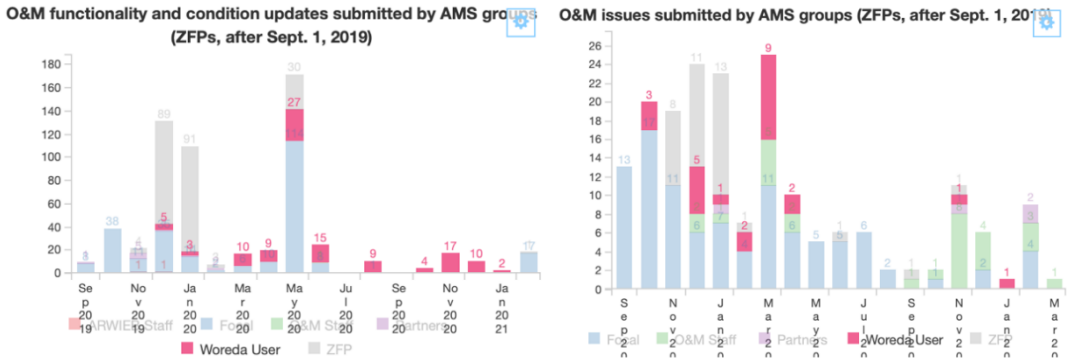


Figure 12: Functionalty (left) and maintenance issues (right) submitted by woreda users

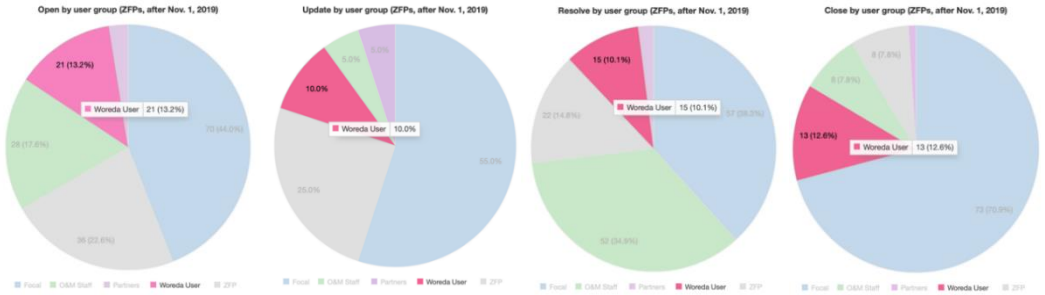


Figure 13: Issues proccess (open, update, resolve, and close from left to right) highlighting woreda use

Role of the focal point

In the initial stages of operationalizing the system most actions were performed by the focal point. However, with increasing operationalization and expected adoption by the region, particularly the O&M team in collaboration with ZFPs, we expected to see a reduction in the number of system engagements submitted by the focal point. Data shows the focal point committed the largest number of O&M issues for all stages of the tracking process: opening, updating, resolving, and closing. Similarly, for updating functionality, the vast majority of updates were submitted by the focal point. The focal point also added the largest number of water installations. Over time the focal point reduced the number of O&M issues submitted to try an encourage more local management and use of the system, and in part this reduction resulted in an increase of issues submitted by the O&M team. However, there is also a generally decreasing quantity of monthly submissions which eventually completely ended. Similarly, for functionality status updates, the focal point has decreased the updates, but there is no uptake by the O&M team.

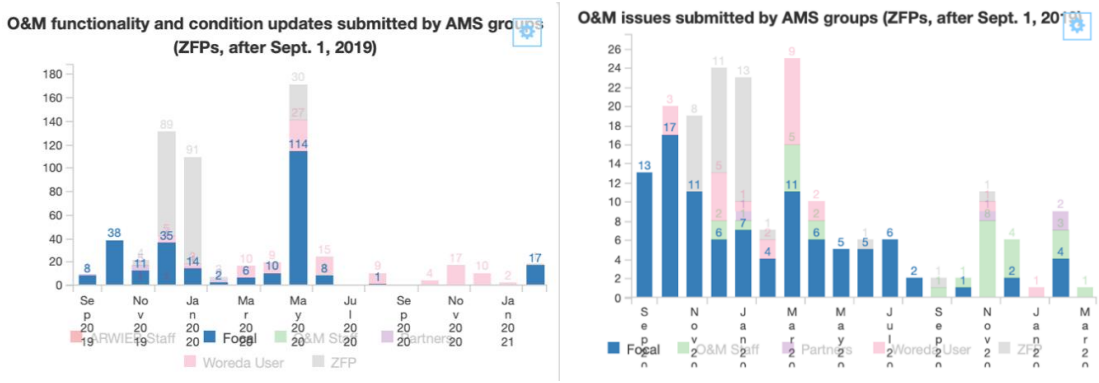


Figure 14: Functionalty (left) and maintenance issues (right) submitted by focal

Outcomes in using system and insights

	Results: Use
Mille Woreda	• Mille WWO staff have opened 13 of 15 issues in the woreda (2 opened by regional focal person) • Mille WWO staff have resolved 13 of 15 issues in the woreda, but records indicate support from the region in terms of spare parts. Two resolved by regional O&M staff • Mille WWO staff have closed all 15 issues in the woreda • Majority of issues resolved within a month indicating active use of the system
Afar Region	• Regional uptake was lower than expected and use of the data was also limited • The embedded focal person was the main user of the issues process. He undertook 70% of all system activities individually • Regional use was limited to a few users with one user managing 1/3rd of issues led by the region • The issues tool captured 192 total maintenance since implementation in September 2019. 45 are still unresolved • O&M staff resolved 52 issues (34%) since implementation in September 2019 and the focal person resolved a total of 57 issues (37%) • The focal person closed 71% of issues further indicating issues are not being used by O&M leadership to manage the maintenance response • Two thirds of issues are either unresolved or are left open more than 2 months indicating less active use of the system • No use of data for planning or budget requests by the region, but data insights were used by SWS to provide evidence to support the increased maintenance and rehabilitation costs (although no additional funds were allocated)

The AMS is intended to strengthen asset management through providing regular and reliable information about the status of water supply services across the region. The hypothesis was that the O&M team would be able to use insights from the AMS to inform and improve their provision of maintenance services. Whilst the chapter above has outlined evidence to show the AMS is beginning to be used within the region, we have yet to see compelling evidence showing that insights from the AMS are informing regional processes and decisions.

Within the O&M team there are two AMS users: the technical staff and the team coordinator (the O&M Head). The AMS was designed to support the technical staff by making available detailed information from the asset inventory on boreholes and other system components. This information was to be used when preparing for and undertaking a repair. The AMS was designed to support the coordinator by creating a process to help coordinate and track maintenance provision through the issues, as well as to provide insights to inform administrative responsibilities such as reporting and planning, and ultimately to provide evidence to advocate for greater financing to address the range of repair and rehabilitation activities required across the region.

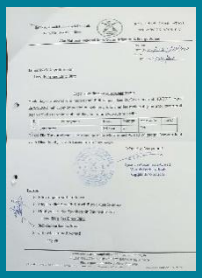
The AMS provided the O&M team with a comprehensive inventory for many of the existing motorized boreholes. The team received daily updates on the use of up to 170 boreholes from sensors. Updating performed by the ZFPs, while active, resulted in the functionality status updating of more than 100 schemes per month, many of which are also the boreholes for which we have sensor use data. Training and continuous support was provided through the imbedded focal person, numerous support visits have provided engagement opportunities, and aspects of the system have been revised according to specifications requested by O&M and other regional staff. Some 15 mobile devices have been provided, in addition to a PC and a small number of tablets.

With uptake lower than expected, use of the data was also limited. Immediate use of the data for maintenance was limited to a few maintenance responses and tracking of that process by the O&M team, regional staff, and woreda users. Long-term use of the data was limited to partners supporting regional activities and to demonstrate the value of the data. Overall, the full use of the data, particularly for long-term planning, was limited due to limited additions to the data set to improve the quality and completeness of the data.

Using the Issues Process

Issue data from the AMS does show some use of the system by the regional O&M team for operational response through the maintenance tracking system. As described above, the majority of actions in managing issues were led by the embedded focal in the region, but there are eight issues that were closed by the O&M team and another 11 closed by ZFPs since implementation began in September 2019. This compares to 99 issues closed by the focal, and therefore, not fully managed by the region.

Open Date: 2 Jan 2020
Water System: Bidu-Sodonta
Problem: Generator
Resolved by: ARWIEB
Replaced: Generator
Downtime: 8 Days
Photos: Repair document and new generator from mWater



Box 1: Issue example

Looking closer at these 19 issues, 11 were opened by the focal, further indicating his major role in managing the data coming into the region via letter, phone call, or other method. The remainder of the maintenance tracking process was led by regional users, with all 19 issues resolved and closed by the region. Interestingly, seven of the 19 issues closed by the region were opened, resolved, and closed by the same person. For instance, Box 1 shows the issue process opened and closed by user mdhussen starting on January 2, 2020 and ending on January 6, 2020. Knowing the regional maintenance process, we did not expect to see issues opened, resolved, and closed by the same user in such a short time frame. Instead, the process is designed to track maintenance activities from start to finish where information comes to the region, is entered into the system, a team is dispatched, the problem is fixed, and then the records are reviewed by the coordinator. This indicates regional usage of the issues process was only to capture maintenance activities after they were concluded for the record, without indicating when the problem first occurred. Issues opened by the focal but resolved and closed by the region took much longer to resolve, typically over a month in seven of the 11 issues opened by the focal, indicating these were entered into the system when new information on breakdowns came in.

The timing of closing issues also further illustrates the very limited timeframe where the ZFPs were active. All ZFP led closures were between December 2019 and Feb 2020. O&M team led closures are more spaced with three in April, one in June, and four between September and November 2020. No issues have been closed by the region since November 2020.

Additionally, it is interesting to observe the outstanding maintenance issues as this shows unresolved maintenance issues dating back to September 2019. It is unlikely that so many schemes remain broken and indicates a challenge utilizing the tool and data. Two thirds of all issues are either unresolved or take over two months to resolve, indicating limited active use and response.

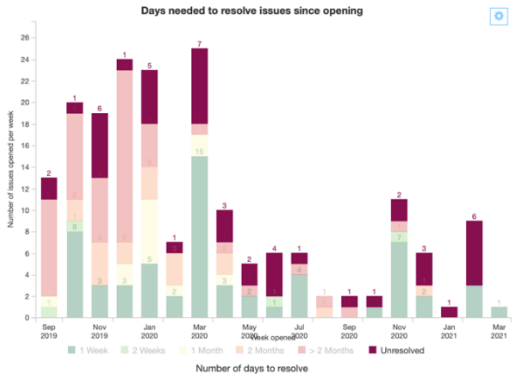


Figure 15: Days needed to resolve issues (unresolved highlighted)

Open date: 25 Dec 2019
By: Woreda
System: Ferede
Problem: Pipes
Pictures: broken pipe
Description: system functional but leaking
Resolved: Dec 6, 2020
By: PACT Ethiopia
Replaced pipes and power cable
Many pictures
Closed: 8 Dec by woreda via site visit
Photos: broken pipe and repair

Box 2: Issue use example

Despite limited use, the issues tool did capture 164 maintenance issues in the region's previous fiscal year (Ethiopian calendar FY2013 / Gregorian FY2020). This is more than the number of activities the region carried out (approximately 130), but the region's numbers do not count what is fixed at the woreda level. Since only Mille Woreda is using the system, it is difficult to compare the total number of breakdowns and repairs performed by the region and captured by the system. O&M staff did resolve 52 issues (34%) since implementation in September 2019 with the focal resolving 57 issues (37%), 45 issues remain unresolved. The focal closed 71% of issues further indicating the system is not being used by O&M leadership to manage the maintenance response.

Woreda use of issues

The woreda also used the issues process to track maintenance activities, closing 15 issues since November 2019. The majority of these, 13 of 15, were opened by the woreda with the other two opened by the regional focal person. 13 of 15 were also resolved by the woreda indicating they did the repairs themselves, but records indicate these activities were sometimes supported with spare parts donated by the region or other support from NGOs in the area. Two were resolved by a regional O&M staff member. Box 2 outlines an extensive repair process begun by the focal with spare parts donated by the region and repairs completed by the woreda. Box 3 shows a woreda led repair process with repairs completed by an NGO.

Of the 15 issues closed by the woreda, the majority (13) were resolved in about a month or less indicating more

Open Date: Aug. 20, 2020
Opened by: Focal
System: Mille – Gelaha
Problem: Damaged switchboard (flood)
Update: Aug 28 by focal, spare part identified
Update: Aug 31, by focal, repair conducted by woreda, generator may be damaged
Closed: 22 Sept. by woreda
Indicates the system is still flooded, unclear if more repairs are needed.
Photo: Repair and new switchboard

Box 3: Issues use example

active use of the system for tracking maintenance. Also, although Mille is managing the process, and regional technical support is limited to two issues, five issues indicate NGOs supported repairs. Spare parts donated by the region or NGOs were mentioned in six of the 15 issues.

Data use in annual planning

In March 2020, the SWS team submitted a proposal to support the O&M team with the annual planning process and found that the process was already underway and the AMS data had not been used to support the process. However, it was not just the AMS data that had not been used, but no evidence had informed the planning process. The O&M team submits largely the same plan each year, which is not based on calculations or historical data for undertaking their O&M tasks.

The proposal to leverage AMS data to provide evidence for annual planning was well received, particularly by the regional Study, Planning, and Budget Directorate. Our goal was to use the AMS and other data to justify the O&M team's draft budget request. To support the analysis, we collected three years' worth of data on past budget requests, past budget allocations, and past reported completed activities. After consolidating the data and clarifying what the data represented, we focused on the line items related directly to maintenance, one focusing on repair and the other focusing on rehabilitations.

In the 2012 EFY, the O&M team was allocated 900,000 ETB for maintenance activities and 300,000 ETB for rehabilitation activities. In the 2013 EFY, the initial draft submission prior to SWS support, requested 1,050,000 ETB for maintenance and 400,000 for rehabilitation. The operational team provided evidence to support the increased maintenance and rehabilitation costs. Regrettably, the evidence was not successful at leveraging additional operational budget for O&M activities, and as a result, no further finance was made available. Overall, although limited, we believe the analysis has value and can be seen as a starting point for using data in planning.

Following the support to annual planning, the Study, Planning, and Budget Directorate has invited SWS to support the new 10-year Growth and Transformation Plan planning process. At the beginning of the 2014 annual planning process, SWS received a request from the Planning Department to help leverage AMS data to provide evidence for regional maintenance and repair activities, as well as for validating the annual plans submitted by woredas. We conclude that although impact has not yet been realized, there is demand for using evidence from AMS to support planning processes, and that demand is steadily growing.

Outcomes in data management

	Results: Data Management
Mille Woreda	• Data management in Mille Woreda has improved significantly and the WWO is engaging with all functions of the AMS through the mobile application
Afar Region	• The AMS has not led to improved data management for documenting assets as updating and use of the system is very limited and has not been integrated into regional processes where data can be collected such as in handing over ceremonies or when visiting and maintaining existing schemes • Processes to update functionality have not been fully operationalized or institutionalized • Although the issues tracking process is used more than other functions, it is not consistently used to document all maintenance activities, is not used to improve maintenance responses, or coordinate staff, and is not used for long term planning to understand the number of activities completed or outstanding • The process for reviewing and approving incoming data via form approvals has not been implemented in the region and there is a constant backlog of data to be reviewed and approved • There is some uncertainty around the quality of updates from the staff and control of the data, resulting in a dataset that requires a major review and cleaning • Ownership of the AMS as regional IT infrastructure has not been accomplished and there is no certainty that the region will be able to undertake management of the system following the departure of implementing partners at the end of the project

- Data collected during maintenance tracking in the AMS and outputs of the system do not well align with existing regional reporting processes, and the incompleteness of data makes it difficult to fully utilize the AMS for any support to reporting or to attempt additional data analysis

As described in the 2016 scoping report, data management in the region and woreda was poor with no comprehensive list of the number of water systems in the region, incomplete detailed information due to misplaced drilling logs and other technical reports, and no comprehensive tracking of maintenance responses beyond quarterly or annual reports. It was also understood that these reports were completed from staff's memories and were incomplete.

During the project, the implementation team was unable to find a full year's set of reports. Additionally, the team found various data sources were often spread among different staff's computers, with sometimes the best source of data with a former employee, and paper-based tracking based on phone calls to woredas was often the most up-to-date functionality data, although these also did not contain a full set of water systems in the region or even in an individual woreda. The AMS tool was intended to consolidate this mishmash of data into one digital system with a full asset inventory, ongoing, up-to-date functionally statuses, and full documentation of maintenance activities.

Establishing comprehensive asset inventory

An important aspect of data management is completing data collection to establish a full asset inventory. All stakeholders recognize the importance of having a comprehensive asset inventory covering at least all motorized boreholes. The full O&M team, and some users from other departments, have been trained on adding new sites within the AMS, which is done by completing a form in the mobile application, and it was agreed that the team would add new sites and update any missing site information during site visits to undertake maintenance or repair.

Despite continuous facilitation, encouragement, and reminders from the focal person, very few sites have been added or updated. The AMS currently has approximately 180 motorized schemes out of an estimated 300 schemes in the region. Fifty-seven have been added by the ARWIEB (17 by O&M and 40 by other staff) Additionally, no staff from the region have completed an asset inventory survey since the system rollout in September 2019.

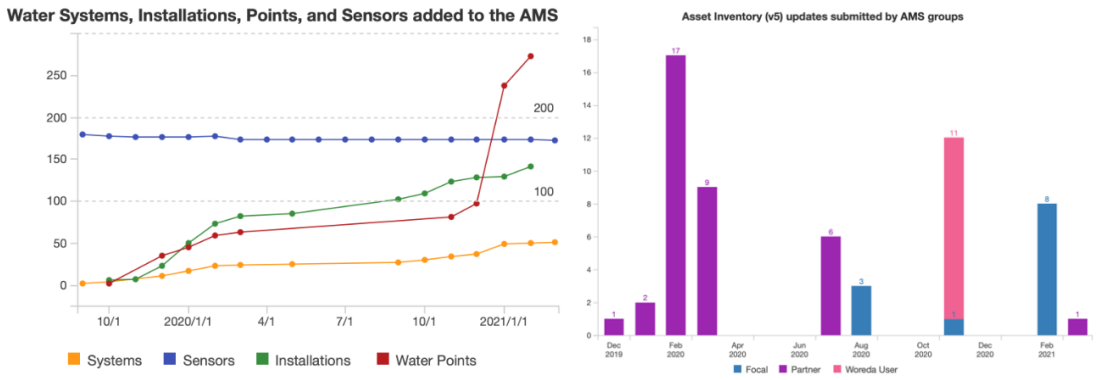


Figure 16: Items added to the system (left) and asset inventories completed by user groups (right)

Overall, although there have been some improvements in the data, the AMS has not led to improved data management for documenting assets, as updating and use of the system is very limited and has not been integrated into regional processes where data can be collected such as in handing over ceremonies or when visiting and maintaining existing schemes.

Functionality updates

Functionally updates are meant to provide an up-to-date view of functionality in the region. Continued updating from maintenance visits, phone calls, requests for maintenance, and other communication to the region should provide a fairly accurate picture of functionality in the region and for individual schemes. It was hypothesized that functionality updating would be the most used aspect of the system as it is easy to do, can be done both in the office and the field, and a very simple indicator for the region in planning and reporting.

As explained in the uptake and use sections, functionality updating has been utilized more than adding new systems or components or adding detailed asset data. But, despite more use of this AMS feature, it was most often led by ZFPs updating from sensor data or phone calls while based in the office, which never became institutionalized and dissolved in March 2020. Field updates during site visits also never became institutionalized despite the donation of new smartphones and continued encouragement and training, both in formal training and during learning and support visits during the implementation.

Why institutionalization did not happen will be further explored in the conclusions and recommendations section, but it was observed during different learning visits that the O&M Head was still collecting functionality data on paper by calling woredas and getting a list of broken schemes. This was then typed into a Word document for reporting, but never entered into the AMS. In reviewing the Word document, it was clear it did not contain a full list of systems but seemingly a sample of functional and non-functional schemes from woredas he spoke to over the phone. Overall, despite the potential long-term benefits of updating functionality in the app, it was not utilized, and management of functionality data did not improve.

Tracking maintenance

Maintenance tracking is intended to count the number and type of repairs happening in the region. Although an exact use of the data was not defined prior to implementation, it was hypothesized that the region could use maintenance tracking to better plan for future maintenance activities and potentially advocate for increased funding to meet known breakdowns.

Maintenance tracking via the issues process in the AMS was the most used component of the system. Nearly 200 issues were opened since major implementation began in September 2019, and, although the focal still processed the majority of these issues throughout the various stages, participation from other staff was higher across the various stages of the issues process than any other component of the AMS. Data shows maintenance issues are created but not all are tracked, updated, and closed. In documenting issues added to the system, data collected by the focal outside the AMS showed that approximately 50% of issues are tracked within the AMS while the rest are never added to the system.

Furthermore, we see that most of the issues are not opened by the O&M team, who opened only a small number of issues between September 2019 and March 2021, but rather by the ZFPs, Mille Woreda or the focal point. More worrying is the absence of any activity from either the former or current O&M Head, who are expected to be the main user managing the issues process by assigning issues to maintenance teams or staff and monitoring the progress and completion of maintenance activities.

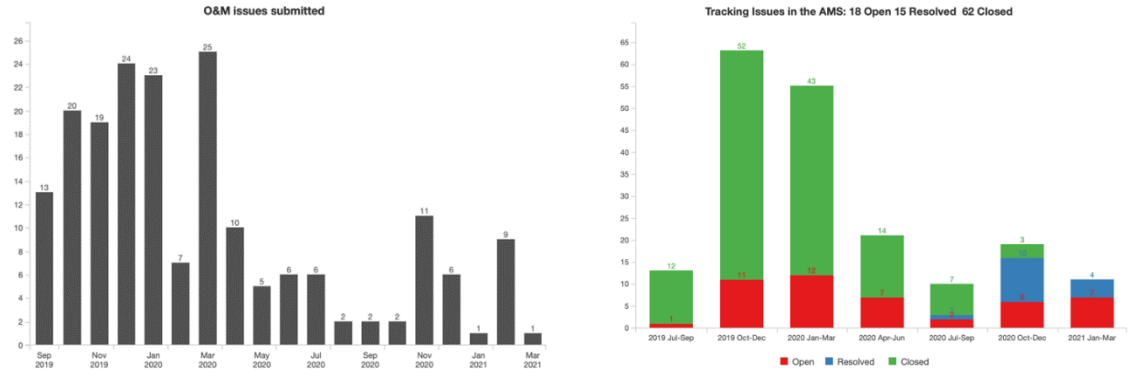


Figure 17: Total maintenance issues submitted (left) and status (right)

In the first three months of 2021, not a single issue in the AMS had been closed. Overall, although the issues process is used more than other functions, it is not consistently used to document all maintenance activities, it is not used to improve maintenance responses or coordinate staff, and it is not used for long-term planning to understand the number of activities completed or outstanding.

Form approvals

A related aspect where we expect to see data management is in the AMS site and form approvals. When aspects of the inventory are updated, for example changing information about a water system or completing a survey, there is a management function within AMS to approve the entry before it becomes finalized and included in the database. The responsibility of this function lies with the O&M Head but there is a continuous backlog of approvals. Attempts to have this managed by the IT Department also failed. The imbedded focal person has worked closely with the O&M Head to facilitate and support these approvals, but they are not being processed and the focal person or partners usually complete the approvals.

Reliability of data

Increasing reliability of data is an important outcome of improved data management. Unfortunately, during support to the ARWIEB's 2013 annual planning we discovered there is some uncertainty in the quality of updates from the staff and control of the data, leading to a dataset that requires a major review and cleaning. This was observed in comparing different datasets made available by the region to the data contained in the AMS. In comparing the full NWI2 dataset, as well as the estimated motorized schemes across the rural and urban datasets, it has become clear that the AMS data reports vastly different numbers regardless of the method for determining location (either automatically through shapefiles in mWater or through manual data entry in the asset inventory form). We have been aware that the administrative boundary shapefiles for Ethiopia are inaccurate but expected the manual entry to help correct this information. This does not seem to be the case and better data validation is needed to improve the reliability of this data.

Since the AMS dataset is incomplete and has generally focused on motorized schemes, it is difficult to compare it to a more complete dataset. To make this comparison, we looked at Mille Woreda across the different datasets. During the SWS baseline for Mille Woreda in 2017, data was collected for 32 schemes, including hand pumps, with 19 motorized schemes. The different regional datasets vary from 27 to 29 schemes. The AMS dataset has 25 schemes in Mille woreda using the shapefile and 50 schemes using manual entry. Although the 25 schemes from the shapefile look correct, in looking closer at those specific schemes, some are not actually schemes under the woreda's supervision, so, although the number is close, it is not accurate. As for the 50 schemes from manual

reporting, it is unclear how this data became so inaccurate, but clearly shows that the manual entry, thought to be accurate, is not more accurate than the shapefile unless new data entry is closely assessed and validated prior to finalizing the entry into the database.

State of records

During our support to 2013 planning, we were unable to obtain past financial expenditures. This is still the case. All but the budget data was contained in Microsoft Word documents and had to be transferred to Excel for analysis. Records were also incomplete with the focal unable to obtain a full set of quarterly or annual reports for any of the past three years. This lack of proper data management and ability to utilize available data further illustrated the need for strengthened information management and how foreign the AMS is compared to existing processes.

In addition to the system data contained in the AMS, we also collected other data sources to triangulate and verify the AMS data including the recollected NWI2 dataset containing a breakdown of the total number of schemes in the region, a 2010 regional dataset thought to be the best internal scheme data, and a recent functionality survey conducted by the O&M Head. Functionality rates were calculated from sensor data and AMS functionality updates, and then extrapolated to the region to get an estimate of existing maintenance needs. These data sources were then utilized to calculate costs to address existing maintenance requirements and costs to address predicted maintenance requirements during the coming financial year. During this process we gained a better understanding of the regional planning process including the past reporting, the data points included in these reports, various budgets and how money is spent to support O&M, gaps in the planning process, and how we may be able to support it better in the future.

In reviewing the O&M department's budget request, budget allocation, and reporting, it became clear that there was not a systematic planning process in place. Reported activities did not influence planned activities as reported activities were consistently below the planned number, and certain activities like handpump repairs were not conducted even though 30 repairs were planned each year. This strategy did not seem to be effective since the annual budget allocation was nearly the same for all three years observed.

In comparing the various scheme level datasets, we found significant variation and contradiction. It was surprising to see that the most recent functionality data used by the O&M team, collected by the O&M Head for 2012 annual reporting, was also incomplete, covering only about 50% of the schemes. We found the NWI2 dataset to be the most comprehensive dataset, and on a woreda-by-woreda basis the NWI2 data also aligned closely with the data from AMS.

Spare parts inventory

Although not part of the AMS, support for a spare parts inventory was regularly asked for during trainings. Unfortunately, this was not able to be supported by either Lowland WASH or SWS and inventory tracking has not improved. Recently, following a theft, the region has requested the ICT Department to support developing this system, but no progress has been made to date.

Role of ICT department

The ICT Department has been seen as an important team member and support mechanism for the AMS. Since the beginning, the ICT team have been involved in nearly all planning, design, and trainings, both at the technical and management level, and at times, have seemed eager to support the system, particularly following trainings, and agreements to return to the region to support implementation and use. The implementation partners have also worked closely with the ICT

Department during all learning and support visits since implementation began, to ensure the IT Department could administer the system through supporting staff obtaining an mWater ID, troubleshooting any challenges in using the application, ensuring users were added and managed in the mWater organizational chart, and understanding how the system is built and how to manage the various pages that make up the dashboard to support changes or additions to the analysis. The ICT Department was also tasked with supporting data management through form approvals.

Despite the enthusiasm, engagement with the system and support of the water bureau has not been sustained, and structures for supporting and implementing the system, such as training, have not been taken over by the department. Tasks, such as form and site approvals, have also not been sustained and the ICT Department has said they struggle to manage incoming data due to a lack of understanding of water systems and the expected data. Overall, ownership of the AMS as regional IT infrastructure has not been accomplished and there is no certainty that the region will be able to undertake management of the system following the departure of implementing partners at the end of the project.

Changes to existing processes

The region has many existing processes that mirror the AMS, but the AMS has not been used to replace these processes, and in many cases, cannot do this. It was observed that a lot of information on maintenance requests comes to the O&M Head informally via phone calls which are not captured systematically. Formal requests for maintenance support come in the form of letters and are filed in a binder by the O&M Head. Within the maintenance response process, a variety of paper-based requests and approval processes for all activities are needed to support maintenance such as spare parts requests, finance requests and transport requests. The AMS has not been able to replace or support these existing processes of data management in the region, particularly the maintenance and reporting process.

Data collected during maintenance tracking in the AMS, and outputs of the system do not well align with existing regional reporting processes, and the incompleteness of data makes it difficult to fully utilize the AMS for any support to reporting or to attempt additional data analysis. Similarly, while the paper-based processes were not meant to be captured by the AMS in its initial design, without that information in the system, there are two parallel, unrelated processes for managing and capturing information on maintenance tracking and response, and, again, this prevents the AMS's ability to support regional planning and reporting. Due to these parallel structures, a lot of data is still captured separately, and reporting has not changed. The quarterly reporting process does not use data from the AMS but is instead still compiled from memory by the O&M Head and followed up with staff at the end of each quarter.

Data management in Mille Woreda

Data management in Mille Woreda has improved significantly and the WWO is engaging with all functions of the AMS through the mobile application. The features most frequently used by Mille WWIEO are updating and issues. During discussions between February 2020 and March 2021, Mille Woreda staff explained how they mostly use the AMS as a tool to improve advocacy and communication with the regional O&M team. Mille Woreda engineers submit issues so the O&M team is alerted and can see problems arising in the woreda in advance of the formal support request. Mille Woreda also estimated the regional O&M team's response time has improved, which they believe is partially due to being able to send pictures and descriptions in the issue form. The woreda also feels there is regional trust in the system and the data submitted, but that the region is not engaged in undertaking actions within or using the system. For example, when the region

provides rehabilitation support, it is the woreda who uses the AMS to update, resolve and close the maintenance issues which they themselves opened.

Conclusions on data management

In conclusion, data management has evolved in several ways since the scoping study, with improvements most notably in Mille Woreda. Although structural changes (e.g., policies) remain unchanged, there are advancements in data management practices at the level of individual staff.

LQ 2.1.1.: In Mille and Afar, what are the outcomes in terms of investment and provision of maintenance?

Outcomes in terms of investment

	Results: Investment
Mille Woreda	• There has been no increase in finance in Mille directly related to SWS activities
Afar Region	• A minor increase in overall budget across the timeframe can be seen, but it is difficult to relate this with AMS, given the very limited use of AMS data in 2013 annual planning

There has been limited impact in investment in maintenance, and budget data is incomplete and continues to be difficult to obtain. That said, there has been some additional focused investment on supporting monitoring in the region with 334,600 birr (approx. 7800 USD) allocated to data collection, sensor maintenance and related activities. Beyond this targeted investment, no additional investment has been made in either Mille or Afar based on AMS data.

Outcomes in provision of maintenance

	Results: Maintenance
Mille Woreda	• There has been no significant increase in maintenance activities in Mille despite Mille using the system. Bottlenecks in the system particularly, finance, spare parts, and dependence on the region hinder improved maintenance
Afar Region	• From 2017-2020 the sensors show very little annual variation (between 64-67%) and no trend towards either increasing or decreasing functionality. We can conclude, based on the sensor data, that there has been no impact on the rate of functionality as a result of the asset management approach • In late 2019 and early 2020, it typically took more than one week to resolve the issue. Longer periods of downtime appear to be reduced in late 2020 and early 2021. This could be a result of faster response times but could also be a factor relating to improved data management of the issue function • The region has begun to undertake a restructuring process with a greater focus on data and preventative maintenance

Expenditure on maintenance

Given the limited AMS uptake and use, there was no determinable impact on the maintenance expenditure. Table 2 shows data on regional O&M team plans, budgets, and expenditure for EFYs 2010-13. Data shows annual fluctuations to most budget categories, as well as the number of maintenance related activities planned and completed. A minor increase in overall budget across the timeframe can be seen, but it is difficult to relate this to the AMS, given the very limited use of AMS data in 2013 annual planning. Overall, the region is completing about the same number of activities each year.

Table 2: O&M department finances

	2010			2011			2012			2013		
Activities	Planned	Budget	Completed	Planned	Budget	Completed	Planned	Budget	Completed	Planned	Budget	Completed
Conducting assessment for preventive maintenance	32	470,000	32	26	320,000		33	300,000		34	450,000	32
Conducting hand pump maintenance	45	50,000	1	20	100,000	5	20	100,000		30	250,000	7
Conducting motorized scheme maintenance	160	1,290,000	116	120	900,000	88	120	900,000	77	120	1,050,000	56
Conducting borehole rehabilitation	22	350,000	15	20	250,000	8	20	300,000	23	20	400,000	2
Installation of on spot water supply schemes	5		14	10	300,000	4	8	300,000	2	15	350,000	
Installation of EM Wat Kit	5	420,000	11	5	450,000	3	3	300,000		2	200,000	2
Budget totals		**2,580,000**			**2,320,000**			**2,200,000**			**2,700,000**	

Impact on scheme functionality

Through the AMS, we have two datasets to triangulate to understand the changes in functionality. Firstly, a key function of the AMS is manually updating functionality. The adoption of this function is discussed at length in the section above. Secondly, the sensors provide a highly regular and reliable source of scheme runtime. Although runtime is not the same as functionality, if the scheme is determined as normal use, it can be considered as functional.

In comparing these datasets, we do not find close alignment in the figures. In no cases are there extremely high or low functionality rates, but neither is there continuity, or a similar trend shown across the data. Both datasets have limitations, but the manual updates are particularly biased towards overreporting on functional schemes, since it is far easier for ZFPs or others to update a scheme as functional, because, for example, it requires no follow-up calls with pump caretakers to determine the cause. Many of the manual updates are indeed based on the sensor reporting and so they are likely over-represent the functional schemes.

Sensor data from 2016 should be discounted because only 10 sensors were installed, and data from 2021 is equally unreliable because data is only until March and does not account for seasonal variations. From 2017-2020, the sensors show very little annual variation and no trend towards either increasing or decreasing functionality. The range has been consistent with between 64 and 67 percent of schemes reporting normal use across the region. However, this is a simplified approach to calculating functionality over time based on weekly averages and trusting the normal use sensor status. A more accurate approach using the sensor data and user-submitted functionality reports looked at a subset of pumps and time periods where pump status could be ground-truthed to a functionality report and calculated verified days of runtime over total verified days to get 88% uptime on average since the start of 2017. If the sensors can be taken as an accurate estimation of pump status, and uptime is higher than expected despite limited to no maintenance process improvements, we can conclude the rate of functionality has not been impacted as a result of the asset management approach.

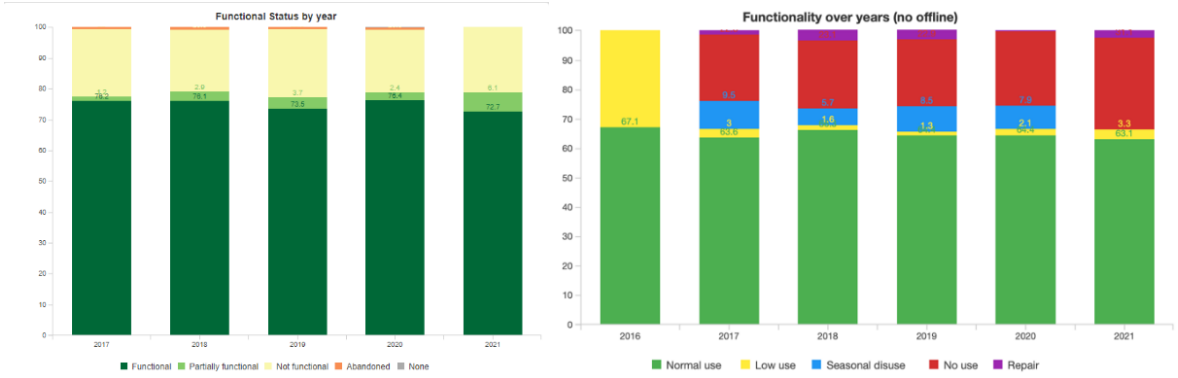


Figure 18: Functionality status out of 100 percent via manual updates (left) and sensors reporting "Normal use" (right)

Impact on scheme downtime

Although the limited system uptake has resulted in a limited dataset that prevents us from drawing strong conclusions, and the short timeframe of the dataset cannot account for seasonal fluctuations in breakdowns, we can observe some progress towards reducing long periods of downtime. In late 2019 and early 2020, it typically took more than one week to resolve the issue. Longer periods of downtime appear to have reduced in late 2020 and early 2021. This could be a result of faster response times but could also be a factor relating to improved data management of the issue function. Either way, it seems positive. Less positive is the decreasing use of the issues tracking function, which shows far fewer maintenance requests are being opened.

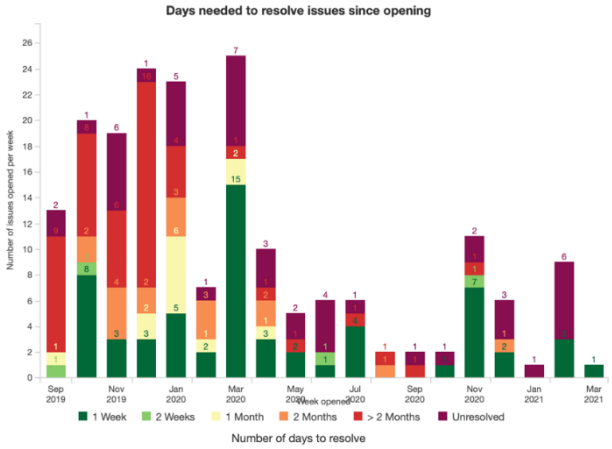


Figure 19: Days needed to resolve issues

Development partners

Development partners were involved from the beginning but were not as involved in the implementation as most of the focus was working with the region. Some examples of use include CARE's electro mechanic using the AMS for maintenance in Mille, a project area, but use was not sustained. UNICEF also created an account and discussed capturing data during assessment but has not implemented this use. GIZ and COOPI discussed getting data on boreholes for solarization of hand pumps, however, not much data was obtained from the AMS.

Service delivery change in Mille Woreda

There has been no significant increase in service in Mille. From manual functionality updates, we see increasing functionality over the first three years, with decreasing functionality in 2020 and 2021. From sensors, we see an initial decrease in 2018 and increase in 2019 and then a decrease in 2020 with a slight increase in 2021. Both measurements should be taken with a grain of salt as the

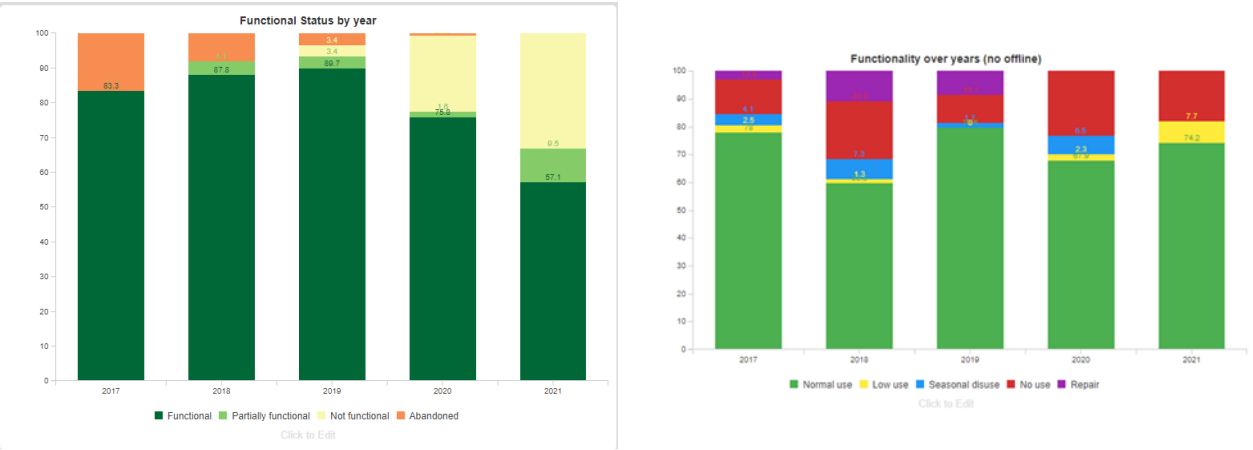


Figure 20: Mille woreda functionality, manual (left) and sensors (right)

woreda is not using the tool to track overall functionality and shapefile challenges make it difficult to determine and utilize the data for woreda level analysis as the shapefile does not encompass all systems.

Lessons learned: Actors and factors leading to successes and challenges in Mille and Afar

Accomplishments

Whilst the chapters above have outlined evidence to show the AMS is beginning to be used within the ARWIEB, we have yet to see compelling evidence showing that insights from the AMS are informing regional processes and decisions. However, despite the unmet expectations and operational limitations, there are some notable exceptions which indicate the tools have not been entirely without benefit.

Prior to development of the AMS there was not a single point for regional staff to access water supply asset data. Despite limitations in extending the inventory to include all schemes, the availability and accessibility of data has greatly improved. Use in Mille indicates lasting capacity for monitoring has potentially been established in the woreda.

Since the engagement around the 2013 EFY annual plan, the Planning Department has shown significant interest in accessing and using the AMS insights to support their processes, including for the GTP3 10-year plan and 2014 EFY annual planning, but to date have not engaged with SWS to do so.

Furthermore, the region is presently planning a restructuring process, and the current proposal includes new roles for data management and sensor maintenance and elevating the O&M team to a directorate to give it more financial power and responsibility to better implement the AMS and manage data. This is a positive sign of the value the region is beginning to assign to the AMS, and their recognition of the need to evolve in order to take advantage of the benefits of new technologies.

The region has also recently implemented zonal maintenance teams to undertake maintenance more efficiently and effectively in the region showing more prioritization on maintenance and repair. Despite this change, the AMS is still not supporting these activities with maintenance and spare part approvals being done through a Telegram group, a mobile messaging platform. Pictures are shared on the platform and maintenance is approved by the bureau head, allowing for finance

to approve resources. The embedded focal person is part of the group and has continued to encourage use of the AMS in documenting activities and capturing asset data for more long-term analysis, but staff are still not utilizing the system and report they are not trained. Leadership also does not seem to fully understand the system and engaging them has remained difficult. Overall, although more maintenance is good, this new arrangement is not strengthening the WASHCOs' or woredas' capacity to undertake repair with the region taking on even more responsibility for maintenance.

Regional interest in the remote sensors has been consistently high. Despite failure to utilize the data generated from the devices, the interest in them and the desire to extend to all schemes has persisted throughout discussions with regional leadership.

Interest relating to the AMS and its application in Afar has caught the interest of many of Ethiopia's WASH sector stakeholders, and the progress of system rollout has been presented on numerous occasions, including at the joint sector review meetings. Learning about strengthening asset management with improved tools and approaches has influenced the national dialogue on appropriate technologies for adoption in Ethiopia. Internationally, experiences and learning from strengthening asset management in Afar has been presented and discussed in WASH sector symposiums, including in Delft and Colorado.

Furthermore, the initiative has provided a platform for further research, such as research conducted by PhD students at the University of Colorado using the AMS and sensor data and focusing on systems approaches to rural water supply real time monitoring, maintenance service provision, and impacts on household water service levels and security.

Constraints and failures

Aspirations around the extent to which the AMS could be operationalized, integrated into regional processes and decisions, and institutionalized as a tool for improving water service delivery have been overestimated. In the updating, use and impact chapters above we clearly outlined the limitations in the system's adoption. The following sections will reflect on our learning around these constraints and failures.

Updating and use

It was understood that without an aggressive data collection effort, as seen in the initial stages of this project with implementing partners gathering comprehensive data in specific areas of Afar Region, the asset inventory would grow slowly. But the asset inventory was the main driver of the AMS development, and was expected to be the most important component, be regularly updated, utilized to make maintenance responses more efficient, allow for better preparation, and form the basis of a comprehensive understanding of regional assets for long-term planning. In reviewing the uptake of this component of the AMS, it is clear these aspirations and hypotheses have not been met.

It is difficult to draw firm conclusions why the asset inventory is the least used component. In speaking to staff and management during learning visits and trainings, feedback on the capabilities is positive and staff even report the asset inventory is valuable, despite it not being used. Still, it is clear that the full capabilities of the system are not well understood by users.

A major challenge to the asset inventory's development, as reported by the focal person, is no buy-in or commitment from leadership including the O&M Head, as well as the regions' lack of long-term thinking and planning. Another challenge was the delay of the updated asset inventory form.

In interviewing the current O&M Head, some clarity on why the system is viewed positively but not used emerges. She reported that the staff see the AMS and updating the various components as additional work, and also reported that the lack of institutionalization has hindered data collection efforts. Staff who are more active in visiting the field, report the asset inventory is difficult to fill out as the form contains a lot of data points that may not be collected or cannot be observed on a site visit. Overall, it seems that as the form grew in complexity and comprehensiveness in response to feedback on what data needs to be collected, the user experience also became more complex and challenging due to these changes. The focal person confirmed this feedback saying that the technicians are solely focused on the maintenance tasks and saw the surveying as outside their technical role despite an understanding of the asset inventory's potential value.

In addition to data collection challenges, it may be difficult for new users to understand and implement the full data collection process when a full asset inventory has yet to be established. New users, who are generally unfamiliar with the system, and in the case of Afar, new to using a smartphone and mobile data collection software in general, must identify whether a system is already documented and whether forms have previously been filled in, either add the system (if it is not present) or select the system and its components and fill in the correct form for each item. This process was not understood, even by the implementing team, until well into the implementation, potentially creating confusion from the start. Still to this day, it is not exactly clear how the online and offline functions of the system work, and preparation for visiting a site requires making data available offline, further preventing ease of use more randomly or ad-hoc in the field where teams are sent for extended periods of maintenance. The daily nature of managing issues and functionality updates, as well as the ability to complete these tasks from the office, are the main reason these two aspects are more widely used than items that must be complete in the field (adding sites and completing asset inventory forms).

Usefulness of the data is also a challenge. Reporting requirements were not well understood until late in the project and the AMS could not be redesigned to have these items included at such a late stage. The cycle between the data not being complete, therefore not being useful, therefore not encouraging use and updating, is challenging.

Despite these challenges, we are confident that O&M team staff have the resources and capacity to undertake these updates and we believe the lack of doing so stems from a lack of interest, commitment, and accountability, particularly from the O&M Heads. They have the most to gain from the system but have engaged the least.

Meeting regional needs

The AMS has the potential to improve data management, but low uptake and poor alignment with existing processes indicates the design of the system could have been improved from the beginning. The complexity of the system with three different functions (asset inventory, functionality updating, and maintenance tracking) also seemed to be beyond the implementation capacity of the region, and the implementing staff from partner organizations. Implementing a complex, multifaceted, and poorly aligned system will encounter challenges, but a true understanding of regional needs and processes was not understood from the beginning, as throughout the implementation the team continued to better understand the complexities, needs, and processes that the AMS did not meet, and had to continually learn about the system, its features, and modify its use while trying to implement it.

More specific examples of continued understanding include the data flows within existing processes, data needs, reporting processes, and, more generally, regional structures and staff, and how the region operates and manages maintenance. In hindsight, it is understandable that the region views the AMS as additional work as it provides only very limited support to existing processes or help in streamlining management and reporting.

The region is also operating on an emergency basis where there is not a 1-1 relationship between requests and maintenance. Priority is the main determinant of maintenance with schemes serving larger populations or populations with no other water sources getting service first. This emergency response prioritization, coupled with batching issues in one area in order to justify a response, and no consistent response teams, made active use and implementation of the issues process very challenging. To this day, the process for implementing this feature within the bureau's regular activities and with an understanding of available bureau resources, such as transport, remains unsolved.

Reporting faced similar challenges. There is a recognized need for monitoring functionality and reporting on activities, but the initial data collection philosophy was to push for data collection first and figure out reporting and use of the data second. Low use indicates this was not effective, and routine, consistent data collection never got off the ground. Additionally, the O&M Head said that updating functionality from the office without consistent naming of schemes was a challenge, and with an incomplete dataset and challenges breaking up the system by woreda due to inaccuracies in the shapefile and in the manual location data entry field, it was difficult to even communicate with the woredas on what systems where theirs and which were the individual schemes to be marked functional or not.

Extracting valuable reports from the data was a challenge. The initial design team reported that they were unable to access reports and therefore did not know what needed to be reported. In 2020 we were able to obtain various quarterly and annual reports dating back three years. These reports showed that many data points were not contained in the AMS. Examples include various borehole cleaning and disinfection activities, specific scheme designations such as temporary water systems before permanent components are installed, as well as tracking who is providing maintenance support in the form of parts or technical support.

When data was present, it was not easily extracted and was not part of the existing dashboard. Just counting the number of specific repairs or replacement activities or what was done at each site, was a challenge with the existing data set. Towards the end of the project this was presented to mWater for review. Continued development of forms and a reporting dashboard to capture and display this information was initiated, but modifying the system at that late stage proved impossible and reporting data contained in regional reports is yet to be captured or reported on in full. The request for inventory management, a continual request, was also not able to be fulfilled under this project.

Other implementation and user challenges

A focused, well supported implementation plan did not start until 2019. Part of this was a long delay in hiring the focal person, but once hired and a full team reengaged with the system it was not clear exactly how the tool should be used as it was designed. Figuring this out was a major delay in working closely with the region and was a challenge even for the technically knowledgeable implementation team. At the regional level, the busy, financially stretched, and less computer savvy group of technicians were also challenged to use the tool and formulate processes for the tool to be utilized.

Beyond challenges to general use and lack of understanding, the implementation team was unable to properly manage the tool without ongoing developer support from mWater. An advanced training was given by mWater in July 2019 to the implementation team and the ARWIEB IT Department on the basics of the backend of the system, but only through practice and experimentation, as well as continued support from mWater, did the team become relatively competent in more advanced use of the mWater tools. Yet, there are still a variety of unanswered questions about various components of mWater's backend management and it is understandable that the region has not committed the time and energy to explore the tool and figure out and learn for themselves how to manage and improve the system.

Another challenge has been managing the data itself. The asset inventory data was collected using mWater's water points function and many individual forms for different system components. Later, a more advanced water system feature in mWater was used and data had to be migrated. Water point data had to be reuploaded into the new water system feature, and form data was consolidated into one comprehensive form. The water point data had to be migrated to this form, then uploaded.

There were a variety of problems in this change. One, merging all the forms created some issues in how the data was able to be collected with large sections of the form no longer working. This was not noticed until late in the implementation phase and was fixed in Version 5 of the form in late 2020. Two, in merging the data into one form and reuploading it, it was discovered in early 2020 that much of the data was missing from the system due to the upload not working, and three, the team was unable to rectify this themselves, having to rely on mWater and an advanced mWater user from outside the project to rectify this mistake. It is still very much beyond the capacity of the implementation team and especially the region to manage these types of problems, so changing the system in any significant way to better meet the needs of the region is not possible, especially as SWS ends.

The reliance on a good internet connection to manage the system has also posed significant challenges in training on the portal, demonstrating its use, and utilizing the system in the region. Although data can be collected offline, accessing the data and insights requires a good connection, especially to access the dashboard and manage the portal where data is visualized and utilized. Throughout implementation, only rarely did the regional office internet connection support accessing the dashboard or portal due to slow network speeds. In investigating further, the team found that the region had not paid its bill and owed the service provider a significant amount of money. Instead of cutting service, it was significantly slowed. It is not clear if the region ever had a fast enough connection, but generally the dashboard and portal are unusable in the ARWIEB office.

A final challenge was not partnering with other potential users earlier, particularly the Planning Department and Study and Design team, both have expressed interest in using the data and have been more eager to learn and use the system. Not understanding the regional needs and processes of other departments earlier in the design phase was a missed opportunity for building a more comprehensive and useful system.

Contracting software development

Many of the delays in improving the system can be attributed to the start and stop nature of the implementation and capacity of the implementing team, but it must also be noted that many delays were due to challenges in working with the software developer. We attribute these challenges to

contracting and contract management and the lack of incentive to deliver a product that worked for the Afar context.

The main challenges in contracting and contract management were delays in support and delivery of changes to the system, challenges verifying and ensuring the contract was fully fulfilled, and the need to engage in multiple contracts when the product still was not working, and with support and development still needed. Throughout the process of development many issues were identified that needed to be improved and needed support. Over time, more issues were discovered forcing delays to training and continued modification of the tool.

When changes were delivered, the team was unable to fully test and verify everything was working prior to implementation. Due to these challenges, the team was often displaying a not yet fully finished, tested, or working system, often leading to problems during training hurting the team's credibility, and making it challenging to show the app and dashboard in the best light.

These type of challenges in developing the system led the team to embark on a weekend retreat intended to identify all challenges needed in the system in late 2019. Over three days, the team worked through each component of the system, individually exploring each form and each graph on the dashboard to fully understand how the data was being captured and displayed. A list of over 50 issues were identified in the app and dashboard. Some items were able to be addressed by the team, but with a considerable learning curve and some challenges. Others were not, forcing Lowland WASH to reengage with the developer and recontract them to finish a system that was supposed to be finalized already.

Throughout 2020, these items were continually addressed with mWater, but not quickly and with additional issues being identified. The data visualization dashboard was eventually completely redesigned, prompting a full review, and significant changes were made to the Asset Inventory Form. As the developer's final contract wound down in 2020, no clear, problem-by-problem list of issues addressed or a complete list of contracted deliverables and outcomes was delivered, and a variety of issues were still unresolved. Overall, delivering the initial product version was straightforward, but continual customization, optimization, and support was highly challenging and greatly hindered the operationalization of the system.

Leadership

Regional leadership and engagement also posed challenges to the implementation. A major challenge in engaging with leadership was the constant turnover. Throughout the project there were three new water bureau heads and deputy heads each, but the costliest change came during the final implementation push throughout 2019 and 2020 following the regional management workshop in November 2019. As can be seen in the data, use of the system increased significantly, due to the implementation of the ZFPs following the management meeting. Engagement and collaboration with regional leadership was at an all-time high, and the Deputy Director was pushing for the AMS to be used and actively working to improve and encourage regional use. Unfortunately, he departed in early 2020, and momentum for use seemed to end along with any additional regional support he was intending to provide. This change in leadership, along with others in the past, was detrimental to building and continuing momentum since the anticipated organic uptake and use by the intended users never materialized.

However, despite the challenges with leadership changes, the implementation team and project leadership could have better engaged with leadership throughout the project to make the transitions smoother and continue the project momentum. This is particularly clear in the last

year of the project (2020). Following the change in leadership at the beginning of the year, the embedded focal person continually tried to set up a meeting with the replacement bureau head and deputy but was unsuccessful. It has been suggested that higher level engagement from implementers may have helped.

Capacity, resources, roles, and incentives

We have seen from Mille Woreda, the ZFP program, and sensor repair program that the capacity to utilize the AMS exists in the region. The project also supplied 15 smartphones to ensure data could be collected following feedback that a lack of devices was a limiting factor. Some users are more equipped to use the system than others, but advanced users can be leaders and proper training and support can help less skilled users catch up. So, with the capacity and resources, what went wrong?

In talking to the ZFPs, the fact that the AMS tasks were not part of their official duties, and the lack of incentives or financial support were a frustration in using the application. At a minimum, they requested phone credit to support making phone calls and updating the app, but it has also been reported that office work does not have the same incentives as field work due to additional per diem received when in the field. Additional incentives beyond phone credit should be considered for ZFPs or users designated to update the system in the office.

The ZFPs also demonstrated the need for clear roles and responsibilities. It was only through this structure and the well-defined role of updating functionality where we saw high use of the system. This contrasts with the lack of use from the O&M team where updating was meant to be done by everyone, but roles and responsibilities were not further assigned or supervised by the team coordinator. This contrasts well with Mille where the Core Processor, whose job is to manage data, was the main user and continually utilized the AMS.

An additional reflection from the focal person is that there are generally managerial weaknesses in the region and more could be done to strengthen management overall which may allow managers to better implement this type of technology. The focal person has said that the two staff members most likely to benefit are currently overburdened with work due to poor distribution of tasks and management. Additionally, due to the nature of schemes in the region, the amount of technical support required in maintaining schemes is high, taking away resources from a focus on improved policy, budgeting, and planning.

Finally, the support for monitoring and implementation in Afar at the regional level focused on monitoring as an entry point for improving maintenance but did not address other aspects of the WASH system. For the sensors and the AMS to improve maintenance and functionality, additional finances to respond to the monitoring data was always understood to be necessary, and advocacy for increased maintenance budgets was part of the original implementation plan. The region knows they are behind in maintaining systems and often runs out of funds before the end of their financial year knowing there are outstanding schemes to be maintained. The addition of detailed data on the gaps in functionality to this situation does not in itself improve the maintenance response without additional budget allocations to support maintenance informed by the data in the AMS.

Reality gap – perception and uptake

One observation in implementing and understanding the AMS has been the constant positive feedback for the system in trainings, meetings, and interviews. Users report that the system is useful to their work with asset inventories needed for better undertaking repairs and improving

the ability of the region to expand schemes or plan for other changes. Sensor data is viewed even more positively with users wanting sensors to be installed on all schemes and improve integration with mWater to allow for automatic updating of functionality or even to expand sensor features to include measurements on yield and metering. In all trainings, and particularly the management training, the region regularly commits to using the system and finding ways to integrate the system in their work.

Despite these positive commitments, we have seen little uptake and use, and it is difficult to understand why. We have covered many of the reasons limiting use, but still fail to fully understand why the system is not better utilized considering the positive feedback and commitment to use. Overall, it seems that there is a general understanding of the value of data and its potential use, but structures to update the data and utilize the data are weak and need more support. Additionally, as noted, more integration into existing processes and structures within the region, as well as clearly defining individual users' roles and responsibilities, may support better use. Also being more responsive to regional feedback and needs to ensure the system and related technologies align with their needs, such as more support for inventory management and reporting, both of which the current system does a poor job supporting.

Sensors

In working closely with the region while implementing the asset management system, the sensors have been described as an exciting and useful component of the system. The data was described as valuable and proved useful to the Zonal Focal Persons in updating scheme functionality, despite the challenge of low accuracy at detecting breakdowns (50%). Schemes without sensors were much harder to monitor and update. Although data for schemes with sensors is more available due to better asset inventory data in the AMS, contacting operators and even woreda staff for both schemes with and without sensors was difficult, and sensors did sometimes indicate a problem, but this system did not increase the number of issues reported.

Although there are issues with integrating the sensor data correctly with mWater (SweetSense and mWater display different numbers of active sensors in Afar), the updated sensor dashboard in the AMS released in 2020 improves utility by displaying sensor status changes (a change in the predicted water system status from the sensor measurements) that likely indicate a breakdown or repair requested by users. Estimates of current scheme level functionality from sensors require backup verification via a phone call since they are not 100% accurate, but the historical sensor data is a reliable estimate of regional level functionality, far more so than traditional point in time estimates from surveys. Unfortunately, other uses of the data like initiating maintenance responses and monitoring potential over- or underuse (indicating potential mismanagement or partial functionality) saw little uptake. At this time, all sensor data analysis has been led by SWS and the region has not integrated the sensor monitoring system into any processes.

Improving upon the reliability of sensor data through better local understanding of the sensors and their accuracy, improved maintenance of sensors, and potentially switching all GSM sensors to satellite may increase their reliability. Sensor accuracy can also be improved through modifications to the current expert status classification system or adoption of machine-learning algorithms under development by SweetSense. Improvements in sensor accuracy may increase confidence in the data for initiating maintenance responses and other decision making. Further integration into the AMS such as automatically updating functionality in the AMS may also increase use of the sensor data.

However, despite being presented with their limitations and the lack of uptake of sensor data as designed within the AMS, regional users consistently recommended purchasing more sensors to cover the entire region and stated that with more time to learn and adopt new technologies and with more donor support, monitoring could be improved using sensors. Going forward, it is important to continue to track sensor challenges, such as false positives or irregularly used schemes, to help improve the expert status classification and trust in the data. Reallocating sensors to more important or more frequently used or failing boreholes may be a better use of resources than the current numbers and placements of sensors, following decreased donor support. Regardless of implementation, systematic troubleshooting and maintenance need to be improved to ensure sensors are online and reporting accurately. Overall, continued use, maintenance, and monitoring of usefulness may guide future use of the sensors and improve their reliability and utility.

Miscellaneous: Engaging others, internet challenges, and COVID

Although partnerships were initially fruitful in designing the system and gathering some of the initial data, as the project moved towards focusing on the uptake and use withing the ARWIEB, there was a missed opportunity to bring in other development partners and sector stakeholders into the design, development, and rollout process. It was expected the region would collect the majority of data, and the project focused on building this capacity in the region but simultaneously engaging with partners may have led to more data being added to the system and another support system in the region beyond the focal person.

The internet was also a challenge to implementing the system. Throughout the project, the ARWIEB was behind in payments to their internet service provider, Ethio telecom, which limited the internet speed in the office. It was observed on multiple occasions that the internet was not fast enough to even load the portal, limiting the ability to engage with the system.

Additionally, multiple internet shutdowns due to instability in Ethiopia were also a major challenge for the project. These shutdowns broke up momentum and made using the system impossible. Internet shutdowns seemed to damage sensors which increased the amount of support needed to repair sensors.

Finally, the COVID-19 pandemic made ongoing support difficult throughout 2020. The imbedded focal person returned to Addis Ababa from April to August 2020 and support visits by other staff did not resume until the end of the year. Although the ZFP structure was showing signs of dissolving before the pandemic and continued regional turnover harmed momentum, the pandemic did not aid in addressing these challenges.

Background and inputs to strengthen monitoring in South Ari and South Omo

Until 2017 the South Ari Woreda Water Office lacked sufficient reliable insight into the status of schemes to effectively maintain, rehabilitate and plan the equitable extension of services. To evaluate strength and weaknesses of the district WASH system a series of assessments were undertaken. The results were used to derive a baseline and inform plans for system strengthening. In the absence of a permanent national or regional monitoring system, and since local routine monitoring was not systematically undertaken, an asset inventory and sustainability check provided insight into existing gaps and helped prioritize activities for strengthening monitoring for asset management.

With support from South Omo Zone, USAID Sustainable WASH Systems Learning Partnership and USAID Lowland WASH Activity, South Ari Woreda developed and operationalized a monitoring and evaluation system to provide water supply operational insights to teams responsible for operation and maintenance activities and planning service extension. Evidence from the system enabled South Ari Woreda to achieve a significant increase in capital budget allocation and insights into scheme functionality and informed planning by government and development partners.

Following initial successes, the continued operationalization and institutionalization of the monitoring system was hampered by high staff turnover and other contextual and environmental factors. A method for updating scheme functionality data was piloted, but after just a few months the frequency and reliability of updates decreased. Two attempts to collect data on new schemes constructed since the baseline were unsuccessful and the division of South Ari into three separate woredas resulted in a pause of the monitoring strengthening efforts.

Between 2017-21 a range of surveys and tools have been deployed. Multiple survey revisions have concluded in an arrangement of four active surveys. Similarly, editions of monitoring dashboards to present the data and analysis have become refined and concluded in a zone-level console with individual dashboards for the five woredas.

Since 2017, training on monitoring tools and processes have been delivered for woreda and zonal staff, and, since 2019, the inclusion of an embedded facilitator provided the opportunity for continuous technical and advisory support. To support monitoring activities, hardware including desktop computers, laptops and mobile devices were provided to the zone and woredas. Financial support was provided for the collection of baseline data and regular updating activities. This support included financing for collection of data on newly developed schemes through financing for two vehicles during the data collection for National WASH Inventory 2, in February 2019.

Since September 2019, with support from South Omo Zone, the three new woredas have engaged in revitalizing the monitoring system. The monitoring tools were updated, and training and support provided. The presence of a SWS embedded facilitator has improved provision of technical support and communications with key woreda staff. Presently, updates on scheme functionality are reported consistently and the data is being used to inform 2014 EFY annual planning. South Omo Zone has strong interest in participating in the monitoring strengthening activities and has planned and budgeted for activities to scale the approach across all woredas in the zone.

The following is a timeline of key monitoring activities undertaken across the woredas and zone:

Table 3: Timeline in SNNPR

Key monitoring related activities	
2017	• woreda water office staff trained on mobile based data collection and basic water supply schemes characteristics and indicators • baseline survey conducted using Akvo FLOW data collection tool
2018	• data migrated to mWater platform and simple visualization dashboard developed and shared • woreda water office staff trained on visualization dashboard • monitoring data analyzed and presented in detail to the woreda and helped to see gaps and establish learning alliance to be used as a platform to continuously discuss and share experiences, data, and results • evidence was used for the first time to inform decisions around the annual planning process in woreda and zone, with SWS support • the non-functionality comparison among villages helped to revitalize water user associations • refresher training provided to woredas and zone WME staff

2019	• data collected for the 2nd national WASH inventory where the woredas monitoring data used for planning and validation • mobile phones and computers provided to woredas for monitoring works
2020	• refresher on job training to 2 woredas (South Ari and Baka Dawla Ari) • monitoring system redesigned, and data migrated to new tables and forms in agreement with mWater's new data type of water system • refresher training on the updated visualization dashboard • inventory in 2 additional woredas
2021	• zonal and woreda progress review to get feedback on all program activities over project lifespan • handover of additional hardware to support monitoring • zone monitoring expanded to 2 additional woredas under Lowland WASH with IRC support

LQ 2.1.2.: In South Ari, how does district-level strengthening of the government-led monitoring system improve data management, updating and use, and uptake at the zonal level?

Results in updating

	Results: Updating
Debub-Ari, Wub Ari & Baka-Dawla Woredas	• Throughout 2020, over 2,000 functionality status updates were reported, occasionally exceeded 300 unique scheme updates per month • Updates have continued into early 2021, and although these are now reported with slightly less frequency, there are still about 100 updates each month
South Omo Zone	• The zone has not directly updated the system but supports the woredas to update the system

For a monitoring system to be successful in ensuring regular updates the available information needs to have clear utility for those managing water supply services. Regular information updates can be challenging since they require time and resources which are not readily available. In the context of South Ari Woreda, the woreda support budget is very small and more readily used on spare parts or transport to make repairs than for monitoring activities.

In 2018, taking account of the limited resources, a methodology for reporting local knowledge on the current status of services was developed and piloted to facilitate updating the inventory based on WWO staff knowledge combined with any recent reports from communities or WASHCOs. Using a printed list of all schemes of the woreda, the team could quickly complete an update for the current functionality status of all schemes across South Ari. WWO staff were able to identify any changes to the functional status, for example which schemes had broken down and when, and which schemes had been repaired and were now functional, providing service as per the system design. The exercise identified 20% of the schemes had changed functional status in 12 months since the inventory was established.

There was a risk of misreporting or underreporting because the approach is limited to existing knowledge and occasional phone calls to WASHCOs to confirm insights, and the approach differs significantly from technology-centered solutions such as the remote sensors used in Afar. However, the method takes only an hour during a monthly team meeting, aligns with the existing financial and technical capacities of the woreda and proved a useful insight for coordinating support activities, planning, and identifying sites for follow-up visits, as part of monthly coordination meetings. The only financial cost associated with the methodology are the calls to WASHCO members to confirm or determine any change to the functional status.

The methodology was operationalized as a monthly practice. Participating staff set up accounts in the mWater surveyor app to access a custom updating survey which enables easy updating of the status for each scheme. Since September 2019, the same updating model has been applied but woredas are supported by the SWS embedded facilitator.

Over time, as the woreda split into 3 different woredas and new administrations came onboard, different teams have adopted varying methods for updating schemes, including physical visits when possible, using maintenance team reports or woreda team knowledge, and through making calls to water user association representatives or kebele leaders.

The three SWS focus woredas have all identified WWO focal persons responsible for improving monitoring, including ensuring monthly updates are complete and the data is used to inform maintenance plans. Woreda and Zonal Administration receive monthly reports on scheme functionality updates and monitoring activities are also included in the sectorial quarterly report for all woredas.

All woredas have progressed towards consistent and reliable monthly updates. Simple update templates are completed by WWO staff calling to WASHCOs and scheme operators to determine the current functionality status. Photo 1 shows the first page of the completed template for Baka-Dawla Ari Woreda between November 2020 and February 2021. Data is complete for all schemes and approved and stamped by the WWO Head.

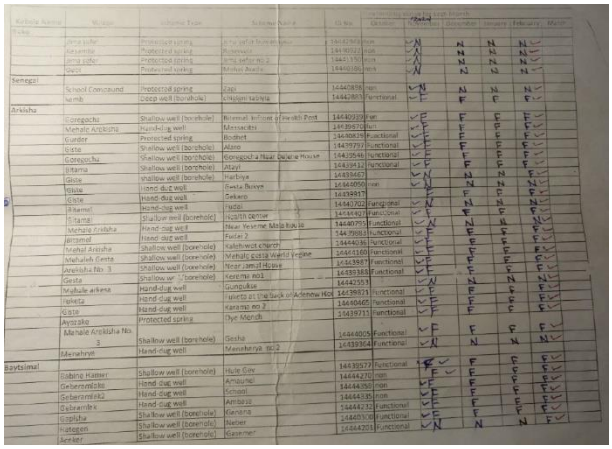


Photo 1: Baka Dawla Ari Woreda updating sheet

In addition to the paper template, WWO staff are also entering the status update into the mWater surveyor app. Progress in reporting the updates is shown in figure 21 and shows a strong frequency of reports, increasing over the period of the system operationalization. The start of the updating pilot can be seen in 2018, followed by a period of very low activity, at the time the woreda was being divided, followed by a revitalization of the updating in late 2019, at the time the focal point began engaging. A high level of engagement, whereby functionality status updates occasionally exceeded 300 unique scheme updates per month, was experienced throughout 2020. Updates have continued into early 2021, and although these are now reported with slightly less frequency, there are still about 100 updates each month.

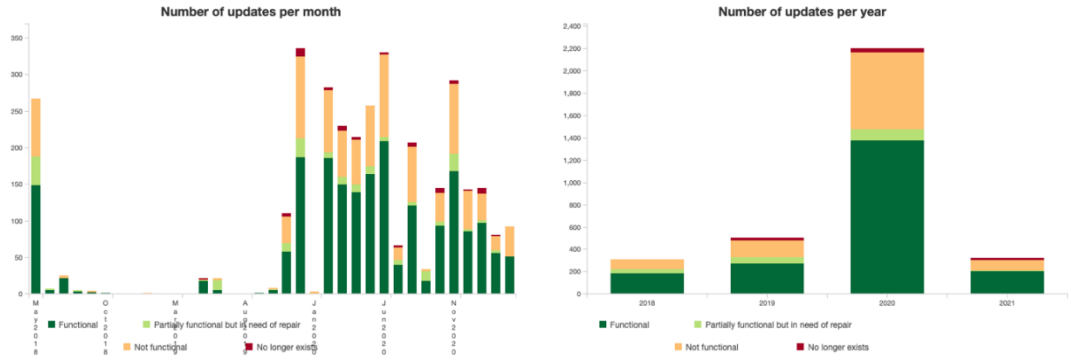


Figure 21: Number of updates per month (left) and by year (right)

A second figure highlights the extent to which functionality status updates are reported. Each day of each year is shown as a unique square, and the intensity of color is relative to the number of updates. Data shows that despite COVID and other challenges of 2020, the frequency of updating was often intense.

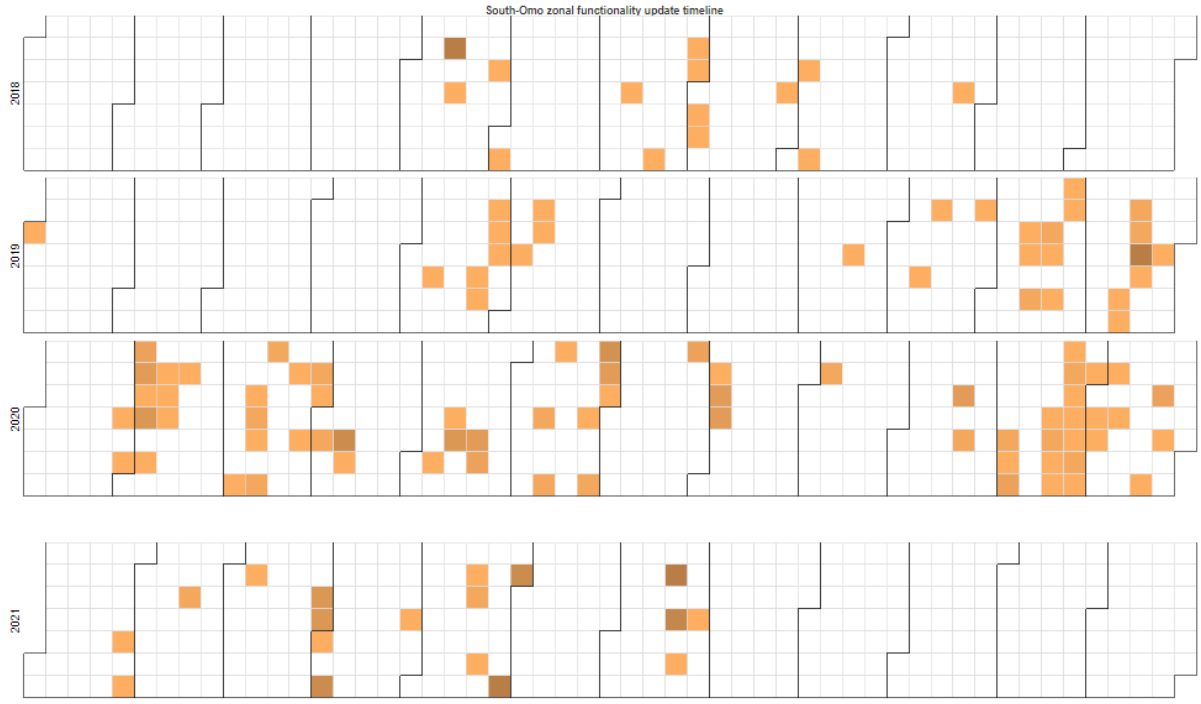


Figure 22: Timeline of functionality status updates 2018-2021

Continued development of the inventory

The South Omo water supply inventory continues to develop. In part, due to the existing woredas adding new schemes upon their construction, and in part through the process of additional woredas coming onboard with the monitoring approach.

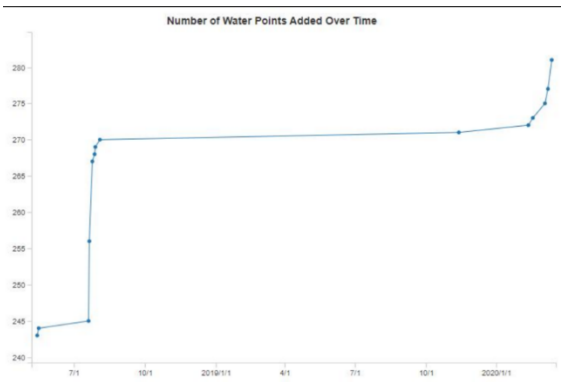


Figure 23: Number of water points added

Data made available by the South Ari baseline inventory included comprehensive details on water supply assets, scheme functionality and management, and community and beneficiary information. The same was done during the data collection in 2019 following the woredas split. Similarly, the fourth and fifth woredas (Male and Bena-Tsemay) collected in collaboration with Lowland WASH. Coming online in late 2020 the same surveys were used and the same datasets made available. Regular updates in the woredas have made the functionality status of schemes available.

Throughout the project, the methodology of updating functionality has changed from using the standard app and dropdown to using a form. This allows more detailed information on breakdowns to be collected and was done at the request of the woredas. The zone is able to manage the forms and data but is not able to manage the backend of the system.

Results in using system insights

	Results: Use
Debub-Ari, Wub Ari & Baka-Dawla Woredas	• revising existing outdated woreda data for reporting purposes, following baseline in 2017 • South Ari baseline data used in WWO maintenance planning, and planning for new construction by development partners • Use of baseline data as evidence to support annual planning resulted in increases to the water sector budget in EFY 2012, in addition to an increase for monitoring related activities • Ongoing use of functionality status reports to inform maintenance activities across the woredas • WWO use of data as evidence to support annual plans
South Omo	• Use of evidence from monitoring data to evaluate WWO annual plans • Zone and woreda both having access to the same dataset strengthened trust and communication

Data use following the baseline inventory

The South Ari asset inventory provided detailed scheme-level insight for the first time since the 2011 National WASH Inventory. The data showed that the total number of water supply schemes was 245 rather than 346, this lower number was largely due to abandoned schemes and previous overreporting.

Following the asset inventory, data was used to inform South Ari Woreda government's planning for 30 high- and medium-level maintenance activities, and the development of 29 new schemes in collaboration with zone and regional government and development partners including UNICEF and Amref.

Having established and presented reliable evidence, the South Ari Woreda capital budget for the water sector increased from 860,000 to 1,050,000 ETB in just one financial year (2012 EFY). Additionally, recognizing the value of insight generated from the asset inventory, the South Ari Woreda budget to perform monitoring, maintenance, and supervision activities was increased from 163,000 to 253,000 ETB in 2012 EFY.

For the South Omo Zonal Water Department the initial inventory dataset enabled greater trust in the maintenance, repair and construction plans submitted by the woreda and resulted in less need for triangulation with field visits. Previous woreda plans were sometimes difficult to justify because of a lack of supporting information. Having access to the data at the zone enabled better and informed decision-making and more effective resource distribution. It also helped the zone and woreda to prioritize harder to reach areas and those with the poorest service levels.

Results for data use in the woredas

Staff in South Ari and Woba Ari woredas are active in using the system and working to use the results to inform operations and planning. Baka Dawla Woreda usage was initially limited but in early 2021 the team completed an update of functionality status for all schemes.

In all woredas, information from the functionality status updates is regularly exported to Excel for analysis and reporting, and the data is being used as evidence for annual reporting requirements (in EFYs 2013 and 2014) from the woredas to the zone. Prioritization of actions is done by comparing community size with the number of schemes. Those with the largest gap are included for new construction and in cases with large proportions of non-functional schemes, maintenance and repairs are planned. Beyond annual planning, monitoring data was used in 2020 to inform the development of plans for the 10 Year Prosperity Plan and SWS led master plans for 2030.

Since 2010 EFY, monitoring data has informed the maintenance priorities. Information about broken schemes is used to inform maintenance visits and plans for support to Water User Associations. Communication between WWOs and WUAs has also improved, as woredas provide frequent updates on the maintenance activities, and share recommendations for interim measures before repairs can be delivered.

The monitoring data is available to all staff in the Woreda Water Office and the results are regularly communicated. Data is also shared with different woreda sector offices and departments in the woreda along with the zonal water department. Data was also used to inform and update government and sector stakeholders during various planning and coordination meetings at woreda, zone and regional levels as well as during the sector-wide learning alliance meetings at the woreda and zonal levels.

Results for data use in the zone

The efforts to strengthen water supply monitoring in the woredas enabled the South Omo Zonal Water Office to better evaluate annual plans and reports submitted by woredas. Similarly, woredas reported an improvement in communication and trust based on having access to the same information. South-Omo zone has been using monitoring data from SWS supported woredas for more evidence-based reporting at regional level as well as to demonstrate or justify a resource request to villages/kebeles with no or little access to a safe water supply system.

Development partners use of data

The data provided by the woreda monitoring activities has also provided development partners with insights to improve the efficiency of their interventions. The woredas worked closely with

development partners to identify communities with the greatest need for new constructions and repairs.

Through access to the dashboards, monitoring data is made available to all development organizations operating in the woredas. They include Action for Development, Catholic Church Aid, the International Rescue Committee, and regional partners such as UNICEF, who use the insights in their organizational planning, to help inform maintenance and rehabilitation works as well as planning the construction of new schemes, and general resource mobilization. For example, the International Rescue Committee used the dashboard to identify non-functional schemes, investigate problems, and resolve issues, and Action for Development has met with the woreda to understand existing schemes and assist in site selection for new schemes using the map in mWater. Table 4 highlights how data insights are used by partner organizations, and it can be observed that partners use data primarily for their own planning, in particular for new constructions. Data was also used by learning alliance partners, during the development of the Woreda WASH SDG master plans.

Table 4: Use by development partners

Partner organizations	Data use for planning	Data use for repair & maintenance	Data use for new construction
Action for Development	✔		✔
Catholic Church Aid	✔		✔
International Rescue Committee	✔	✔	✔
IRC WASH	✔	✔	
Regional level partners (like UNICEF)		✔	✔

LQ 2.2.2.: In South Ari, what are the outcomes in terms of investment and provision of maintenance?

Outcomes in terms of investment in South-Ari

	2008 E.C budget in ETB	2009 E.C budget in ETB	2010 E.C budget in ETB	2011 E.C budget in ETB	2012 E.C budget in ETB
Total woreda budget	205,484,210	132,855,780	329,248,857	204,659,770	125,845,084
Water, Mining & Energy budget	4,259,934	2,189,313	6,731,000	3,135,361	1,927,180
Water office capital budget	92,000	210,000	650,000	860,000	1,050,000

Table 5: South Ari budget 2008 to 2012 (E.C)

The woreda budget varied each year between EFYs 2009-12. The WWO capital budget increased from less than 100,000 ETB in 2008 to 1,000,000 ETB in 2013 EFY. The increased budget is due to a better understanding of financial needs based on SWS activities including data collection and planning support through the learning alliance but does not represent an actual increase in available finance. The woreda reports that they have only received money for salaries and other operational expenses, but has no additional funds, despite the budget being approved by the woreda cabinet. In 2013 EFY, due to the additional two woredas but the same zone budget, the individual woreda budgets were subsequently decreased.

Outcomes in provision of maintenance

Scheme functionality

The woredas' use of the monitoring data for planning and operation response has, in part, led to results in decreasing non-functionality of schemes. At an individual scheme level, inventory data and status updates have provided the insights for operational repair responses. Across the woredas, the level of scheme functionality changed from 60% at the time of baseline in 2017, to 65% in early 2021. However, during the same period, the rate of schemes reported as partially functional has decreased from 13 to 3% whilst the rate of non-functionality has increased. So, the resulting share of schemes which are either functional or partially functional has decreased during the project timeframe. This could be partly due to increased reporting of abandoned schemes, as well as the addition of schemes which were missed during the baseline which are in more remote areas and less likely to be functional. Additionally, more schemes have been constructed, increasing coverage, but also adding schemes to breakdown and requiring maintenance.

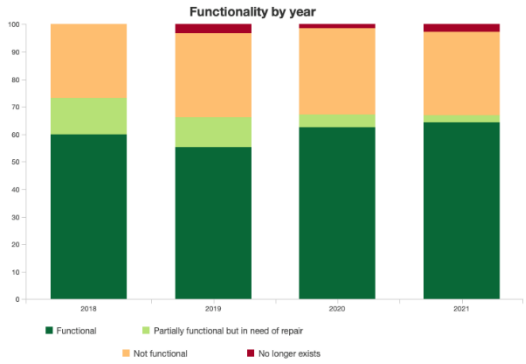


Figure 24: Functionality by year

Maintenance response

The woredas are using the data to inform scheme maintenance activities. In each woreda, the maintenance team checks the data in Excel from mWater and use the insights to prepare for maintenance. In South Ari Woreda, certain technicians are assigned to specific kebeles. These individuals have the list of schemes and the woreda uses this to coordinate the response. When a non-functional scheme is reported, the technician is assigned. The Zone also provides maintenance support that cannot be done by the woreda. They are well positioned to use the data because they have a good internet connection and can utilize the system to verify woreda requests and respond. Overall, the data has helped inform maintenance response but the result in maintenance outcomes has been limited due to continued shortages of finance, transport, and other contextual challenges.

Lessons learned: Actors and factors leading to successes and challenges in South Ari and South Omo

Results in the zone

The immediate result of the monitoring system at zonal level is creating better understanding and trust between woredas and zone. Previous arguments and mistrust over the reliability of periodic reporting data (such as the number of schemes and their functionality status) have been reduced. The other result at the zonal level is that South-Omo Zone has an example benchmark to guide them on how a monitoring system can be established, and they seem enthusiastic to implement monitoring systems in other woredas. Because of the monitoring systems in the SWS woredas, the

zonal team receives higher-quality reports from the SWS-supported woredas and subsequently has asked for more data and updates from other woredas in the zone.

The South-Omo Zone has also benefitted from monitoring related capacity building activities. The zonal team benefited from trainings as they have more opportunities to use a computer and have a better internet infrastructure than the woredas. The South-Omo zonal department also had the opportunity to present the monitoring work at a global conference when the then zonal Water and Mining department head, Mr. Hagere Belete, travelled to the Netherlands and presented the learning based on initial operational activities at the IRC WASH Symposium 'All Systems Go!' in 2019.

PART 2: STRENGTENING MAINTENANCE ARRANGEMENTS FOR RURAL WATER SUPPLY

Background on strengthening maintenance

Baseline assessments and subsequent discussions within the learning alliance platforms in South Ari (SNNPR) and Mille (Afar) at the end of 2017 and beginning of 2018 identified the weakness of maintenance approaches and capacities as critical challenges to the sustainability of rural water services. In consultation with the learning alliances, the Sustainable WASH Systems Learning Partnership (SWS) committed to support the strengthening of maintenance mechanisms in these two woredas through action research.

In South Ari (Baka Dawla Ari, South Ari, and Woba Ari[1]), rural water services are provided through community-managed hand pumps, protected springs (on-spot and with distribution systems), and a small number of motorized boreholes with limited distribution networks[2]. As per government guidelines such as the "Rural WASH regulation of SNNPR 102/2004", community-based Water Supply, Sanitation and Hygiene Committees (WASHCOs) or Water User Associations (WUAs) and their caretakers are responsible for preventive and minor maintenance of water schemes. When maintenance is beyond their capacity, WASHCOs and WUAs can call in support from the woreda water offices (South Ari Woreda Water, Mines, and Energy Office (WWMEO)), which may escalate to the Zonal Water, Mines and Energy Department (ZWMED) or Regional Water Bureau, if needed. As the number of WUAs is high, as shown in Table 6, kebele-level WUA Federations are supposed to be in place to streamline communication between WUAs and the WWMEO. WUAs pay a certain amount, typically between 20 to 50 ETB per month, to the WUA Federation to cover the costs of running the federation.

In Mille, rural water services are mainly provided through deep wells with solar, generator set, or national grid line electricity-powered pumps with small distribution schemes. Because of their technical nature, these schemes do not tend to break down with the same frequency as the point sources in South Ari, but when they do break down, repairs are often beyond the capacity of the WASHCOs, caretakers, and often even the Mille Woreda Water, Irrigation and Energy Office (WWIEO). The regional water bureau therefore plays a major role in providing maintenance and repair services.

Table 6: WUA tracking

Region	SNNPR				Afar
Woreda	Baka Dawla Ari	South Ari	Woba Ari	Total	Mille
Population	82,997	161,606	65,487	310,090	113,915
Total number of kebeles	12	31	11	51	12
Total number of WUAs/WASHCOs	48	73	19	121	20
Total number of schemes	97	178	16	282	31
Main type of water facilities	Hand pumps (60%) and springs on spot (30%)	Hand pumps (36%), springs on spot (38%) and springs with distribution schemes (16%)	Spring on spot (60%) and spring with distribution (33%)		Boreholes with distribution schemes

[1] In November 2018, South Ari woreda was split into three new woredas: Baka Dawla Ari, South Ari, and Woba Ari. All three woredas were subsequently involved in the action research.

[2] South Ari's capital Gazer is served by a utility-managed piped scheme supplied by a protected spring.

In general, the following key challenges related to maintenance mechanisms were identified by the learning alliances:

- **Low demand** for maintenance services: The willingness and ability to pay for such services by the users was low and the perception of most users was that such services were to be paid for by government or NGOs. WUAs and WASHCOs were weak and did not have the capacity to raise the funds required for preventive, minor, and major maintenance on a structural basis, nor were they motivated to do so. The established WUA Federations in South Ari did not yet act in their foreseen role in facilitating communication between WUAs and the WWMEO. In Mille, the baseline assessment shows that more than half the rural water schemes do not have a WASHCO to take up the role of service provider.
- **Low supply** of maintenance services: Volunteer caretakers, which are part of the WUAs and WASHCOs, were only able to do the most basic repairs. Although minor maintenance was supposed to be the responsibility of communities themselves, local government often stepped in to provide maintenance services.
- There was a **lack of an enabling environment** at the woreda level for ensuring and facilitating demand and supply for maintenance services: woredas are responsible for systems and procedures for ensuring ongoing (rather than one-off) capacity building of WASHCOs/WUAs, caretakers, and water users, monitoring functionality of water supply facilities, providing technical support to WASHCOs/WUAs where needed and in ensuring an enabling environment for maintenance service providers, and linking them to WASHCOs/WUAs who are in need for their services. However, woredas struggled to undertake these tasks as they lack systems and procedures to undertake these functions and are under-staffed and under-equipped in terms of logistics such as transportation facilities and budget. At the woreda level there were few or no incentives or systems to monitor and support improvements in functionality. Rather, the focus was on the construction of new water infrastructure that is immediately counted towards increasing woreda water supply coverage.

In both South Ari and Mille, learning alliances expressed interest in putting in place the capacities and arrangements needed for maintenance that are in line with government guidelines. There was also interest in strengthening supply of maintenance services beyond the woreda water offices, by putting in place spare part supply and maintenance service enterprises. During the third learning alliance meetings in July/August 2018, it was agreed that the action research would focus on operationalizing these mechanisms, studying what it takes to put these mechanisms in place (and their scalability) and whether they have the desired impact (effectiveness).

Learning questions for maintenance and the hypothesis

The following action research question was framed after the assessment of the existing practices of rural water supply maintenance and discussions among the learning alliances:

> *"How can rural water maintenance services be provided in ways that are sustainable and potentially scalable through innovations in demand, supply, and the enabling environment for maintenance services (infrastructure management building block)?"*

In line with the focus areas identified, the action research initially focused on whether strengthening the current government-led arrangements and proposed maintenance models (a combination of government, community, and enterprises) improve maintenance services.

Therefore, the current hypothesis of the Learning Partnership is that rural water maintenance services can be provided in sustainable and potentially scalable ways through:

- ***Action Area 1*: Enhancing demand** for maintenance services through capacity building (i.e., raising awareness and skills through training and coaching on the roles and responsibilities, leadership, revenue collection, and recording expenditures, etc.) and creating interest/motivation of water service providers (WUAs, WASHCOs, and caretakers) on the benefit of both preventive and responsive/curative maintenance.
- ***Action Area 2*: Enhancing supply** of maintenance and spare parts supply services through the development and strengthening of local enterprises (e.g., association of caretakers in South Ari and enterprises in Mille).
- ***Action Area 3*: Strengthening the enabling environment** by strengthening systems, capacities (in terms of human, logistical, and financial resources), and incentive structures at the woreda level related to 1) on-going capacity building of water users, WASHCOs/WUAs and caretakers; 2) monitoring functionality and WASHCOs'/WUAs' performance; 3) provision of technical support related to maintenance; 4) linking demand for maintenance to supply; and 5) recognizing, enabling, and regulating maintenance service providers.

The above actions were expected to contribute to effective and efficient maintenance services. Effective maintenance services are services which ensure low non-functionality rates and downtimes. They are financially viable and can be scaled up in a financially viable way. Figure 25 shows how the action areas are expected to contribute to effective maintenance services.

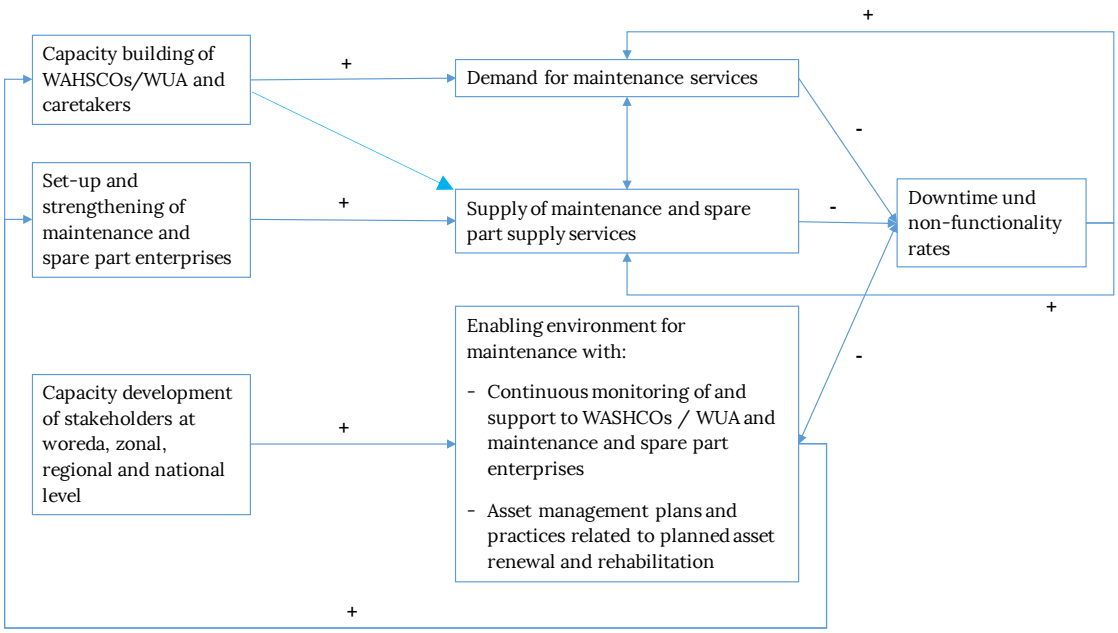


Figure 25: Expected relations between activities, action areas, and outcomes in strengthening maintenance

Action Area 1: Creating demand for maintenance services through capacity building of WASHCOs and WUAs

The action and research design

Under this action area, SWS intended to enhance demand for maintenance and spare part services from small and medium-sized enterprises by building the capacity of WASHCOs, WUAs, WUA Federations, and caretakers. Capacity building was expected to stimulate WASHCOs and WUAs who in turn create user demand for sustainable water services and to raise awareness and willingness of users to pay for sustainable water services. The hypothesis was that if users appreciate the provided water services and if WASHCOs/WUAs have a clear understanding of their roles and responsibilities, it would motivate them to contribute to ensuring schemes are well maintained and provide sustainable services. In addition, capacity building was expected to improve financial management capacity and practices of WASHCOs and WUAs. Together with increased willingness to pay, this would lead to an increase in revenues which could increase the demand for spare part and maintenance services.

In the absence of small and medium spare part supply and maintenance enterprises, local caretakers, which are part of the WASHCO/WUAs, were considered as a transitional solution for ensuring preventive and minor maintenance. Enhanced technical capacity of caretakers was expected to lead to better preventive and minor maintenance. This was expected to decrease the demand for maintenance services by enterprises because skilled caretakers could take the role of maintenance enterprises or compete with them but increase demand for spare part supply.

Figure 26 gives an overview of the expected intermediate outcomes of the action. It also shows "Ability to pay" as an important moderating variable, influencing whether an increase in user awareness and willingness to pay and improved financial management will lead to increased WASHCOs/WUAs revenues.

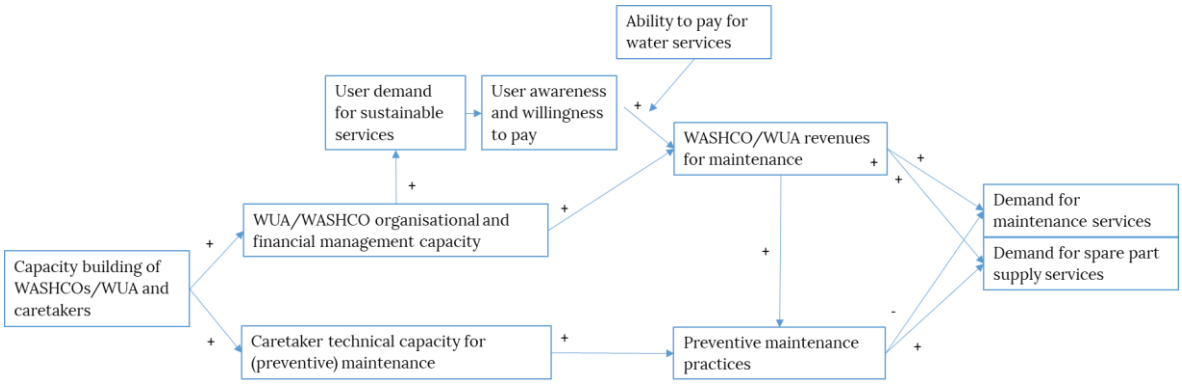


Figure 26: Theory of change action area 1

This part of the action research is intended to answer the following research questions:

- Does capacity building of WASHCOs/WUAs contribute to…
  - …better organizational and financial management?
  - …more awareness and willingness to pay by users?
  - …higher revenues for financing maintenance services?
  - …better preventive maintenance practices?
  - …more demand for maintenance and spare part supply services?

The action and research activities

Figure 27 presents an overview of the main actions undertaken under action area 1.

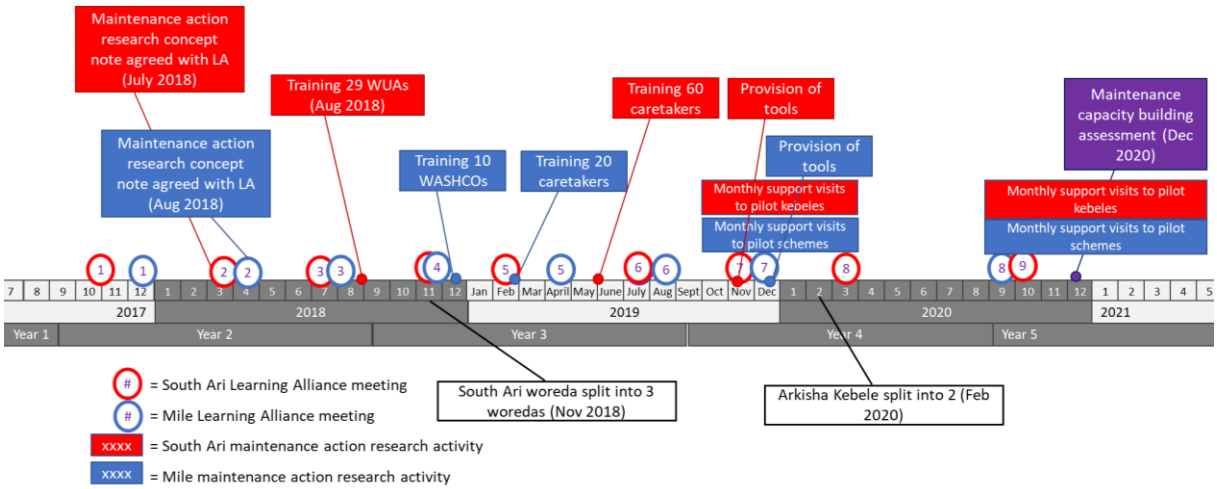


Figure 27: Timeline action area 1

In order to study the effect of capacity building of WASHCOs and WUAs on maintenance and spare part supply, **pilot areas were selected** in the SWS focus woredas South Ari and Mille following the agreement on the maintenance action research concept notes during the second learning alliance meetings in both woredas. Three of the (originally) 50 kebeles in South Ari were selected in June 2018 as pilot kebeles by SWS in close collaboration with the Zonal Water Department: Arkisha, Shisher and Maytol. These represent high, medium, and low performing kebeles respectively, as identified by the members of the learning alliance. Both potential performance of WASHCOs/WUAs and distance from town (Jinka) were considered as selection criteria for the pilot kebeles. Since the division of South Ari into three woredas in mid-2019, one kebele (Arkisha) is located in Baka Dawla Ari Woreda, while the other two are in South Ari Woreda. As shown in the map in Figure 28, Arkisha is located next to Jinka town and connected to the town by an asphalt road. Shisher is connect to Gazer by an unpaved road, while Maytol is connected to both Jinka and Gazer by a mostly unpaved road. All 14 WUAs in Arkisha, nine of the ten WUAs in Shisher, and six WUAs in Maytol, as well as the three kebele-level WUA Federations, were selected for the capacity building pilot. As shown in table 7 these WUAs manage a total of 42 hand pumps and protected springs (with predominantly hand pumps in Arkisha and Maytol and predominantly protected springs in Shisher).

In Mille, 10 of the 31 water schemes were selected as pilot schemes for the maintenance action research at the third learning alliance meeting in August 2018. These ten rural water facilities are found in seven of the 12 kebeles within the woreda. These include three hand pumps, three boreholes with solar pumps, and four motorized boreholes (see table 8). Five of the selected schemes can be found near the road from the woreda capital Mille to the regional capital Semera.

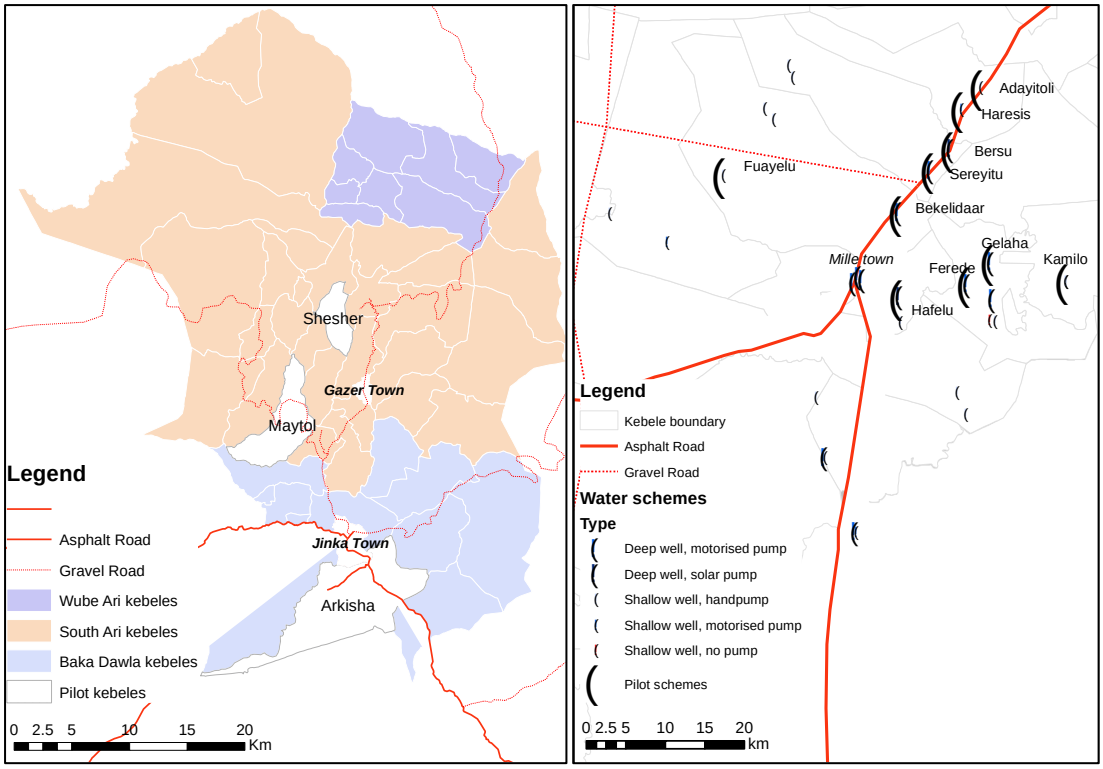


Figure 28: Pilot areas in Baka Dawla Ari and South Ari (left) and Mille (right)

As shown in table 7, the average number of households per water scheme is considerably higher in Mille than in the south woredas. However, it should be noted that the number of users in Mille differs from month to month because of the pastoral nature of the woreda.

Table 7: Overview of the pilot areas

Region (Zone)	SNNPR (South Omo)				Afar
Woreda	Baka Dawla	South Ari		Total	Mille
Kebele	Arkisha	Maytol	Shisher		
Number of active WUA/WASHCO	14	5	8	26	10
Total number of water schemes managed by WUAs/WASHCO	21	7	14	42	10
Average number of households per water scheme	59	39	40		81

Table 8: Overview of selected pilot schemes, Mille

Kebele	Village/Tabiya	Scheme type
Geraro & Ayibelo	Hafalu	Solar pump
Gesiyu & Le-as	5th camp (Bersu)	Solar pump
Bekele de-ar & Abeledera	Bekele de-ar	Solar pump
	Feayilu	Hand pump
Diyile & Geraru	Kamilo	Hand pump
	Ferede	Motorized
Hintimeyita & Hidel	Seraytu	Motorized
Seneas & Kesertu	Geleha	Motorized
Harsis & Bede-alo	Harsis	Motorized
	Adayhale	Hand pump

Members of the selected 29 WUAs and three WUA Federations in the three South Ari and Baka Dawla Ari pilot kebeles and the ten pilot WASHCOs in Mille were trained in the second half of 2018. Capacity building of service providers was done through a Training of Trainers (ToT) approach, where the regional water bureau, with the support of SWS, trained woreda and zonal staff who in turn trained WUAs, WASHCOs, and caretakers.

Caretaker training took place in the first half of 2019. The caretaker training in South Ari focused on preventive and minor maintenance of motorized water schemes, hand pumps and protected springs and included minor maintenance and repair of the generator set for motorized schemes. The training of trainers was provided by technical staff from the region. A total of four staff from the Zonal Water Department and four from the WWMEO, including the heads of both organizations, were trained. They in turn trained a total of 60 caretakers in the three pilot kebeles. In Mille, two WWMEO Monitoring and Evaluation (M&E) staff members and four WWMEO technical staff members were trained by regional staff in collaboration with CARE International's Afar Office and SWS. The four trained technical staff members visited each of the ten selected pilot schemes and trained two caretakers at each of the schemes.

Table 9: People trained

Woreda (Region)	South Ari Woreda (SNNPR)	Mille Woreda (Afar)
Number of woreda and zonal staff trained	8	6
Number of WUA/WASHCO members trained	160	50
Number of caretakers trained	60	20

The ToT approach was done to build capacity of woreda water office staff so they could provide ongoing follow-up training and even possibly scale the training to other kebeles. It also ensured that the training for WUAs, WASHCOs, and caretakers was provided in the local language.

Following the training of WASHCOs, WUAs, and caretakers, members of the learning alliances in South Ari and Mille realized the need for proper **maintenance hand tools** which were needed for caretakers to put their newly acquired skills into practice. During the sixth learning alliance meeting in both woredas it was agreed that these would be procured through SWS and made available to trained caretakers. Hand tools were provided in November and December 2019 in South Ari and Mille, respectively. The donation was done on the basis of the government's asset management system and tools were given to the woreda water offices who made them available to their trained caretakers.

In addition to the importance of hand tools, SWS recognized the importance of **regular follow-up support** from the woreda level to trained WUAs, WASHCOs, and caretakers to ensure sustainable water service provision. In order to support the woredas in undertaking such follow-up support, local facilitators recruited by SWS were stationed at Jinka (supporting Baka Dawla Ari, South Ari, and Woba Ari) and Semera (supporting Mille) in mid-2019. They arranged monthly support visits to each pilot water scheme in October 2019, together with an assigned scheme management focal person from the Woreda Water Office to provide technical support to the WUAs/caretakers. The activity had to be suspended in March 2020 because of the outbreak of the COVID-19 pandemic and the related travel restrictions but resumed in August 2020.

Related to the regular follow-up with trained WUAs and WASHCOs, SWS facilitated the **on-going tracking** of finances (revenue and expenditures), requests for and responses to maintenance, and scheme functionality from the pilot WASHCOs and WUAs. This data is to inform follow-up action from the woreda level and beyond and increase accountability. In Baka Dawla Ari and South Ari,

the pilot WUA Federations report on the performance of the WUAs to the learning alliance meetings. Although the support visits had to be discontinued because of the pandemic, WUAs continued to provide data.

The ongoing WUA and WASHCO tracking data provided SWS with data for assessing the impact of its interventions. Another source of information on the impact of the activities under action area 1 was the **maintenance capacity building assessment** which was undertaken by SWS in December 2020 to inform subsequent trainings[3]. Finally, as common in action research, **process documentation**, mainly facilitator's diaries with dated activities and observations as recorded by SWS, provided invaluable information for understanding the impact of actions.

Results and outcomes

This section explores how the above-mentioned activities have contributed to the following expected results/outcomes in the South Omo pilot kebeles and Mille pilot schemes:

1) Improved organizational capacity of WUAs and WASHCOs
2) Improved user awareness and willingness to pay
3) Improved WUA/WASHCO financial management capacity
4) Increased WUA and WASHCO revenue
5) Improved connections between WASHCOs/WUA and woreda water offices
6) Improved preventive maintenance capacities and practices
7) Change in demand for maintenance and spare part supply services

Organizational capacity of WUAs and WASHCOs

Results:

The findings show that the combination of training WUAs, stakeholder involvement in learning alliance meetings, and monthly follow-up and tracking of WUA performance has had a positive impact on the organizational capacity and performance of some WUAs (about a third). However, more than two years after the trainings, interest of the WASHCOs' and WUAs' members to engage in voluntary activities had dwindled. Support activities need to be provided on a continuous basis in order to have the desired, sustained effect.

The Water Scheme Administration Guideline issued by SNNP's Regional Water, Irrigation, and Energy Bureau, clearly describes the roles and responsibilities of all WUA members including the ones in the South Ari and Baka Dawla Ari pilot kebeles. The WUA training in August 2018 aimed to explain the collective and individual roles and responsibilities of WUA and Federation members in scheme management. In December 2020, at the time of the maintenance capacity building outcome and gap assessment[4] , all but two of the trained WUAs were found to have copies of the guideline, which was the provided at the WUA training. However, only about half (14 of the 28 assessed WUAs) reported understanding the guidelines and about half reporting that they use and refer to the guidelines in their operations. A reason for that was the fact that the training had not covered all major components of the guideline and participants had been advised to read the guideline after the training. However, many WUA members are not able to read. Almost two-thirds (63%) of the 28 assessed WUAs consider themselves weak in their activities and achievements.

Nevertheless, there is also (anecdotal) evidence that SWS action research activities under action area 1 have had positive impact on the set-up and organizational capacity of WUAs. Examples of these are presented in box 4 on the following page.

[3] IRC WASH Ethiopia. 2020a. South Ari maintenance capacity building outcome and gap assessment report and IRC WASH Ethiopia. 2020b. Mille Woreda WASHCOs scheme administration assessment report
[4] IRC WASH Ethiopia. 2020. South Ari maintenance capacity building outcome and gap assessment report

Following the WUA training in August 2018, the Arkisha WUA Federation organized meetings with its WUAs to discuss progress and challenges and to share best experiences among the different WUAs. The Federation also graded the WUAs based on their performance. The best performing WUA was invited to the learning alliance meeting to present their performance as an incentive. However, by October 2020, the Federation was no operational and WUAs requested the Woreda Water Office to reconstitute the Federation. All 14 WUAs participated in the new Federation meeting, thanked the former Federation members, and elected three new members.

Similarly, in November 2020, the South Ari water office and SWS facilitator visited Maytol Kebele Federation and WUAs as part of the monthly scheme management support. The team observed poor scheme management by many WUAs. This was discussed at a meeting at the kebele center in which all WUAs and federation members participated. Participants agreed to re-establish and strengthen the Federation by electing seven new members.

As part of the monthly support visit to SWS pilot WASHCOs, in February 2021, a Mille Woreda Water Office representative and the SWS facilitator, with the support from Woreda Administration, visited each of the pilot WASHCOs and their respective kebeles (Harsis, Ferede, Hafelu, and Kamilo). It was observed that following the WASHCO training in December 2018, members had been very active and initiated scheme management services. However, with the schemes suffering breakdowns at different parts of the transmission pipe and of the motor, the commitment of members decreased, and members left their activities when the schemes were not maintained for long periods. For example, Geseyun solar scheme was non-functional for more than ten months in 2020.

The assessment of Mille Woreda WASHCOs' scheme administration in December 2020 found that by then none of the capacitated WASHCOs feel they are successful in managing their water schemes. WASHCO members tend to quit as soon as schemes break down. Committee members lack clarity on their roles and responsibilities as most of them are either not active or new members.

During their visit to Arkisha Kebele in January 2020, the SWS facilitator and Baka Dawla Ari Woreda community mobilization officer observed weak financial management by some WUAs. They noted that four WUAs did not have a user registration book nor a savings account and were instead keeping the collected monthly users fee as cash-in-hand. After several monthly follow-up visits to these WUAs, three of the four started registering water users in the new registration book, had opened saving accounts at the Commercial Bank of Ethiopia, and had started collecting monthly user fees on a regular basis.

The Giste Kerma Kutir-2 shallow well in Arkisha Kebele had been constructed eight years ago under the WUA Federation on the land of a private farmer. There had been long-standing problems with right-of-way related to this scheme. In July 2020, the WUA, strengthened through monthly support visits, engaged in discussion with the farmer. Areas were identified for walkways and fencing of the scheme. The WUA took care of the fencing, repairs of the lockable door, daily cleaning of the scheme, monthly fee collection, and registration of financial records.

When Arkisha Kutir-3 WUAs observed the slab of the shallow well had eroded because of ageing and needed rehabilitation they addressed this issue with woreda water office staff during a monthly visit, requesting a cost estimate for the required repairs. The WUA contributed to the costs of the repairs from their savings which amounted to about ETB 29,000 (about 800 USD).

Box 4: Examples of how regular monthly support to WUAs brought change in Arkisha

User awareness and willingness to pay

Results:

The findings from South Omo, and to some degree from Mille (Bekelidaar WASHCO), show that capacity building of WASHCOs and WUA has resulted in WASHCOs and WUAs registering users, organizing meetings with users, and increasing tariffs. Increased payment of tariffs can be seen as evidence of increased willingness to pay. However, close follow-up and regular discussions with users were found to be essential.

Following the WUAs training, WUAs in **South Ari and Baka Dawla Ari** organized community dialogues about water scheme sustainability challenges. During these meetings, users agreed to increase user fees (tariffs) from 2-5 ETB to 10-15 ETB per month per household and to register users in water fee collection books.

According to these fee collection books, the proportion of households that pay the WUAs for their water amounted to 93%, 96% and 97% in Arkisha, Maytol and Shisher, respectively in the period November 2019 - February 2020. However, as shown in figure 29, the proportion of households paying for water services dropped in March 2020, especially in Shisher and Maytol. By January 2020, 67%, 73% and 83% of households were reported to pay for water services in Shishir, Maytol and Arkisha, respectively. At the start of the COVID-19 pandemic, a decrease in the percentage of households paying for water was clearly observed. The restriction by the government on gatherings resulted in WUA members losing the momentum, motivation, and commitment to actively ensure that households pay for their water services.

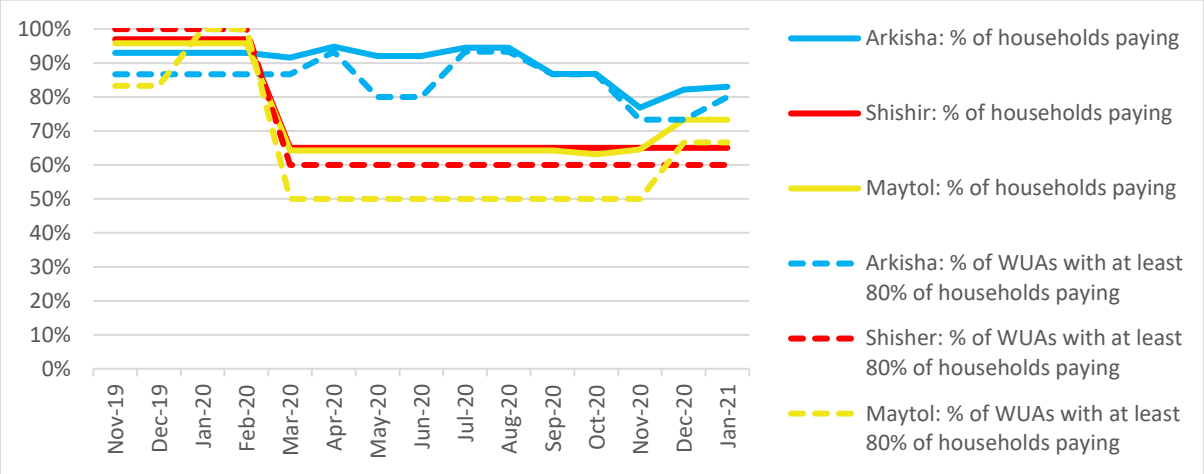


Figure 29: Proportion of households paying for water use

In **Mille,** on the other hand, water user awareness and willingness to pay have remained low, even after training the WASHCOs. Although the motorized nature of many of the schemes in Mille implies that there should be ongoing revenue collection from users to pay for the required fuel or electricity, there are no WASHCO bylaws obliging household to pay water fees. Water users still commonly believe government is supposed to provide water services, including taking care of and paying for maintenance. Indeed, because of the complex nature of the schemes in Mille, maintenance is commonly handled by the regional water bureau, rather than by the WASHCOs. As per the regional draft water schemes administration guideline, all WASHCO members should be elected from and by the user community during a user meeting. However, the assessment of the Mille Woreda WASHCOs scheme administration (IRC, 2020b[5]) found that only 60% of WASHCO members were elected by the user community in the presence of Woreda Water Office

[5] IRC WASH Ethiopia. 2020b. Mille Woreda WASHCOs scheme administration assessment report

and kebele leaders, while the remaining 40% were assigned by kebele chairpersons. Committee members assigned by kebele chairpersons are often not living in the villages where the water scheme is found (e.g., three members of the Hafelu WASHCO live in Mille town rather than in the village) and turnover of these members is very high. These WASHCO members are often not active and do not have a strong relationship with the water users. As a result, in general, the capacitated WASHCOs of the pilot schemes in Mille have not been successful in increasing user willingness to pay.

In Bekelidear, however, following a WASHCO meeting, community members have committed to pay for their water use for the past 38 months (EFY 2010 2 months, 2011, 2012, and 2013). As a result, the WASHCO collected ETB 34,200 from the users, an average of 900 birr per month, or about 19 birr per household per month. This shows the importance of regular follow-up and awareness creation for communities to understand their scheme management.

Willingness to pay for water use is low. Even if there is an observable change around thinking about paying for water and scheme maintenance, there is no regular and fixed payment for water in the pilot water schemes and most households also do not pay for water. This is because most WASHCOs are inactive and there are no bylaws to oblige households to pay.

WUA/WASHCO financial management capacity

Results:

The findings from South Omo show that capacity building of WUAs has led to better financial management in terms of the presence of tariffs, dedicated accounts, and up-to-date financial records. However, this has not been the case in Mille. This was caused by several contextual factors, including the absence of micro-finance facilities and low ability and willingness to pay, as well as factors like the higher technical complexity of water schemes and practice of government-supported maintenance.

Comparing the baseline data and WUA tracking data shows that the financial management of WUA in South Ari and Baka Dawla Ari has improved over time. As shown in Table 10, there has been an increase in number of WUAs setting tariffs, opening bank accounts, and keeping up-to-date financial records.

Table 10: Financial management

	Arkisha Kebele			Maytol Kebele			Shisher Kebele			Mille Woreda		
Indicators	Baseline*	November 2019	January 2021	Baseline*	November 2019	January 2021	Baseline*	November 2019	January 2021	Baseline*	December 2019	January 2021
Number of WUA/WASHCOs tracked	14		15	6			10			10		
Number of WUAs with tariff	14	14	14	4	5	5	0	8	8	4	4	5
WUAs with bank or micro finance account	4	8	12	2	5	5	0	7	8	0	2	3
WUAs with up-to-date financial records	≤4	8	13	≤2	5	5	0	7	8	0	0	3

*Source of data: Asset inventory in South Ari and Mille woredas (March 2017)

In Mille, on the other hand, there has been no considerable improvement in the capacity of WASHCOs and their financial management. Only four of the ten trained WASHCOs have set a tariff and only three have opened a bank account. Unlike in the South Omo pilot kebeles, no microfinance institutions are available at the kebele level in Mille. The Commercial Bank of Ethiopia is only found in Mille town. Therefore, depositing revenues requires additional travel costs. As a result, none of the WASHCOs with bank accounts make regular deposits. Only a few WASHCOs have tariffs in place and most WASHCOs collect revenues on an ad hoc basis (e.g., to

pay for fuel), with many users contributing in kind rather than cash (e.g., by providing fuel or a goat).

WUA and WASHCO revenues

Results:

Improvement in financial management in combination with increased willingness to pay for continuous water services has increased WUAs revenues and savings in the South Ari and Baka Dawla Ari pilot kebeles. Saved money can be used for procuring spare parts and maintenance services. However, so far, expenditure has been low. Care should therefore be taken that revenue collection does not become an end goal in itself, but rather is a means towards ensuring availability of sufficient funds for procuring spare parts and maintenance services when needed. In Mille, there is no clear evidence of increased revenues and savings, in line with the lack of improvements in willingness to pay and financial management.

Since the beginning of WUA tracking, revenues of pilot WUAs in South Ari and Baka Dawla Ari have far outweighed the expenditure, as shown in figure 30. As a result, the amount of money saved by WUA has been increasing, especially in Arkisha.

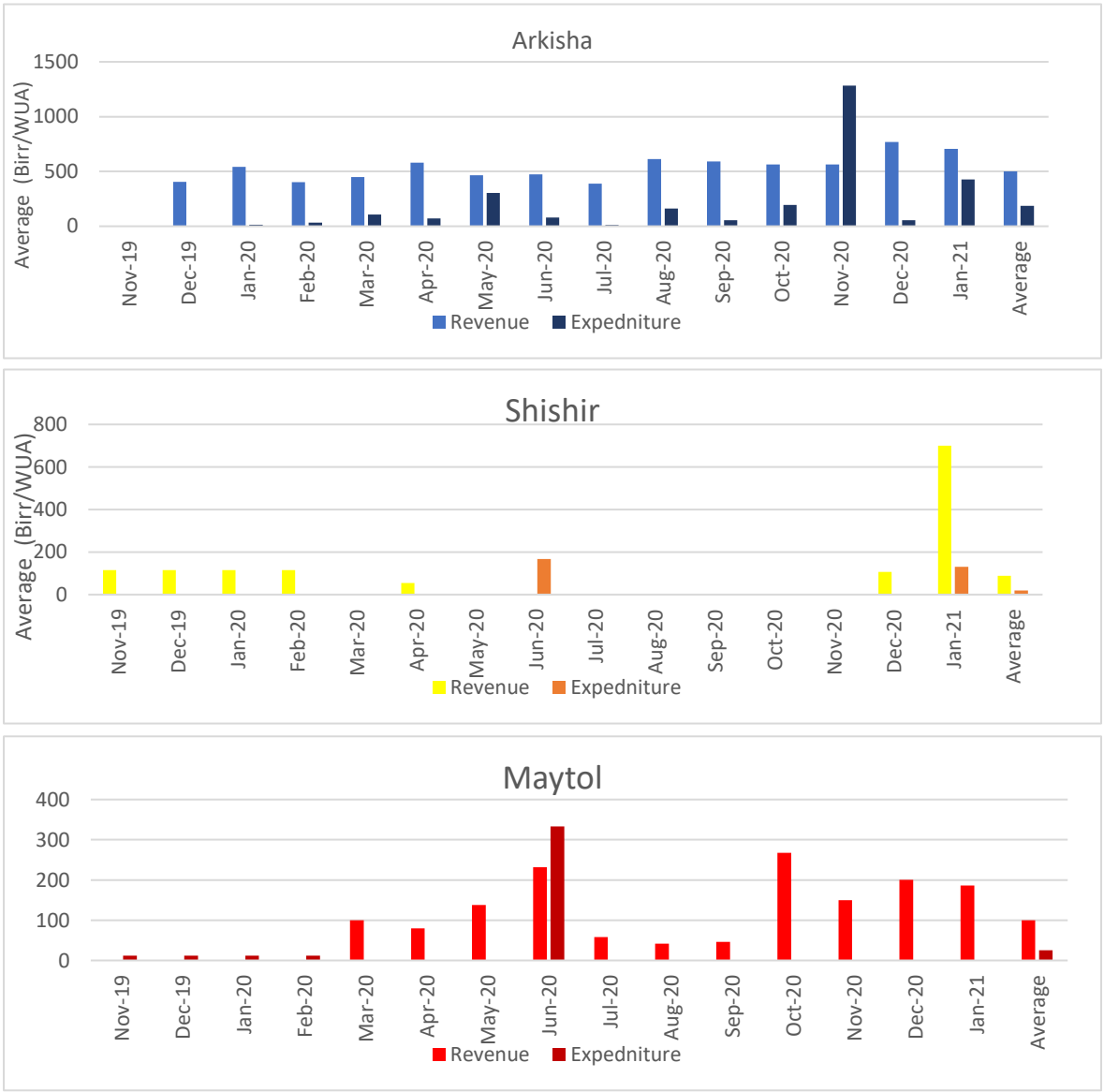


Figure 30: Average monthly revenue and expenditure per WUA

The amount of money available in the WUA savings accounts in Shisher, Maytol and Arkisha has increased considerably since the WUA training, as shown in Figure 31. The figure also presents the average amount saved per WUA with savings. It shows that the amount saved per WUA in Shisher is considerably lower than in the other kebeles. This is because WUAs in this kebele only started saving money after the WUA training in August 2018 and because of the limited number of user households who are relying on improved water supply sources due to the presence of many springs in this kebele.

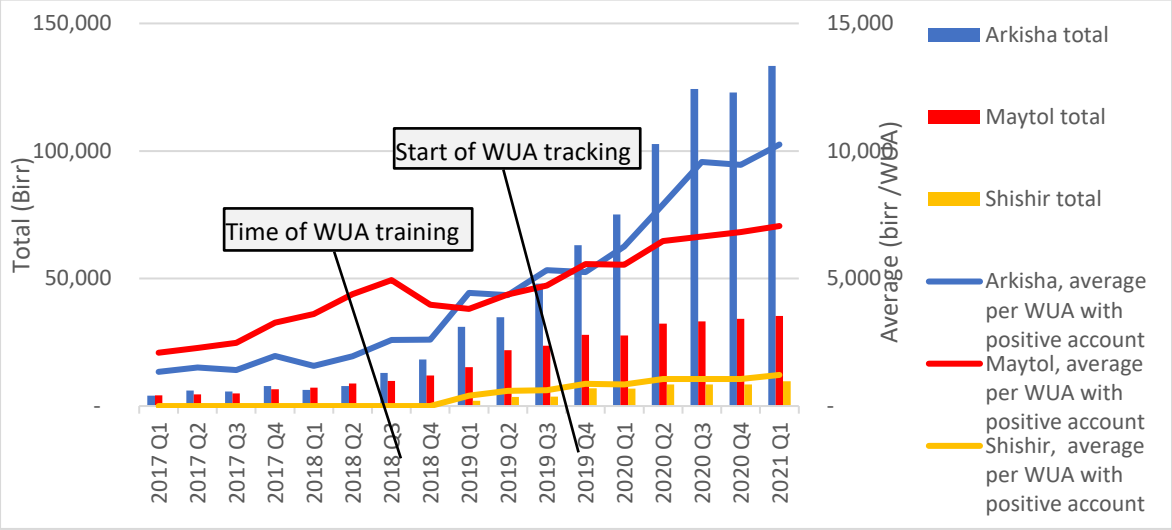


Figure 31: Amount available in WUA accounts (total and average per WUA with positive account)

As shown in Figure 32, the proportion of WUAs with savings has increased considerably since the training of WUAs in the third quarter of 2018 and increased even more after the start of the WUA follow-up and tracking in October 2019. Since the first quarter of 2020, there has been little change, with the majority of WUAs having savings.

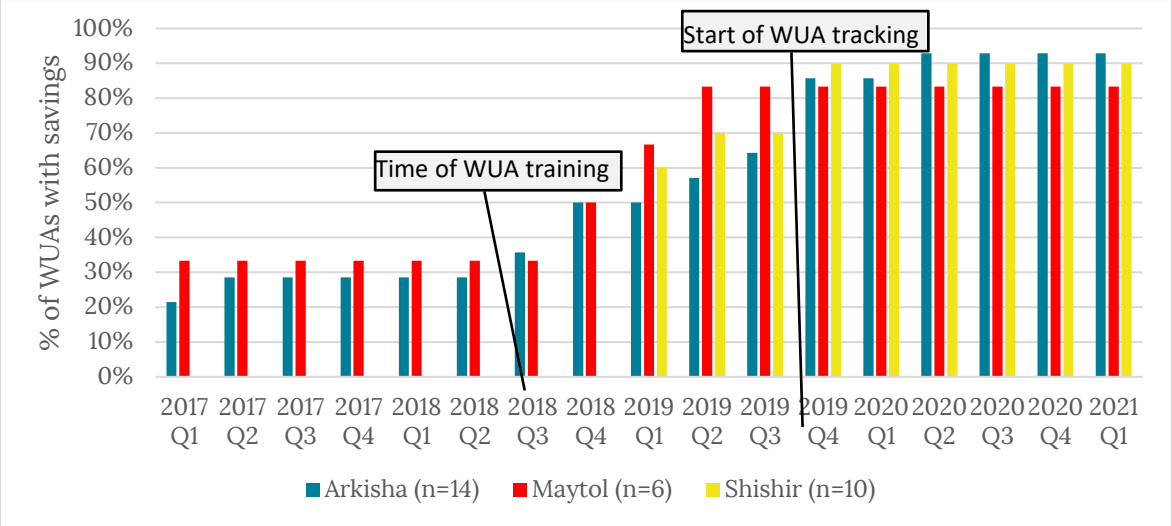
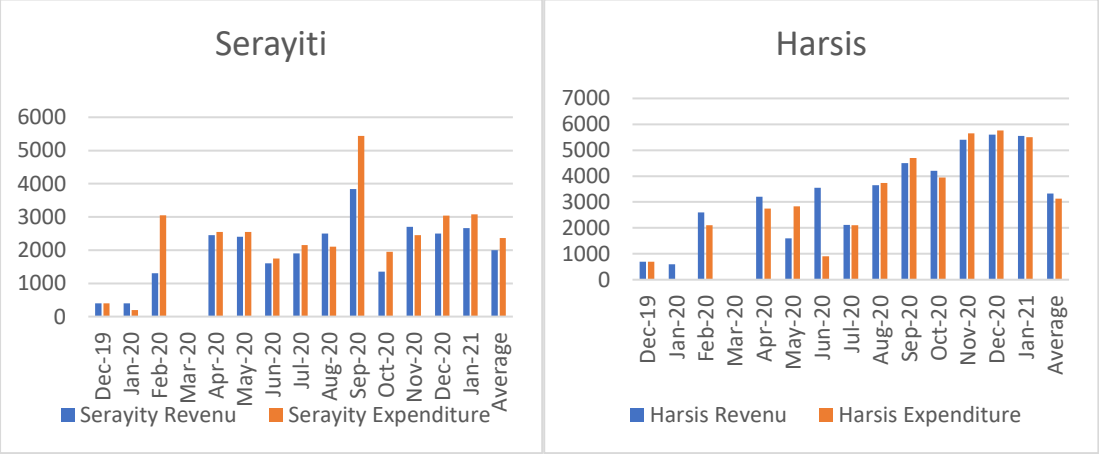


Figure 32: Proportion of tracked WUAs with positive account

In **Mille**, data on monthly revenue and expenditure has only been consistently available from two WASHCOs since the start of WASHCO tracking: Serayitu and Harsis. At about 2000 and 3000 birr per month for Serayitu and Harsis, respectively, average monthly revenues of these two WASHCOs exceed the average monthly revenues of the Arkisha and Shisher WUAs, which amounted to about 500 birr per WUA per month. However, unlike in Arkisha and Shisher, revenue does not outweigh

expenditure (by a lot) and tends to be close to the revenues. This is related to the differences in scheme type and numbers of users. The schemes in Serayitu and Harsis are motorized boreholes, which, unlike the hand pumps and protected springs in Arkisha and Shishir, require fuel. In some communities, users contribute in kind to the operational costs. In Geleha, for example, users take turns supplying five liters of fuel which costs around ETB 130 (3 USD). Most WASHCOs in Mille only collect user contributions when the scheme fails. The amount to be collected is decided by WASHCOs on a case-by-case basis and is supposed to cover spare parts, transport costs, and per diems of woreda staff that provide technical support. For example, at Fayilu, households with many animals paid ETB 100 while others paid ETB 50 when the scheme had broken down and needed repairs.

It is therefore not surprising that WASHCO savings in Mille are limited. Although there are three WASHCOs who have opened a bank account, none of the ten pilot WASHCOs have started depositing money into the account. Detailed revenue and expenditures per month are available from Serayiti and Harsis in Figure 33.



*Source of data: WASHCO tracking

Figure 33: Revenues and expenditure Serayiti and Harsis woreda

Improved connections between WASHCOs/WUA and woreda water offices

In **South Ari**, the monthly scheme status reporting template was developed based on the suggestion from the learning alliance meeting. The reporting template was distributed to all trained WUAs by Woreda Water, Mines and Energy Office through facilitation of IRC WASH. But the use of the template to report from WUAs to federations is very poor. Only 18% of WUAs report using the template and the other 82% do not report the status of their scheme. Some of the reasons mentioned for not reporting are WUAs with the template lack understanding in filling it in and reporting is not mandatory as there is no monthly report requested from the Federation. The Federation does sometimes come to WUAs to request scheme information. The most common reporting by WUAs is requesting support when there is a breakdown. In Mille, the same template was developed but its use to communicate is also poor although information is provided orally upon request[6].

Preventive maintenance capacity and practices

Results:

Caretaker training has resulted in caretakers taking up their role in preventive maintenance, especially following the procurement and distribution of hand tools.

[6] IRC WASH Ethiopia. 2020. Mille Woreda WASHCOs scheme administration assessment report

Following the caretaker trainings in 2019, WUAs in South Ari committed to undertake preventive maintenance on a monthly basis in line with the best practices taught in the caretaker training. The procurement of maintenance hand tools to facilitate preventive and minor maintenance repairs also contributed to improved preventive maintenance, especially of the AfriDev hand pumps in Arkisha Kebele. This includes cleaning the water point, improving the fencing around the water supply facilities, and replacing spare parts such as u-seals.

The trained caretakers have been discharging their responsibilities and have been progressing well as reported during learning alliance meetings and monthly performance monitoring. South Ari Woreda, in collaboration with the woreda administration, has provided certificates of recognition as motivation for two champion caretakers.

Photo 2: Certificate award by South Ari woreda for champion caretakers in Arkisha

In **Mille**, caretakers are mainly responsible for operation and preventive maintenance of schemes, while maintenance is often beyond their technical and financial capacity. The regional water bureau plays a considerably larger role in maintenance in Mille than in South Omo.

Following the caretaker training in Mille in February 2019, the Woreda Water Office assigned three to four kebeles to each of the three woreda technicians. With support from SWS, these technicians were to regularly visit the WASHCOs. These support visits by the SWS facilitator and woreda technician allowed caretakers to ask questions about preventive and minor maintenance. This has improved preventive maintenance practices, especially for boreholes with motorized pumps. These types of schemes require frequent operation and preventive maintenance. Preventive maintenance of hand pumps and solar pumps was considered as less important.

"The maintenance request to the Woreda Water Office from the SWS pilot kebeles has reduced following the training and provision of maintenance hand tools. WUAs and federations have not requested maintenance except when the schemes required major maintenance beyond the capacity of the caretaker."

Ato Yohanis Melti
South Ari WWMEO Head

During the sixth Mille Learning Alliance meeting in August 2019, some schemes' caretakers were reported to have started doing more preventive maintenance than before. This included changing oil and fuel filters, battery acid and water, corrective work on vibrating generators, cleaning solar panels, fencing and preventive work on pollution and flood protection, fixing leaking elevated reservoirs, and trying to fix exhaust manifolds of generators.

Demand for maintenance services

Results:

Demand for external maintenance services seems to have decreased, rather than increased. This is mainly due to the increased capacity of caretakers to undertake preventive and minor repairs. This was especially in South Ari and Baka Dawla Ari, but less so in Mille.

As a result of improved caretaker and WUA capacities, and improved preventive maintenance, WUAs and federations have reported in interviews that the request for maintenance support to the South Ari WWMEO has gone down as the capacity of the WUA and caretakers to undertake maintenance has increased.

Table 11 gives an overview of the average monthly maintenance and spare part requests from the WUAs to the WWMEO from November 2019 to January 2021. Based on this, annual maintenance requests are estimated to range from six in Woba Ari, 23 in Baka Dawla Ari, and 28 in South Ari, and spare part supply requests range from five in Woba Ari, 18 in South Ari, and 25 in Baka Dawla Ari. Data from Mille Woreda on number of maintenance requests was available from the Afar Asset Management System. This showed a relatively high number of requests per month up to April 2020 (the beginning of the COVID-19 pandemic), ranging from zero to nine requests per month, with an average of 2.1 request per month over the 23-month period. Following the beginning of the COVID-19 pandemic, the number of requests through the ASM dropped, resulting in an average of 1.4 requests per month in the period November 2019-January 2021.

Table 11: Average monthly maintenance and spare part requests to woredas (Nov. 2019 – Jan. 2021)

	Baka Dawla Ari*	South Ari*	Woba Ari*	Mille**
Average number of maintenance requests per month	2.3	1.9	0.5	1.4
Average number of spare part requests per month	1.5	2.1	0.4	NA

*Source of data: WASHCO tracking

**Source of data: Asset Management System Afar Region, Mille data

Reflection on learning questions

Here we reflect on the learning question of action area 1:

> *Does capacity building of WASHCOs/ WUAs contribute to more awareness and willingness to pay by users, better financial management, higher revenues for financing maintenance services, and better preventive maintenance practices, and does this lead to an increase in demand for maintenance and spare part supply services?*

The above presented results have shown that WUA and WASHCO capacity building activities have had a positive effect on the organizational capacity of WUAs and WASHCOs, allowing them to engage with water users in order to increase awareness and willingness to pay. Improved willingness to pay and financial management of WUAs and WASHCOs have increased WUAs' and WASHCOs' revenues, especially in South Ari and Baka Dawla Ari. Capacity building of caretakers and ensuring they have the tools they require to put their newly acquired skills into practice has had a positive effect on caretakers undertaking preventive and minor maintenance. This has all contributed to an increase in demand for sustainable, well-maintained water services from community members and to increased ability of local water service providers to provide such services.

However, one-off standalone capacity building activities are unlikely to ensure sustainable water service provision by WUAs/WASHCOs. Systemic, regular support, (re-) training follow-up from the local government (kebele chairman and woreda technicians) is very critical. Improved willingness to pay and financial management of WUAs and WASHCOs have increased WUA and WASHCO revenues, especially in South Ari and Baka Dawla Ari.

Incentives like certification, recognition, or a small payment will encourage WUAs/WASHCOs to perform their voluntary work.

SWS has tried to address this issue in multiple ways including the ToT approach involving woreda staff and by promoting and facilitating monthly follow-up visits in the pilot areas. But the training has not led to institutionalized systematic refresher trainings for WASHCOs/WUAs, and caretakers and the sustainability of ongoing support is questionable. Furthermore, certification, recognition, and/or a small payment which could serve as incentives for WUAs/WASHCOs to perform their voluntary work are not in place.

Summing up: In line with the hypothesis, the activities under action area 1 have increased willingness to pay for water services, financial management, revenues, maintenance capacity and practices, and demand for sustainable, well-maintained water services provided by WUAs/ WASHCOs. However, the activities have not led to systemic change in capacity building of and support to WUA/WASHCOs. This is mainly due to systemic issues related to the enabling environment, as discussed under action area 3.

Action Area 2: Improving supply of maintenance and spare part supply services by strengthening local maintenance services and spare part supply enterprises

The action and research design

Under action area 2, SWS intended to improve the supply of maintenance and spare part services by stimulating, strengthening, and facilitating the establishment of local enterprises which provide such services. Establishment and capacity building of these enterprises was expected to result in technically capable and financially viable maintenance and spare part supply service providers. This was expected to lead to higher demand for such services, which in turn was expected to lead to higher financial viability of these enterprises. This aligns with the interest of the Ethiopian government who is also interested in addressing low employment rates amongst women and youths through establishing and strengthening local enterprises. However, as employment rates are not expected to have direct impact on the supply of spare part and maintenance services, this is not pursued further in this research.

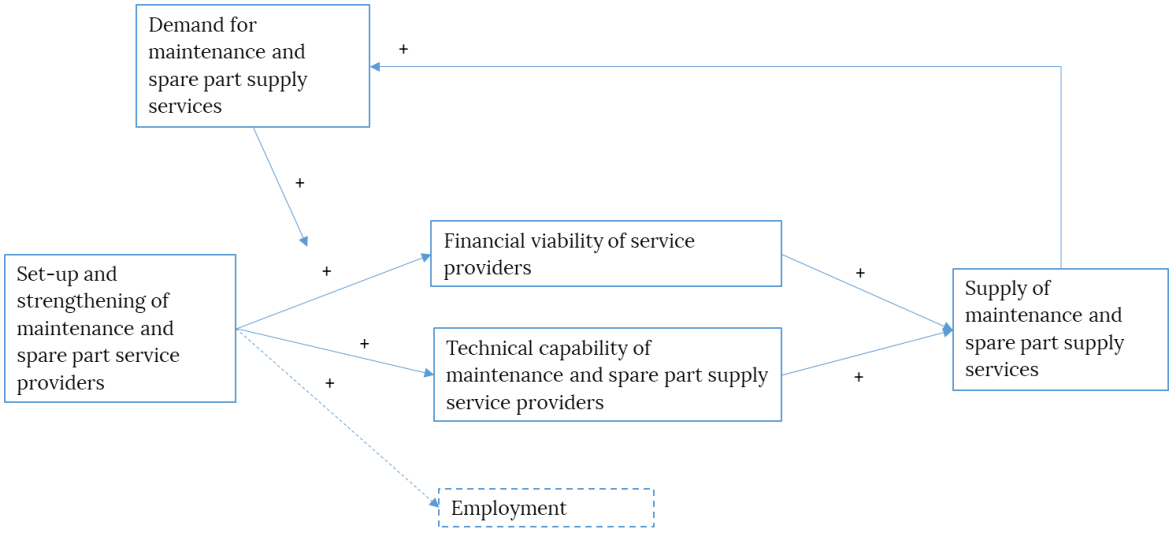


Figure 34: Theory of change action area 2

This part of the action research intends to answer the following research questions:

- Does the setup and support of maintenance and spare part supply services lead to technically capable and financially viable enterprises supplying such services in South Ari and Mille?
    - Does the setup and support of maintenance and spare part supply services lead to maintenance and spare part supply enterprises that are able to respond to requests of clients?
    - Is there sufficient demand for services of maintenance and spare part supply providers to be financially viable?
- Is there a difference in financial viability between the two woredas (pastoralist versus highland context and predominantly point sources versus predominantly motorized boreholes)?

The action and research activities

Figure 35 presents an overview of the main actions undertaken under action area 2.

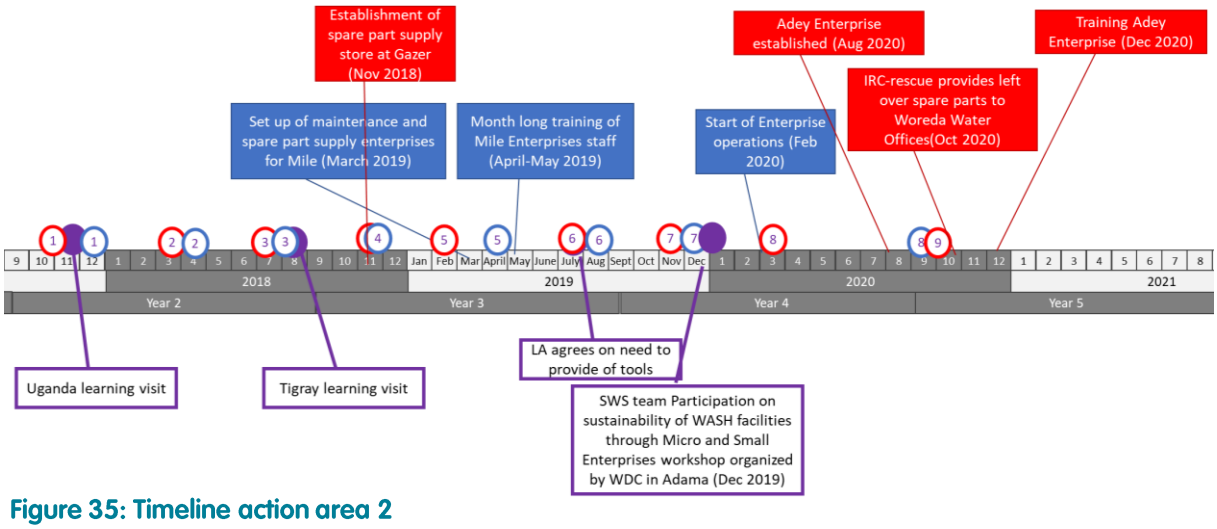


Figure 35: Timeline action area 2

SWS organized two major learning visits focused on maintenance models and practices: Uganda in November 2017 and Ethiopia's Tigray Region in August 2018. Both visits involved government staff from woreda, regional, and national levels and development partners including MWA, SNV and UNICEF. Inspired by the experience in Tigray with a revolving fund for spare part supply, the SNNP Regional Water Bureau decided to establish a **spare part outlet at Gazer Utility** for rural water supply in November 2018. A revolving fund budget of 130,824 birr (about 5000 USD) was made available. A first batch of spare parts was procured by the Regional Water Bureau and handed over to South Ari Woreda. Gazer Town Water Utility managed the spare part supply.

By December, 16 types of spare parts including o-ring, u-seal and plunger were no longer available from the spare part store and the utility struggled with high transaction costs related to the procurement of new spare parts from Addis Ababa. Therefore, during the seventh learning alliance meeting in December 2019, IRC WASH Ethiopia was requested to support the transport of spare parts procured by the utility.

In the long run, spare part supply is expected to become the responsibility of the to-be-established Maintenance and Spare Part Supply Enterprise, rather than the utility. Although establishment of such maintenance and spare part enterprises has been in South Ari's plans for a long time, establishing it has been a challenge. During the eighth learning alliance meeting in February 2020, the head of the Zonal Small and Medium Enterprises Office was invited to present directions on what establishment should look like in the three focus woredas. However, no immediate action could be taken because of the outbreak of the COVID-19 pandemic in March 2020.

The Woreda Water Office advertised for people to apply to become a member of the enterprise and the Woreda Enterprise Office selected five persons. In August 2020, the maintenance service provider was finally established under the name **Adey Rural Water Maintenance Enterprise**. The enterprise was expected to provide preventive and minor maintenance for South Ari, Baka Dawla Ari and Woba Ari woredas.

In December 2020, members of the newly established enterprise followed an SWS-organized one-week training together with ten woreda water office technicians from South Ari, Woba Ari and Baka Dawla Ari[7] who were included to create linkages between the enterprise and woreda water office staff and to share experiences. The trainers were from South Ari Woreda Water Office, Zone Water Department and Jinka Construction and Industrial College. The training focused on business planning, entrepreneurship, spare parts, and preventive and minor maintenance, supported by practical training in one of the SWS pilot kebeles (Shishir).

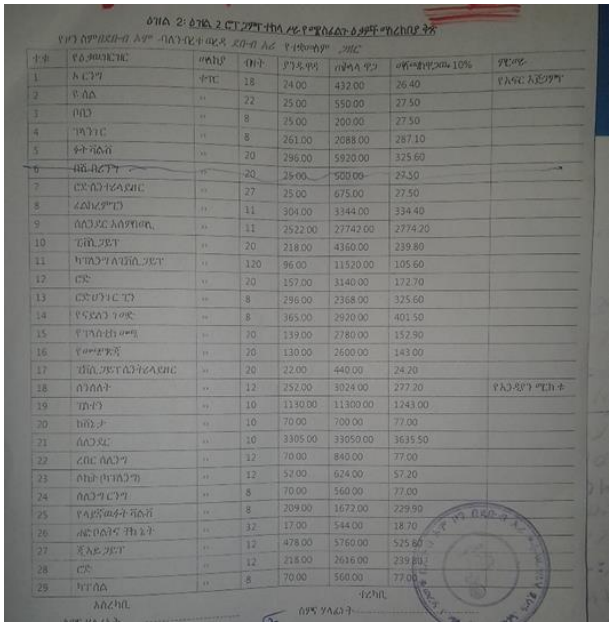


Photo 3: Spare parts provided to Gazer Utility

Mille is one of the 23 pilot woredas of the "*Sustainability of Rural Water Schemes through Small Micro Enterprise*" project (2017-2021) by

[7] In addition, the Gazer Utility manager seized the opportunity of this training to ensure training of four technicians from the Gazer Utility and two from the Gazer hospital, with the utility covering the costs for these additional participants.

the Water Development Commission of the Ministry of Water Resources, Irrigation and Electricity (MoWIE), with financial support from the African Development Bank (AfDB), with a total budget of 20 million ETB. The project intends to support the establishment of a total of 31 enterprises (21 for maintenance services and eight for spare parts supply), including a maintenance service enterprise and a spare parts supply enterprise in Mille Woreda. SWS facilitated the discussion in the learning alliance to speed up the establishment of a maintenance and spare parts enterprise. As a result, a maintenance enterprise with six members and a spare parts enterprise with five members were established in Mille in March 2019 which eventually merged into the **ARDI Water Scheme Maintenance and Spare Parts Supplier PLC**.

The enterprise staff received a one-month training in April/May 2019 at the Ethiopia Water Technology Institute (EWTI) in Addis Ababa, supported by the AfDB-funded project for the establishment of water enterprises. This training focused on technical aspects. Business aspects were not comprehensively covered in the training.

Construction of the spare parts warehouse (also funded by the project and supported by the Woreda Water Office which provided land and the Regional Water Bureau who recruited the contractor) was finalized in January 2020. In total, the Regional Water Bureau, through the project, contributed nearly 1 million ETB for spare parts, a motorbike, and the construction of the spare parts shop. Hand tools and spare parts from the Regional Water Bureau were donated to the enterprise and the enterprise started operations in February 2020.

Results and outcomes

Here we explore how the above-mentioned actions have contributed to the expected results/outcomes in the SWS focus woredas:

1) Financially viable maintenance and spare part service providers
2) Technically capable maintenance and spare part service providers
3) Increased supply of maintenance and spare part services

However, it should be noted that at the time of writing of this report, the enterprise in South Ari had only been set-up about six months ago and the one in Mille had been operational for only about one year.

Utility-led spare part store, Gazer

Technical capacity: The rural water supply spare part store of the Gazer Utility is run by utility staff (manager and storekeeper). Managing the spare parts is an additional activity for the utility staff who have not received training to undertake this particular task. The financial aspects of the spare part supply are run by the Gazer Utility in collaboration with the Finance Department and Woreda Water Office with a dedicated account signed by both parties.

Procurement of new spare parts to replenish the spare part stock is a bureaucratic process. First, proformas have to be collected from possible suppliers based in Addis Ababa, some 750km from Gazer. The proformas have to be handed over the Woreda Finance Office in Gazer, which selects the supplier and provides permission for procurement. After this, the purchases

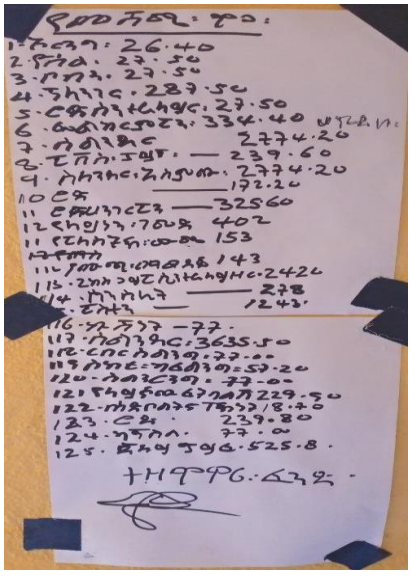


Photo 4: List of spare parts and their prices at the Gazer Utility Casher Office

can be done in Addis. In addition, revenues from spare part sales are hardly sufficient to cover the transport costs. In order to minimize transport costs, IRC WASH Ethiopia, based in Addis Ababa with frequent visits to Gazer, was requested to facilitate the proforma request, procurement, and transport. IRC produced the proforma letters within one week. However, actual procurement has been stalled at the time of writing this report.

Financial viability: The Gazer Utility sells spare parts only to federations, WASHCOs, and WUAs which have a support letter from the SNNPR Water Bureau. The price of each spare part has been fixed by the Woreda Water Office with a 10% profit as the fixed profit margin set by the Regional Water Bureau[8]. The most sold items are spare parts for AfriDevs and shallow wells as these are often not readily available on the market.

Since November 2018, sales amounted to about 30,000 ETB which was deposited in the dedicated microfinance account. However, most of these sales took place in the first couple of months after which 16 of the most popular spare parts were sold out and have not been replaced at the time of writing of this report. This shows the importance of clear supply chains for spare part supply.

Assuming a maximum profit of 10%, only 3,000 birr profit was made (some 75 USD) over this two-year period. It is therefore questionable whether this amount is sufficient to sustain a dedicated enterprise.

Mr. Maya Reda, one of the members of the newly established maintenance enterprise, already had ample experience as a caretaker from Arkisha Kebele providing maintenance services to Baka Dawla Ari Woreda, South Ari Woreda and many kebele federations. By becoming a member of an officially established and recognized enterprise, he expects to reach more clients than in a personal capacity.

The payment he has been receiving per maintenance service is linked to the extent of the work and the distance to be travelled. For example, Mr. Maya charged 400 birr for scheme maintenance for a scheme far away and 200 birr for a hand dug well. According to Mr. Maya, this amount is rarely enough to cover his expenses. He also often struggled in obtaining the money owed to him. During a recent rehabilitation assignment for Bako Kebele at the request of Baka Dawla Ari Woreda it was agreed that the kebele administration would collect money to pay for his services. However, after the activity the kebele administration revealed they had used the collected amount for another urgent activity which meant Mr. Maya had to wait until another round of money collection from the community.

Mr. Maya confirmed that he has an average of 3 or 4 requests from kebele federations within a week and he can address all requests if materials are available from Jinka.

Mr. Maya recommends that government should set standard tariffs and legal directions for payments for maintenance services. Mr. Maya observed that demand for his maintenance services by WUAs who are supported and visited by woreda officers (like Arkisha Kebele) is considerably higher than WUAs who do not have woreda support.

Box 5: Maintenance services by Mr. Maya Reda

Improvement in supply of spare parts and maintenance services: The spare part shop at the Gazer Utility has brought spare part supply closer to WUAs/WASHCOs, compared to Jinka, and ensures lower costs for spare parts compared to private shops. For example, the cost of one u-seal at the utility is 25 ETB but at the private shop is 200 ETB.

Adey Rural Water Maintenance Enterprise, South Ari

Technical capacity: The maintenance enterprise consists of five members (two female) including one experienced caretaker trained during the SWS caretaker training, two technical graduates,

[8] Please note that the Regional Water Bureau is able to set a profit margin for the Gazer Utility spare part store, as that has been set up under a government unit. The Regional Water Bureau may not be able to set a profit margin for private enterprises.

and two persons who completed grade ten. Fato Seid, Secretary of the Enterprises, rated their technical capacity as two on a scale from one (being lowest) to five (highest) in March 2021.

Financial viability: Since setup in August 2020 and training of staff in December 2020, the enterprise has not become operational yet at the time of writing this report. Looking at the experience of one of its members (see box 5), who used to provide similar services as the enterprise on a personal basis, questions on the financial viability of the enterprise. The Woreda Water Office has a plan to set detail tariffs to be paid to the enterprise based on distance and level of work.

Improvement in supply of spare part and maintenance services: As the maintenance enterprise has not started operations, it has not yet changed the supply in maintenance services.

ARDI Water Scheme Maintenance and Spare Part Supplier PLC, Mille

Technical capacity: The enterprise has 12 staff members, including a manager, a deputy manager, seven maintenance staff, and three spare part sales staff. Although the enterprise staff have received training, their capacity is low as they lack the required background, experience, and skills. The enterprise depends on technical staff of the Woreda Water Office for technical support. Enterprise members rate their technical capacity at three out of five with higher levels of capacity in areas like pipeline maintenance and lower in areas like solar, generator, and switchboard maintenance. On managerial, business, and administration capacity, the enterprise members score themselves at two out of five, and training of the enterprise members has not focused on these aspects. Support from the Mille Woreda Water Office has been limited which has had a negative impact on the motivation of the enterprise members. Nevertheless, the members intend to increase their activities, including in sanitation and hygiene.

Financial viability: As stated during the launch of the enterprise in March 2020, the Regional Water Bureau, the Microfinance Bureau, and the SME bureau are all committed to strengthening enterprises and scaling the establishment of enterprises in other areas. However, the chair of the enterprise has expressed concern over the lack of market opportunities. As mentioned under action area 1, user awareness and willingness to pay remain low in Mille and WASHCOs' financial management remains a challenge. Demand for spare parts and maintenance services from the enterprise therefore remains low. The chair has been communicating with kebele chairs in order to raise awareness and demand for services that the enterprise offers. Furthermore, the enterprise hopes to be able to sell their services to the Regional Water Bureau and the State-owned Enterprise, which focuses on construction.

Improvement in supply of spare part and maintenance services: So far, many of the spare parts sold by the spare part enterprise have been bought directly by water users from Mille town rather than by WASHCOs from the rural areas. Water users in Mille town tend to make use of maintenance and construction services of utility staff rather than from the maintenance service enterprise, hence, the utility staff are competitors of the maintenance service enterprise. The only service that the maintenance enterprise has provided is construction services for the extension of a pipeline to households in Bekeledair Kebele with support from woreda technicians.

Reflection on learning questions

Here we reflect on the learning question of action area 2:

> *Does the setup and support of maintenance and spare part supply services lead to technically capable and financially viable enterprises and maintenance and spare part supply enterprises that are able to respond to requests of clients?*

Unfortunately, because of various delays, at the time of writing of this report, the enterprises in South Ari and Mille have not been operational for more than a year. It is therefore not possible to give a well-founded answer to this question.

Reflecting on the sub-research question under this action area:

> *Does the setup and support of maintenance and spare part supply services lead to maintenance and spare part supply enterprises that are able to respond to requests of clients?*

We observed the emphasis that the capacity building of spare part and maintenance enterprises has been on technical capacity rather than business and administrative capacity. The results have shown that, as a result, there are challenges with the administrative and business aspects of the enterprises. The enterprises are also still closely linked to local government which has made them vulnerable to bureaucracy. An example is the inability of the Gazer Utility spare part store to organize the procurement of spare parts.

> *Is there sufficient demand for services of the maintenance and spare part supply providers to be financially viable?*

Kebeles which have received capacity building support for WUAs and WUA Federations were observed to have a higher demand for well-maintained water services. Nevertheless, it is questionable whether there will be sufficient demand for spare part and maintenance services as woredas and regions still provide a large part of the maintenance and spare part supply.

> *Is there a difference in financial viability between the two woredas (pastoralist versus highland context and predominantly point sources versus predominantly motorized boreholes)?*

Most water facilities in South Ari and Baka Dawla Ari woredas have hand pumps or protected springs. These types of facilities tend to require more frequent repairs than the mostly motorized boreholes in Mille Woreda. Also, the number of schemes is considerably smaller in Mille, and the region tends to play a more important role in providing maintenance services for the more complex schemes. Therefore, the potential market for a spare part and maintenance enterprise may be bigger in South Ari than in Mille. However, at the time of the research, the maintenance enterprise in South Ari had not yet become operational.

Summing-up: Because of delays with the setup and capacity building of the maintenance services and spare part supply enterprises, the question of whether this would lead to technically capable and financially viable enterprises, could not be answered. However, the research has observed possible challenges, including lack of capacity building in business and entrepreneurial skills, bureaucracy, and lack of demand because of supply of cheaper or even free maintenance and spare part services from (local) government (and NGOs). This puts (tentative) question marks on the technical, and especially financial, viability of maintenance service and spare part supply enterprises in the current context in both South Omo and Mille.

Action Area 3: Enabling environment for woreda and zonal staff

The action and research design

Under action area 3, SWS intended to contribute to strengthening the enabling environment for rural water service maintenance through capacity development of stakeholders at woreda, zonal, regional, and national level. Capacity development activities were expected to contribute to strengthened systems, capacities, and resources for enabling rural water supply maintenance by:

- Increasing incentives and interest of woreda and zonal staff in supporting maintenance of rural water supply facilities.
- Increasing political will for supporting and enabling maintenance related to rural water supply, including putting WASH higher on the political agenda, and an increase in resource allocation by local government.
- Improving insight into the required human, financial, and logistical resources, procedures, and systems which need to be in place to ensure effective maintenance of rural water facilities.

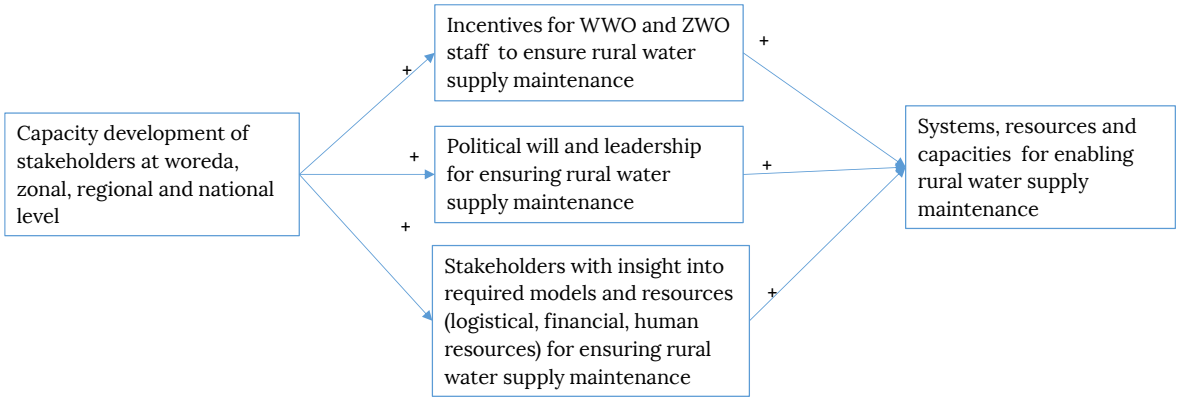


Figure 36: Theory of change action area 3

This part of the action research intends to answer the following research questions:

- Does capacity development of stakeholders at woreda, zonal, regional, and national level contribute to:
  - Increased incentives?
  - Increased political will?
  - Increased insight into required models and resources?
- Do increased incentives, political will, and insight into required models and resources contribute to an increase in human, logistical and financial capacities and resources related to enabling rural water supply maintenance?

The action and research activities

Actions undertaken by SWS to build capacity of woreda, zonal, regional, and national stakeholders responsible for supporting and enabling maintenance of rural water facilities included:

- Setup and facilitation of learning alliances in the focus woredas and involvement of stakeholders in action research activities
- Organization of learning visits and policy dialogue among officials
- Direct support to woredas through provision of logistical resources

- Capacity building of national level stakeholders through national level learning events and platforms

Figure 37 presents an overview of the main actions undertaken under action area 3.

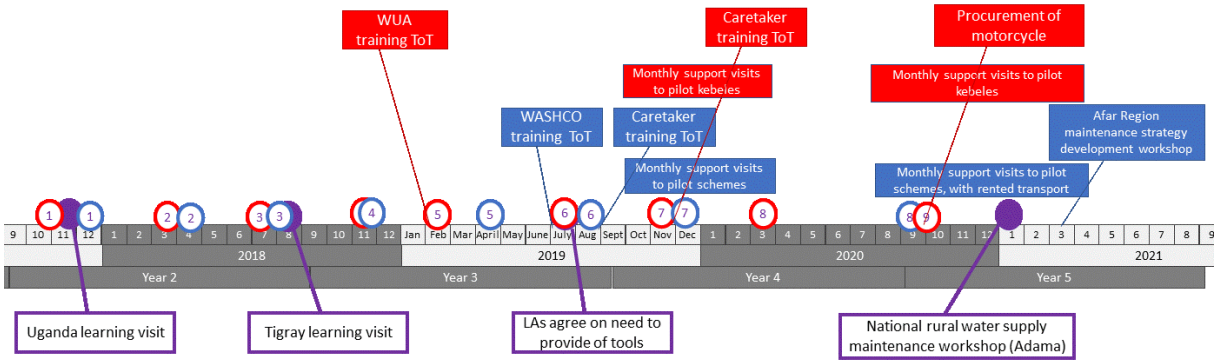


Figure 37: Timeline action area 3

Learning alliance: Maintenance issues have featured prominently on the agenda of the learning alliances, as referred to under action area 1 and 2, and as shown in tables 12 and 13.

Table 12: South Omo learning alliance meeting

LA meeting		Agenda point related to maintenance
1	November 2017	• Launching meeting
2	March 2018	• Discussion on proposal for action research on maintenance (asset management)
3	July 2018	• Discussion to understand the process to establish and legalize WUAs and their current status • Discussion on the draft concept note to strengthen rural water supply operations and maintenance
4	November 2018	• Discussion on outcomes from the rural water supply maintenance training for WUAs • Discussion on Tigray's learning visit on rural water supply maintenance
5	February 2019	• Linking maintenance of water schemes with monitoring activities by trained WUAs
6	July 2019	• Discussion on progress and challenges of activities related to WUAs and caretakers, establishment of SME and strengthening Gazer Utility • Agreement on the need for procurement of hand tools for Woreda Water Office and caretakers
7	November 2019	• Discussion on progress and challenges of activities related to WUAs, caretakers, monitoring water schemes data and establishment of SMEs • Discussion on the challenges in establishing maintenance service provider enterprises
8	March 2020	• Discussion on the performance of WUAs and caretakers and their challenges

Table 13: Overview of Mille woreda learning alliance meetings

LA meeting		Agenda
1	December 2017	• Launching meeting
2	April 2018	• Discussion on proposal for action research on maintenance (asset management)
3	August 2018	• Discussion on concept note to strengthen rural water supply O&M • Sharing and discussion on the status of woreda water scheme maintenance pilot project (establishment of small microfinance entrepreneur by MoWIE)
4	November 2018	• Update from the learning visit to Tigray on rural water supply maintenance model and • Discussion on status of piloting project by MoWIE on enterprise development at Mille on spare part supply and maintenance services; and identify possible niche of support from SWS
5	April 2019	• Discussion on implementation progress of trained WASH Committees (WASHCOs) and get inputs for the scheduled cascading of training for selected water scheme caretakers

6	August 2019	• Discussion on woreda WASH progress and challenges (activities related with WASHCOs and caretakers, establishment of SME and monitoring activities) • Agreement on the need for procurement of hand tools for Woreda Water Office and caretakers
7	December 2019	• Discussion on the current status of WASHCO activities and support needed • Provision of hand tools to strengthen caretakers' maintenance capacity

Learning alliance members have been actively involved in the action research under action area 1 and 2. As mentioned under action area 1, SWS had involved regional and zonal staff in training woreda staff to train WUAs, WASHCOs, WUA Federations, and caretakers. Furthermore, woreda staff were actively involved in the monthly follow-up meetings to the pilot kebeles and schemes under action area 2.

Learning visits and policy dialogue: Two major learning visits involving different development partners and government officials from different levels were organized in November 2017 and August 2018 to Uganda and Ethiopia's Tigray Region, respectively.

The visit to Uganda included 12 persons, eight staff representing government involved in rural water and Micro and Small Enterprise (MSE) development at national, regional, zonal, and woreda levels in Afar and SNNP regions, and staff from IRC WASH, Lowland WASH and UNICEF. The team further included participants from Kenya, two representatives from Fundi-Fix and Oxford University (and the Water Development Trust Fund), and the University of Colorado Boulder (UCB). The objective of the visit was to learn from the experiences with professional maintenance service provision from Whave, IRC Uganda Hand Pump Mechanics Associations) and Fundi-Fix.

The visit was also intended to strengthen understanding of key staff, motivate staff with respect to implementing best practice in maintenance, help push maintenance higher up the sector agenda, explore strengths and weaknesses of association/job creation approaches to rural water maintenance, and identify opportunities to improve these models and potential innovations.

The learning visit to Tigray involved 13 persons representing MoWIE, Afar Region, SNNPR, UNICEF, Charity Water, MWA, and IRC WASH. The objective was to learn from Tigray's experiences:

- Establishing Private Local Service Providers (PLSP) at woreda center by SNV
- Establishment of spare part supply shop through a revolving fund by the region
- Strengthening (capacity building) of WASHCOs/WUAs/caretakers
- The contribution of water extension workers at kebele level to improve water supply

Furthermore, SWS, in collaboration with MoWIE, organized a two-day policy dialogue among Ethiopia and Uganda officials on operation and maintenance of rural water supply on 09-10 May 2019 in Addis Ababa. The objectives of the dialogue were:

- To share updates, information, and build linkages between officials driving rural water supply maintenance in Uganda and Ethiopia.
- To develop an understanding of the likelihood and possible directions of policy change in Uganda and Ethiopia with respect to rural water supply maintenance.
- To formulate key recent lessons learned in each country (to be used as part of the review of activities by the SWS Learning Partnership to guide future activities).

The event involved 34 participants (nine from the Uganda Ministry of Water and Environment and IRC WASH Uganda) including government officials from Ethiopia (region and federal) and development partners.

Direct support: SWS has provided direct support to its focus woredas in the form of equipment (like hand tools), logistic resources, and transport facilities in order to facilitate action research activities, especially the monthly WUA/WASHCO support, and strengthen the woreda water offices' capacity in terms of logistical support.

National-level learning and influencing on asset management: Under this action research, national-level learning and influencing on asset management has been facilitated by SWS through the national initiative on Strengthening Rural Water Supply Operation and Maintenance (later re-named as the national initiative on Strengthening Water Supply System Management), chaired by the Water Development Commission (WDC) and co-chaired by SWS/IRC WASH. The objective of the initiative is to coordinate national level learning and sharing on experiences and challenges in strengthening rural water supply operation and maintenance, to facilitate technical collaboration between organizations, and to stimulate systematic integration and harmonization of approaches and mobilizing the required resources. The initiative involves government partners from regional and national levels and development partners (NGOs and donors). The initiative developed a Terms of Reference (TOR) for its functioning in mid-2020. It has organized meetings on 25 February 2020 and 16 June 2020, during which different initiatives shared their experiences, progress made, and lessons learned related to improving maintenance and spare part supply for rural water supply. This included the presentation of the SWS paper on the comparative study of maintenance model. The initiative has also supported a national rural water supply maintenance workshop in Adama on 22- 23 January 2021, involving some 35 participants from regional water bureaus, WDC NGOs, and maintenance and spare part supply enterprises. It also supported the Afar Region maintenance strategy development workshop, which took place on 10- 11 March 2021 in Semera.

In collaboration with Water Supply & Sanitation Infrastructures Administration Directorate under the WDC, SWS has been convening regular meetings on strengthening rural water supply maintenance. Before the outbreak of COVID- 19, monthly meetings were conducted face to face. Since the outbreak, the meeting has been virtual and held more or less every two weeks depending on outstanding agenda items. The main agenda has been the National Rural Water Supply Management Implementation manual, which the team has been working on for some time.

Results and outcomes

Here we explore whether the above-mentioned activities have led to the following anticipated results and outcomes:

1) Creation of incentives for government staff to ensure good maintenance services
2) Political will and leadership
3) Improved insight into required models and resources for ensuring effective maintenance services
4) Availability of human, financial, and logistical capacities, and resources at local enabling environment level

Incentives for government staff to enable maintenance services

The ToT and cascading approach for WUA/WASHCO and caretakers capacity building helped the woreda and zone technicians acquire additional knowledge. Their involvement in the trainings also created an opportunity for woreda technicians to establish a link with committee members.

In Mille, the provision of hand tools for maintenance technicians provided an incentive for them to support and, where needed, provide maintenance services. The needs and the types of the hand tools were identified by the respective woreda learning alliances, and included spanners of

different sizes, mechanical toolboxes, clamps, and fishing tools for hand pumps. The hand tools were provided following the government asset management procedure and the woreda finance office is expected to audit the assets. Almost all caretakers under the pilot kebeles received hand tools from the woreda. Confident caretakers were observed to be using the tools for preventive and minor maintenance during the monthly visits in Seraytu and Harsis in Mille and most water schemes in Arkisha.

Political will and leadership

Involvement of the South Omo Zonal Water Department and the woreda water offices in learning alliances and action research has resulted in the zonal department and woreda office taking action to set up and strengthen WASHCOs and WUAs. For example, South Omo Zone developed a small booklet in May 2019 compiling best experiences related to WUA management in one of the SWS pilot kebeles with the title "*Best Experience at Arkisha Kebele, Wenta Kenin Water User Association*". The booklet described the status of the association before and after SWS interventions and capacity building activities. It concluded that through capacitating WUAs, their capacity to manage had improved and user satisfaction had been ensured. The booklet expresses the desire to scale up the capacity building approach to an additional 102 WUAs under the South Ari Woreda and beyond. It was presented to the Zone Administration in May 2019 with the purpose of soliciting additional funding for maintenance. Although the zone expressed interest to scale up the WUA training to an additional 27 kebeles in South Ari Woreda, this was not realized because of leadership turnover.

In the fifth learning alliance meeting, experiences of Shishir, Maytol, and Arkisha WUAs were shared. Woba Ari Woreda was inspired and decided to establish 24 WASHCOs and four federations. The woreda reported its establishment in the sixth meeting and allocation of ETB 25,000 for the training in 2019. This shows an increase in political will and willingness to allocate public resources towards strengthening WUA and WASHCOs and, hence, strengthen preventive and minor maintenance in the South Omo focus woredas. However, the training and legalization did not happen as they did not get timely support from the zone water department for provision of the training.

> *"The woreda has never had such kind of maintenance hand tools to maintain the water schemes and provide technical support to care takers."*
>
> Kedir Yusuf
> Mille Woreda Maintenance Technician

Improved insight into required models and resources

Involvement of woreda, zonal and regional government staff in capacity building of WUAs and WASHCOs and in following up and monitoring WASHCO and WUA performance has provided these government staff with insights into the required models and resources needed to implement and sustain this.

MoWIE is planning to expand the recently piloted approach of sustaining rural water supply services through maintenance enterprise development and engagement to 16 woredas through financial support from AfDB. Ideas of expanding this approach to 16 more woredas were presented to the National Strengthening Water Supply System Management Platform.

SNV, which had been involved in the PLSP (Private Local Service Providers) model in Tigray Region, has shown interest in the Whave model as practiced in Uganda and is looking into piloting this model in the near future in Ethiopia.

The woreda SDG planning process included an assessment of the current and required costs for the provision of direct support by the woreda water offices to WUAs and WASHCOs. This includes

planning and reporting, training of WASHCOs/WUAs, monitoring and follow up on WASHCOs/WUAs, maintenance support, and water quality monitoring. This provides insight into the required resources for ensuring an enabling environment at the woreda level for supporting WASHCOs/WUA. Table 14 gives an overview of the results of this assessment with Part 3 of this report focusing on the planning.

Table 14: Direct support cost estimates 2019

	South Ari	Baka Dawla Ari	Woba Ari	Mille
Per diem per person per day (birr/day)	50	50	50	210
Total number of actual per diem days per year	288	265	135	620
Total actual annual non-staff expenditure (birr/year)	25,300	23,020	45,380	330,080
Total actual annual staff costs (birr/year)	291,272	323,593	161,160	660,864
Total actual annual expenditure (birr/year)	316,572	346,613	206,510	993,944
Total expenditure per beneficiary, actual -> required (birr/year/person)	8 -> 48	23 -> 126	23 -> 171	28-> 63
Total expenditure per beneficiary, actual -> required (USD/year/person)	0.2-> 1.2	0.58 -> 3	0.58 -> 4.3	0.72 -> 1.59

*Source: Woreda SDG planning Excel sheets for South Ari, Baka Dawla, Woba Ari, and Mille woredas

Availability of resources

The tables below show that the human, financial, and logistical resource situation of woreda water offices have not improved in the pilot woredas and remains challenging. The split of South Ari into three new woredas has increased the total number of staff involved in rural water supply in the combined three woredas. However, although the new South Ari Woreda has considerably more water facilities, it has less staff members involved in rural water supply than the other two. As shown in table 15, the number of schemes per staff member is especially high in South Ari and actually increased compared to the baseline situation of the original South Ari Woreda. The number of staff members is far under the required number of staff. For example, in South Ari, the Woreda Water Office requires 40 staff but only has ten staff in place four of which dedicated to rural water supply.

High turnover of regional, zonal, and woreda staff, mainly office heads, still presents a challenge. As per August 2019, a year after the ToT for the WUA training, only two of the six trained members were still active in South Ari Woreda which presented a clear challenge for scaling the training.

The situation related to availability of transport facilities has also not shown improvement, as shown in table 15. However, through the learning alliance process, stakeholders have been looking for solutions to address transport challenges. In Woba Ari Woreda, for example, the woreda administration has made their car available for water scheme maintenance and WASHCO support travel since August 2020 and learning alliances contributed some ETB 30,000 for maintenance of water schemes. In South Ari Woreda, the health office made the Gazer health center ambulance available for transporting maintenance equipment and for chlorination activities in 2020.

Table 15: Action area 3 indicators and results for South Ari

Indicator	SNNPR				Afar	
	Baseline (2017)	Current situation (2021)			Baseline	Current situation
	South Ari	South Ari	Baka Dawla	Woba Ari	Mille	
Number of schemes	245*	179	103	16	31*	31

Human resources involved in rural water supply	8 *	9***	5	5	24	18
Number of facilities per staff member	30.6	44.8	20.6	3.2	1.3	1.7
Logistical resources available for direct support	One motorcycle, used by office head*	One motorbike	One motorcycle but old and out of service	No transportation facilities	One motorcycle, used by office head*	No vehicle and motorbike

*Baseline report on water levels
**Sustainability check (August 2017)
*** SDG planning report

Through dividing South Ari into three woredas, the total number of staff members involved in rural water supply has increased from eight to a combined total of 14 staff members.

The learning alliance process has contributed to additional budget allocation for rural water supply maintenance. For example, the involvement of the Baka Dawla Ari WASH sector office heads and the Woreda Administration in the ninth learning alliance meeting at Jinka where South Ari and Woba Ari Woredas shared their water sector capital budget allocation resulted in increased priority for the water sector in Baka Dawla Ari. The day after the meeting, the Baka Dawla Ari Administration called a Woreda Council meeting and allocated ETB 200,000 for the water sector as a capital budget and ETB 75,000 for per diems, fuel, and transport costs for supporting WUAs in providing sustainable water services.

Disbursement is not always as per the budgets. In Mille, for example, it was reported in February 2021 that the Woreda Finance Office was unable to pay per diems because the woreda had been unable to raise the ETB 18 million in taxes, as required by the region.

Table 16: Budget allocation (ETB)

	South Ari (ETB)	Baka Dawla Ari (ETB)	Woba Ari (ETB)	Mille (ETB)
Baseline*	Capital budget: 504,510 Running costs: budget: 400,000			Budget for CapManEx, maintenance and spare parts: 696,677 Running costs: 979,460
2012 EC (2019/2020)**	Capital budget: 1,001,000 Running costs: 10,000	Capital budget: 0 Running costs: 7,500	Capital budget: 650,000 Running costs: 8,500	Budget: 3,280,000
	Total Capital budget for the 3 woredas: 1,651,000 Total running costs: 26,000			
2013 EC (2020/2021)**	CapEx: 500,000 CapManEx: 100,000 + 20,000 for spare parts Running costs: 210,000	Capital budget: 200,000 Running costs: 75,000 (including 10% for O&M)	Capital budget: 500,000 Running costs: 160,000 (including 15,000 for monitoring and maintenance follow-up)	Capital budget: 3.1 million Cap: 750,000 Running cost: 650,000
	Total Capital budget for the 3 woredas: 1,200,000 Total CapManEx: 120,000 Total running costs: 445,000			

*Source: LCCA baseline report. Data South Ari: Average of 2006-2008 Ethiopian Calendar or 2013/14-2016/17. Data Mille: 2016/2017)
**Source: Facilitators' diary

Reflection on learning questions

Here we reflect on the learning questions of action area 3.

> *Does strengthening systems and capacities at woreda, zonal, regional, and national levels for enabling maintenance contribute to increased incentives, political will and insight into required models and resources?*

Under action area 3, a wide variety of actions have been undertaken at different levels to strengthen systems and capacities for enabling maintenance of rural water facilities. The learning alliance approach, with engagement of local stakeholders in the action research, has been key. Furthermore, activities have included learning visits and policy dialogue, direct support through provision of equipment and logistics, and stimulation and facilitation of national level learning events.

The learning alliance approach, involvement of local stakeholders in the action research, and supply of equipment and logistics have had a small, positive effect on incentives for and political will of government to ensure an enabling environment for rural water service maintenance.

Monthly support to WUA and WASHCOs has shown positive results. However, this has mainly been possible because of logistical and capacity support of the SWS learning partnership to the woreda water offices. Because of the continuous structural lack of human, logistical and financial resources, it is questionable if this could be sustained and / or scaled up.

Learning visits and policy dialogue have played a role in increasing insight into required models and resources for ensuring sustainable rural water service maintenance. In addition, the SDG planning and costing exercise has provided better insight into the required resources for ensuring a suitable enabling environment for ensuring and supporting maintenance of rural water supply. It has also had impact on the introduction of new models for maintenance and spare part supply. The setup of the spare part supply at Gazer Utility has for example been the result of a learning visit.

- There seems to be a drive by government to bring the maintenance and spare part service enterprises to scale. However, we have not seen clear evidence yet of the financial viability of these models which need more time for testing. Overall, results indicate that there are improvements, but they are not always easy to put into practice.
- Learning alliances seem to have had the most effect on the enabling environment in terms of political will and availability of resources.

> *Do increased political will, insight into required resources and incentives contribute to an increase in human, logistical and financial capacities, and resources related to enabling rural water service maintenance?*

- Concrete improvement in systems, capacities, and resources at local level to enable and support rural water maintenance is limited.

Although there has been some anecdotal evidence of increased government budgets for supporting maintenance, this research has not observed a structural increase in human, logistical and financial capacity, and resources made available to enablinging rural water service maintenance.

Summing up: The activities under action area 3 have contributed to some degree in increasing incentives, political will, and insight into models and resources required for ensuring rural water service maintenance, but this has not led to strengthened systems and availability of resources at woreda level.

Effectiveness and efficiency of the actions

Here we assess the effectiveness and efficiency of the combined actions undertaken under this action. Effectiveness is assessed in terms of change in functionality and downtime as a result of the actions. Efficiency is assessed in terms of the inputs (expenditure) for the actions and the achieved outcomes, in terms of change in functionality and downtime.

This will be assessed by answering the following research questions:

- Have the actions contributed to higher functionality rates and lower downtimes?
- What are the costs of the actions taken on systems strengthening?
- Are the actions taken to strengthen systems financially viable and scalable?

Effectiveness: The contribution of action research activities to increasing functionality and lowering downtime

In order to see whether or not the actions related to strengthening the demand, supply, and enabling environment under this action research have resulted in lower downtime and higher functionality rates, an analysis of downtimes and functionality status of the facilities provided with capacity building support was done comparing the baseline situation with the current situation and found the impact to be inconclusive. The results are presented in table 17. The table shows that in Arkisha and Shishir kebeles functionality has increased since the baseline, while in Maytol it has decreased. Overall, there is a slight increase in functionality of 12 percentage points. However, functionality of the pilot schemes in Mille decreased. The proportion of facilities without breakdowns over the last month decreased from the baseline to the current situation. However, this may, at least to some extent, be due to better availability of data on downtimes in the current situation than in the baseline situation.

Table 17: Baseline and endline functionality

	Functionality rate (number of functional facilities / total number of facilities)		Facilities functioning throughout last month (number / total number of facilities)	
	Baseline*	Current**	Baseline*	Current**
Arkisha Kebele	65% (13/20)	86% (18/21)	55% (11/20)	38% (8/21)
Maytol Kebele	71% (5/7)	57% (4/7)	71% (5/7)	43% (3/7)
Shisher Kebele	58% (7/12)	71% (10/14)	58% (7/12)	43% (6/14)
Total South Omo pilot kebeles	64% (25/39)	76% (32/42)	59% (23/39)	40% (17/42)
Mille pilot schemes	100% (10/10)	80% (8/10)	100% (10/10)	70% (7/10)

*2017 asset inventory
**WUA/WASHCO tracking January 2021

Figure 38 presents an overview of functionality rates in the pilot areas over time since November 2019, as well as the functionality rate at the 2017 baseline. The figure does not show a clear trend in an increase or decrease of functionality rates.

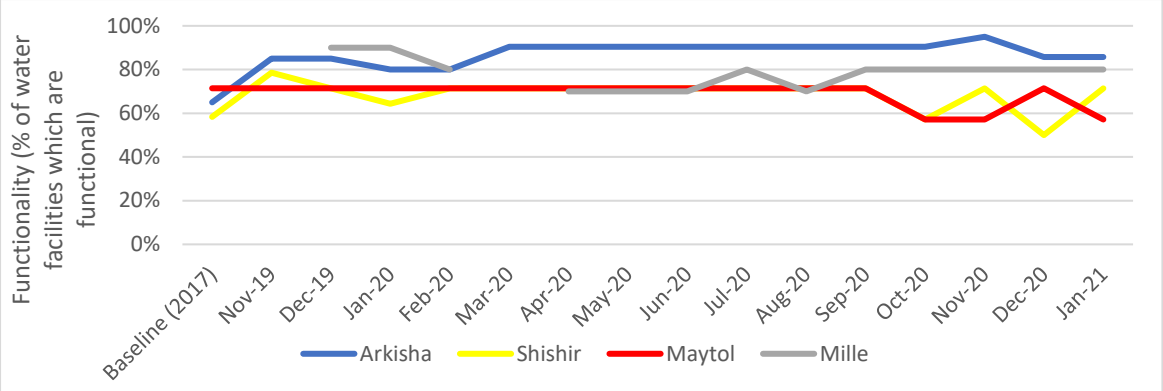


Figure 38: Functionality over time

Figure 39 presents an overview over time of the proportion of facilities which had been functioning without breakdown over time. The figure does not show an increase but, a decrease for Maytol and Shishir since the beginning of the COVID-19 pandemic.

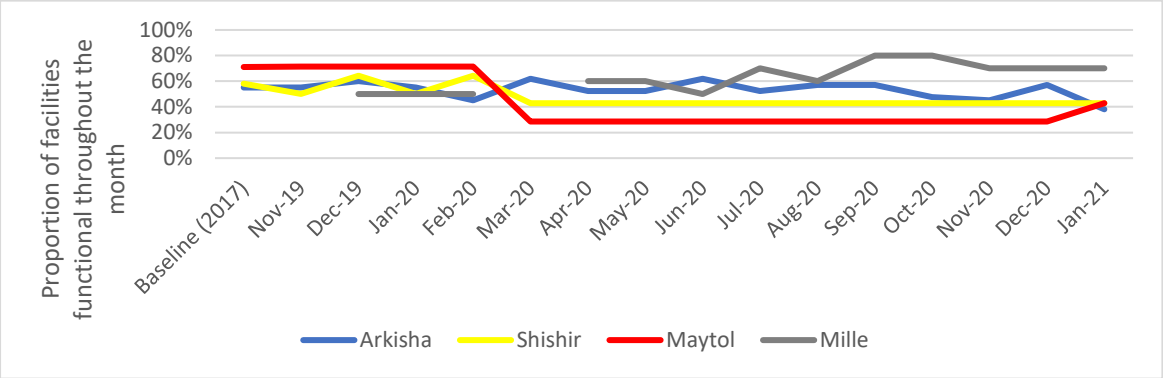


Figure 39: Proportion of facilities functioning over time

Efficiency: Expenditure and results

In order to provide insight into the viability of the application of the tested maintenance system-strengthening activities at scale, we have to look at the efficiency and value for money of the systems strengthening activities by comparing expenditure with outcomes. The figure below presents an overview of the expenditure on actions related to the maintenance systems strengthening activities.

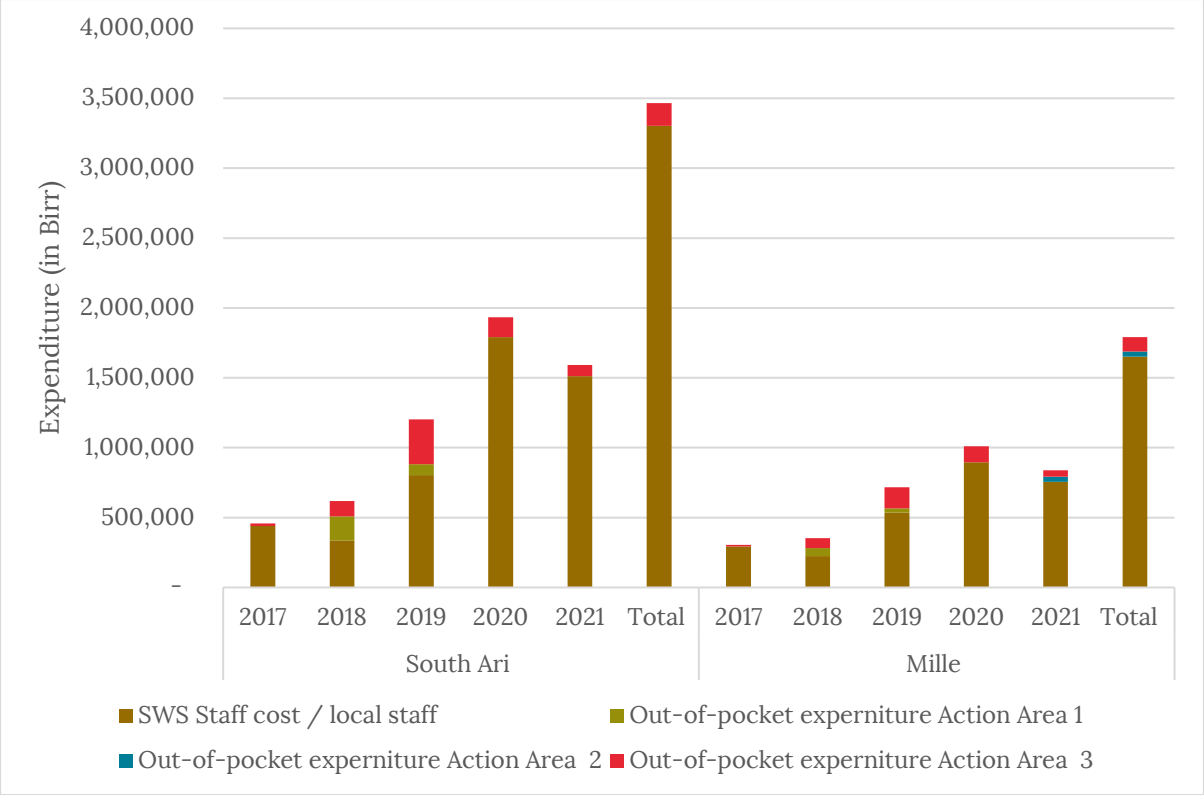


Figure 40: Action research and learning alliance facilitation expenditure (in ETB)

Reflection on the learning questions

Here we reflect on the following sub-research questions:

> *Have the proposed actions interventions (over time) contributed to higher functionality rates and lower downtimes?*

Overall, this research has not shown a clear link between the actions undertaken under the action research and improvements in functionality and downtime. Improvements have mainly been in performance of WASHCOs and WUAs, but this has not translated into obvious improvements in functionality and downtime.

> *What are the costs of the proposed interventions?*

The costs of strengthening rural water supply maintenance services involve different components including staff time (local, national, and international), costs of learning visits, trainings, workshops, conferences, provision of maintenance hand tools and other logistics for monitoring and costs to provide follow-up support to communities. As shown in figure 40 above, the total cost of the action research amounted to slightly less than 3.5million ETB (slightly less than 100,000 USD[9]) in South Ari and about 1.85 million ETB (about 53,000 USD) in Mille.

> *Are the proposed interventions financially viable and scalable?*

The level of effort and the associated costs for piloting and strengthening rural water maintenance also depends on the extent to which the national and local level experts have capacity (skills and tools) to undertake such interventions. Since the current intervention was the first pilot in Ethiopia, there has been intensive support from international experts on various aspects of testing

[9] taking an average exchange rate of 1USD= 35ETB between January 2018 and June 2021

and strengthening maintenance systems, requiring more resources. Therefore, the scaling up of similar interventions per district may be less in the future as national and local capacity to support the scaling up has been built.

Conclusions and recommendations

This action research intended to answer the following main research question:

> *How can rural water maintenance services be provided in ways that are sustainable and potentially scalable through innovations in demand, supply, and the enabling environment for maintenance services?*

The maintenance action research intended to answer this question by exploring whether the following actions would have a positive effect on functionality and downtime and whether the activities would be scalable:

1) Capacity building of WASHCOs/WUAs and caretakers, in close collaboration with local government, which was expected to lead to increased demand for sustainable water services and willingness to pay by water users, improved financial management and revenue collection by WASHCOs/WUAs and improved preventive maintenance.
2) Supporting the setup and capacity building of maintenance and spare part supply enterprises, which was expected to improve supply of maintenance and spare part supply services
3) Strengthening the enabling environment through involvement of stakeholders in learning alliances, action research activities, learning visits, policy dialogues and through national level learning activities. This was expected to improve incentives, political will, insight in required models and resources for ensuring maintenance, which would lead to strengthening of the enabling environment in terms of supportive systems, capacities, and resources.

The action research has not shown a direct improvement in functionality and downtime, with the implementation of the above-mentioned actions. However, improvements have been observed in the above-mentioned intermediate outcomes.

The research has shown that capacity building activities have been effective in improving organizational capacity, willingness to pay, financial management, revenues, preventive maintenance, and coordination between communities and the woredas. However, although the capacity of woreda, zonal and regional staff has been built to provide training to WASHCOs, WUAs, and caretakers, little change has been observed in terms of systems and procedures at the enabling environment level for ensuring ongoing capacity building and support to WASHCOs/WUA and caretakers. This is likely to result in sustainability challenges. Indeed, towards the end of the research period, a decline in support activities has been observed in some areas following initial improvement. This is related to systemic challenges in the enabling environment.

Action area 3 intended to address (some of) these challenges. The actions under action area 3 contributed to some degree to improved insight into required models and resources, political will, and incentives, but weak systems, capacities, and availability of resources limited the impact of the activities under action area 3.

Under action area 2, establishing new enterprises for providing spare parts and maintenance services was found to be extremely difficult and the current new enterprises have not been established long enough to draw firm conclusions on their success or failure. But business enterprise capacity building should go beyond technical components and have more emphasis on business administration. Government can support business, but government bureaucracy may hinder business development. Demand is high, but as woredas and regions currently perform functions the new enterprises should take over, financial viability is likely to be a challenge.

Overall, the action research, with its multi-layered hypothesis, has shown that although progress on intermediate outcomes has been observed, overall results can only be achieved in a sustainable way through systemic change at different levels. This takes a considerable amount of time and goes beyond the common 5-year program period.

Strengthening of weak systems in resource-poor settings like Ethiopia is very difficult, takes (a lot of) time, and requires actions / interventions (including evidence-based advocacy) at multiple levels, including national level.

We should also ask ourselves:

> *Did strengthening the existing model work, or is there a need to explore alternative models? What are outstanding challenges? Is there a need to look for alternative models in order to overcome these challenges?*

If the (single-loop learning) approach of strengthening existing mechanisms and making them work ("doing things better") did not result in the improvement of maintenance services, resulting in less downtime and better functionality at costs and efforts that can be applied at scale, then SWS would have proven that current model is not a feasible solution. In that case, there would be a need to explore alternative maintenance models and arrangements (moving to double-loop learning by "doing things differently").

Related to action area 1, it could be argued that continuous coaching and support may sustain the momentum of the commitment (improved willingness to pay, community meetings, better revenue collection, etc.) of the service providers (WUAs and WASHCOs) in the short to medium term, but this alone might not guarantee the sustainability of the community-based service authorities (WASHCOs, WUAs, caretakers, and other voluntary based services). A long-term alternative solution to sustain the water service provision that could be explored is through professionalizing of water service providers, introduction of professionalized service provision models (e.g., the Whave model), or, where appropriate and viable, "utilitization" of rural water services.

Under action area 1, the action research has already explored some alternative models (or elements of models) with the introduction of maintenance and spare part enterprises as a model for improving maintenance. As activities under this action area were still underway at the time of the research, it was difficult to draw conclusions on results, viability, and impact of these enterprises. However, tentative findings seem to suggest the need to critically reflect on the assumptions underlying the model, especially related to financial viability.

PART 3: STRENGTENING FINANCING OF WASH SERVICES: Development of woreda WASH SDG master plans

Introduction

The water, sanitation, and hygiene (WASH) sector in Ethiopia does not have a consolidated, long term strategic plan to meet the Sustainable Development Goals (SDGs). Previously there were two medium term plans, i.e., Growth and Transformation Plan (GTP) 1 and 2. GTP 1 was completed in 2015 and GTP 2 in 2020. Both did not incorporate sanitation and hygiene and institutional WASH aspects. In addition, these national plans did not consider Life-Cycle Costs (LCC), i.e., Operational Expenditure (OpEx), Capital Maintenance Expenditure (CapManEx), and Direct Support Costs (ExpDS) that can ensure sustainability of WASH infrastructures. With the phasing out of GTP 2, development of a new ten-year plan called the Prosperity Plan is underway. From the draft plan, we learned that the WASH plan is not consolidated, i.e., dispersed across different sector ministries and life-cycle costs are not considered.

To address the observed gaps, SWS supported the development of consolidated woreda WASH master plans that aim for universal access to safe and sustainable WASH services for the entire population of the woredas by 2030. The master plans are framed within the targets of SDG 6 and provide a strategy towards achieving the set goals and visions for WASH in the woredas.

The main purpose of the woreda WASH SDG master plan is to address both access and sustainability. It is a full package containing a detailed plan for community and institutional WASH. The plan helps to understand the woreda's WASH status and strategizes how to achieve the SDGs. It includes mechanisms and costs for operation and maintenance, replacement, and direct support (monitoring, routine technical assistance, and training/retraining of service providers). The plan considers a variety of WASH service delivery models. For water supply, the main service delivery models are self-supply, community managed, and utility managed. For sanitation and hygiene, the approaches are Community-led Total Sanitation (CLTSH), School-led Total Sanitation (SLTSH), sanitation marketing, Information Education Communication (IEC) and Behavior Change Communication (BCC). The plan also helps to understand the costing gaps and henceforth uses them as evidence for resource mobilization.

The process to develop the woreda WASH SDG master plans started at early stages of the learning alliance when the woreda administrations in South Ari and Mille requested support to develop well rounded WASH master plans to be used for evidence-based planning and resource mobilization.

The following research questions were developed to assess the development of the woreda WASH SDG master plans:

- Did the woreda SDG planning process lead to costed, actionable, and achievable plans?
- Did the SDG planning process contribute to strengthening collaboration between stakeholders?
- Has the SDG plan helped the woreda understand their WASH systems and challenges better?
- What does the SDG plan look like across the four woredas?

The process

At the sixth learning alliance meeting, learning alliance members discussed the importance of developing woreda WASH master plans for the four woredas (Mille, South Ari, Woba Ari and Baka

Dawla Ari). The learning alliance recognized that it was a good opportunity to have a long-term plan for the woreda to mobilize, fund, and work with development partners to achieve SDG 6 targets. The planning team was established comprising of six to nine members from six woreda sector offices (water, education, health, finance, administration, and women and children). For Mille, in addition to these six sector offices, Mille Town Water Utility and the Pastoral Community Office were included in the planning team.

The planning process involved a series of workshops with coaching and evaluation activities by IRC WASH. To support the planning process, IRC WASH developed four Microsoft Excel-based planning tools.

In the first workshop (October 2019), the planning team had an introductory training on the (water) planning tool. The main objectives of the workshop were to discuss the basic concepts of SDGs, to provide training on the water SDG planning tool, discuss data requirements, and develop a timeline for the planning process. The discussion was supported by the demonstration of similar activities from another program in the Amhara Region. The planning team took the responsibility of collecting information and filling in the Excel planning tool for the next workshop.

The woreda planning teams set the vision, reviewed, and decided the vision together with the Woreda WASH Team (WWT), collected woreda baseline information, and selected new infrastructure options based on the water resource potential of the woredas, as a draft. The teams identified new infrastructure required to achieve full coverage/access to all by 2030, considering and providing attention to planning assumptions like the number of users per scheme, the lifespan of water schemes, and unit cost of water schemes. The woredas planned to achieve at least 100% basic access by 2030.

The planning teams used different baseline data sources to develop the master plans. For drinking water, the planning teams, in collaboration with Woreda Water Offices, updated the SWS supported 2017 baseline asset inventory data. For sanitation and hygiene, school WASH and Health Care Facility (HCF) WASH, the planning team used existing datasets from the Woreda Health and Education Offices supported by field surveys to fill the gaps. The planning teams shared draft documents with IRC WASH for review, and comments were discussed during the second workshop.

In the second workshop (February 2020), the planning teams presented the draft SDG plan (data collection, data entry, setting assumptions) for discussion to get feedback, discuss the challenges of the planning process and find solutions, evaluate the timeline for the planning process, and develop an ideal schedule to finalize the plan. In addition, the planning teams had a training on the sanitation and hygiene planning tool. The teams took additional responsibility and set timelines for further development of the plans.

After the second workshop, the teams addressed the comments from the workshop related to the water plans. The teams then collected data for sanitation and hygiene. Because of COVID restrictions and unrest, the planning process was delayed. During this period, the planning tools for school WASH and HCF WASH were developed and shared with the planning teams. The local facilitators discussed and supported the planning teams to understand the tools and start data collection.

In the third workshop (June 2020), the planning teams verified all data for all four plans with the support from local facilitators. The planning teams gave comments on the tools for adjustment

and editing. The planning teams also discussed the inputs to the narrative report as bullet points with the support of the local facilitators.

The SWS team adjusted the tools based on comments from all the planning teams and created a final version of the tools. All data were migrated to the final versions of the tools. Using the detailed bulleted information, the narrative report was developed.

The woreda WASH SDG plans were validated at the learning alliance meetings held in January 2021. In addition to learning alliance members, WASH stakeholders from the woredas, zone, regions, and national level participated in the validation workshops. The planning teams from water, health and education presented their respective plans. Participants suggested to get approval for the plan from the management of each WASH sector office and the Woreda Cabinet Council after incorporating the comments so that it can be used as a WASH roadmap by the woreda.

The comments from the validation workshops were incorporated into the plans and shared with sector offices for endorsement. The plans were finalized in February 2021. Up to now, South Ari and Baka Dawla woreda sector offices have endorsed their respective plans with a signature and stamp.

The planning tools

Four planning tools have been developed to facilitate the planning process. The water planning tool was initially developed for another project and modified for the four SWS woredas. Additionally, separate tools were developed for sanitation and hygiene, school WASH, and HCF WASH.

The aim of the tools is to support the handling of quantitative data systematically and support the strategic planning and costing process of going from the current service to the desired, as per the agreed vision. The tools support planning for infrastructure investment needed over longer periods to provide universal services for all and planning for all necessary activities to sustain these services including CapManEx, OpEx, CapEx, and ExpDS to service providers.

Each tool has woreda information, planning assumption, option selection/planning, cost estimation, and financing sheets. All information is presented per kebele.

The **woreda information sheet** includes general information about the woreda including woreda name, region name, baseline year, population growth rate, inflation rate, exchange rate, population per kebele, and average number of people per household. In addition to general information the sheet also includes specific information for the four different tools.

The **planning assumption sheet** includes unit cost calculations for unit costs for CapEx, rehabilitation and CapManEx, OpEx, and ExpDS. This part also includes a minimum design lifespan per scheme type. For water, school WASH and HCF WASH there are separate sheets for OpEx and ExpDS estimation to facilitate calculations. For sanitation and hygiene, the planning assumption sheet also includes sanitation and hygiene approaches (CLTSH, SLTSH, sanitation marketing, and information education communication/behavior change communication production) and their unit costs.

The **option selection sheet** is where the planning happens. It includes sections for setting and achieving the vision, planning of rehabilitation for non-functional schemes, upgrading of existing schemes and planning for construction of new schemes

The **cost estimation sheet** presents an overview of the expected changes in service levels and required costs in line with the planning. It shows all costs CapEx, CapManEx, OpEx, and ExpDS.

The **financing sheet** was developed to define options available to finance the SDG plan. It estimates the amount of money to be spent from main sources of finance (taxes, transfers, and tariffs). For school WASH and HCF WASH, it is assumed that all costs will be covered by tax.

The plans

Woreda context

The three South Omo woredas were, until recently, one woreda (South Ari). Since 2019, they have started operating separately. The context is similar in these woredas. Table 18 shows the population for the four woredas. Population growth rate for the South Omo woredas is 2.9% and 3% for Mille. The average household size is five for all woredas. The inflation rate is 8.1% using the national average.

Table 18: Woreda populations

Woreda	South Ari	Baka Dawla Ari	Woba Ari	Mille
Population	177,136	82,997	66,466	113,914

Water supply

For water services, the JMP differentiates between safely-managed services, an improved water source which is located on premises, available when needed, and free from fecal and priority chemical contamination; basic services, an improved water source, provided collection time is not more than 30 minutes roundtrip, including queuing; limited water services, improved water source for which collection time exceeds 30 minutes roundtrip, including queuing; and unimproved water services, water source from an unprotected dug well or unprotected spring or directly from a river, dam, lake, pond, stream, canal, or irrigation canal.

The main service delivery models in the woredas are community-managed and utility-managed schemes. There are also a very limited number of self-supply schemes in rural kebeles of the woredas. The community-managed schemes are managed by WASH committees (WASHCOs). In South Omo, when legalized, WASHCOs are called Water User Associations (WUAs). They are elected from the user community and work on a voluntary basis. WASHCOs/WUAs are responsible for tariff collection and day-to-day operation and maintenance of schemes. There are also federations at the kebele level that manage and support the WUAs. In Afar, the regional government has issued new legislation on water service provision recently, but this has not been implemented yet.

Table 19 shows types of technology and non-functionality rate in each woreda. The dominant water supply technology in the South Omo woredas is spring (on-spot and with distribution system). There are on-spot shallow wells and deeps wells with distribution systems in South Ari and Baka Dawla Ari. There are also limited self-supply hand dug wells in these woredas. The context is different in Mille where water supply technologies are mostly deep wells with solar or generator distribution systems with limited number of hand dug wells and shallow wells.

Table 19: Type of technology and current non-functionality rates

Woreda	Types of technology	Current number of schemes	Non-functionality rate
South Ari	Hand dug wells with hand pumps, hand dug wells with rope pump, shallow wells, deep wells with distribution, on-spot springs, and spring with distribution (medium and large gravity)	178	34%
Baka Dawla Ari	Hand dug wells, hand dug wells with rope pump (self-supply), shallow wells, deep wells with distribution, and on-spot springs	97	43%
Woba Ari	Spring on spot, hand dug wells, medium gravity spring with distribution, and large gravity spring with distribution	19	33%
Mille	Shallow wells and hand dug wells fitted with hand pump and solar powered, and deep wells with generator-powered distribution systems and solar-powered distribution systems	31	35%

The challenges and gaps in providing sustainable water services are divided into low coverage, frequent breakdown of schemes (high non-functionality rate), low level of safely managed water services, challenges with availability of water resources and water quality, and challenges with presence, capacity, and performance of service providers (WASHCOs/ WUAs) and service authorities (woreda/zone/region). The woredas have similar challenges in these areas including but not limited to lack of sufficient budget allocation, lack of water resource potential, lack of community awareness and sense of ownership, poor construction quality, lack of funds, spare parts, tools, and knowledgeable technicians for maintenance, lack of skilled or trained caretakers for preventive maintenance, and lack of proper documentation and information exchange about schemes between service providers and service authorities. There is shortage of logistics, budget, and equipment for the Woreda Water Offices to carry out their work. There is also high staff turnover in all the woredas. In addition, the WASHCOs/WUAs do not have the financial or technical capacity to do maintenance. Payment for operation and maintenance is expected to come from the community, though this mostly happens on an ad-hoc basis.

All the woredas have set the vision of achieving 100% coverage with at least basic water service in rural and urban areas. In addition, each woreda has planned for some percentage of the coverage to be safely managed. As most of the woredas are starting with a significantly low percentage of safely managed services, the planning team and the Woreda Sector Heads found it unrealistic to plan for achieving 100% safely managed services within an implementation period of less than 10 years. Table 20 shows baselines and visions of the woredas.

Table 20: Baseline and 2030 vision for water service levels

	South Ari		Baka Dawla Ari		Woba Ari		Mille	
	2019 baseline	2030 vision	2019 baseline	2030 vision	2019 baseline	2030 vision	2019 baseline	2030 vision
% Served	22%	100%	18%	100%	14%	100%	31%	100%

% Served Basic	21%	88%	18%	92%	14%	92%	24%	60%
% Served Safely Managed	1%	12%	0%	8%	0%	8%	7%	40%

Strategies to achieve the targets include rehabilitation of broken-down schemes, construction of new schemes including self-supply and household connections, and sustaining these services through establishment, legalization, and strengthening of WASHCOs/ WUAs and federations, tariff setting and revenue collection, and strengthening spare part supply and preventive maintenance services. Total and disaggregated costs to achieve at least 100% basic services by 2030 are included in Table 21. CapEx, CapManEx and ExpDS are expected to be covered by the government in most of the schemes. OpEx is expected to be covered by the community through collection of user fees.

Most NGOs that work in the woredas have short-term plans, lasting a maximum of 5 years, and when their implementation is complete there is a handover process where the role of long-term service provision falls to the government, often without any long-term planning assistance. NOGs do not engage in service provision; they construct or rehabilitate water schemes and handover to the government or community on a project-by-project basis. Mobilizing finance from different stakeholders including NGOs, community, bilateral and multilateral organizations, and government at higher level for long-term asset management is considered the responsibility of the government and most of the financing is sourced from the government. But this can be modified from time to time based on actual data when available; woredas can update their plans based on their own context annually and based on previous year performance.

Table 21: Costs to achieve at least 100% basic water services by 2030 (community)

	South Ari	Baka Dawla Ari	Woba Ari	Mille
CapEx	662.17 million ETB (16.76 million USD)	225.89 million ETB (5.72 million USD)	195.43 million ETB (4.95 million USD)	863.92 million ETB (21.87 million USD)
%CapEx	47%	31%	42%	49%
CapManEx	462.12 million ETB (11.70 million USD)	255.72 million ETB (6.47 million USD)	90.73 million ETB (2.30 million USD)	751.19 million ETB (19.02 million USD)
%CapManEx	33%	35%	19%	42%
OpEx	195.26 million ETB (4.94 million USD)	140.01 million ETB (3.54 million USD)	63.38 million ETB (1.60 million USD)	82.74 million ETB (2.09 million USD)
%OpEx	13%	19%	14%	5%
ExpDS	94.31 million ETB (2.39 million USD)	111.41 million ETB (2.82 million USD)	119.14 million ETB (3.02 million USD)	84.32 million ETB (2.13 million USD)
%ExpDS	**7%**	**15%**	**25%**	**4%**
Total	**1.41 billion ETB (35.79 million USD)**	**733 million ETB (18.56 million USD)**	**468.68 million ETB (11.87 million USD)**	**1.78 billion ETB (45.12 million USD)**

Sanitation and hygiene

The JMP defines sanitation with respect to whether people access safely managed (improved private facilities with safe treatment), basic (improved private facilities), limited (improved facilities shared with multiple households), unimproved sanitation services or practicing open defecation. Hygiene services are defined with respect to whether the households have a hand washing facility with soap and water.

There are private and shared improved household pit latrines, private and shared unimproved latrines, and unimproved latrines in the woredas. Table 22 shows sanitation and hygiene contexts in the woredas.

The main approaches towards improving sanitation and hygiene in the woredas are CLTSH, SLTSH, sanitation marketing, and IEC and BCC. In the sanitation and hygiene context, there are service providers like the utilities/municipalities and private pit emptying services in the urban context who are responsible for desludging or managing the pipe system. However, there are no service providers in the woredas. Households are responsible for construction and maintenance of their own latrines. It is assumed that sanitation promotion and marketing will be sufficient to create demand for sanitation and hygiene and households will construct their own latrines.

Table 22: Sanitation and Hygiene service levels

	South Ari	Baka Dawla Ari	Woba Ari	Mille
Total number of villages	531	282	159	76
Number of CLTSH triggered villages	328	11	70	13
Total number of households	36,097	16,599	12,323	19,974
Sanitation				
% HH Safely managed	0%	0%	0%	0%
% HH Basic	32%	38%	47%	17%
% HH Limited	4%	0%	2%	9%
% HH Unimproved	51%	16%	44%	27%
%HH Open defecation	13%	46%	85%	47%
Hygiene				
% HH Basic	9%	6%	31%	9%
% HH Limited	14%	32%	17%	8%
% HH No facilities	77%	62%	52%	83%

The most common challenges and gaps found in the woredas are lack of water for hand washing, lack of handwashing tradition, hygiene messaging not being covered during CLTSH triggering, weak post-ODF follow-up and support, limited awareness about the need for sanitation and hygiene practices within the community, lack of capacity to finance latrine construction, and lack of bylaws to prevent slipping from ODF status.

All the woredas have set the vision of achieving 100% coverage with at least basic sanitation and hygiene services. Each woreda also planned a percentage of in situ safely managed sanitation services. Table 23 shows the visions of the woredas.

Table 23: Sanitation and Hygiene vision for 2030

Woreda	South Ari	Baka Dawla Ari	Woba Ari	Mille
Sanitation				
% HH Safely managed	30%	10%	12%	10%
% HH Basic	70%	90%	88%	90%
%HH Open defecation	0%	0%	0%	0%
Hygiene				
% HH Basic	100%	100%	100%	100%

Since the construction of sanitation and hygiene facilities is the responsibility of households, the main strategy is the successful and sustainable implementation of CLTSH and a sanitation marketing approach, which will require strengthening of the Woreda Health Office capacity and performance.

Total and disaggregated costs to achieve at least 100% basic services by 2030 are included in Table 24. CapEx for sanitation and hygiene is divided into two parts as CapEx software and CapEx

hardware. CapEx software is the cost of CLTSH triggering which is to be covered by taxes and transfers. CapEx hardware is the cost related to the construction of new sanitation and hygiene facilities which is fully covered by the households. CapManEx and OpEx costs are covered by the households. ExpDS which is the cost of post-triggering support, post-ODF follow-up, and IEC and BCC material production, which is expected to be covered by taxes and transfers.

Table 24: Costs to achieve sanitation & hygiene vision (100% basic service) by 2030

	South Ari	Baka Dawla Ari	Woba Ari	Mille
CapEx hardware	273 million ETB (6.92 million USD)	276 million ETB (7 million USD)	123 million ETB (3.11 million USD)	1.08 billion ETB (27.38 million USD)
% CapEx hardware	9%	10%	8%	33%
CapEx software	69 million ETB (1.74 million USD)	86 million ETB (2.17 million USD)	41 million ETB (1.03 million USD)	15 million ETB (370 thousand USD)
% CapEx software	2%	3%	3%	0.5%
CapManEx	990 million ETB (25.07million USD)	621 million ETB (15.73 million USD)	249 million ETB (6.31 million USD)	1.44 billion ETB (36.38 million USD)
% CapManEx	31%	22%	17%	43%
OpEx	1.81 billion ETB (45.77 million USD)	1.82 billion ETB (46.08 million USD)	1.04 billion ETB (26.23 million USD)	751 million ETB (19.02 million USD)
% OpEx	56%	63%	70%	23%
ExpDS	58 million ETB (1.47 million USD)	63 million ETB (1.6 million USD)	32 million ETB (820 thousand USD)	9 million ETB (220 thousand USD)
% ExpDS	2%	2%	2%	0.5%
Total	**3.2 billion ETB (81 million USD)**	**2.87 billion ETB (72.6 million USD)**	**1.48 billion ETB (37.5 million USD)**	**3.29 billion ETB (83.38 million USD)**

Institutional WASH

The JMP separately defines WASH for schools and health care facilities. For water, there is basic, an improved source available on premises; limited, an improved source within 500m; and no service, no water source or unimproved source. For sanitation, there is basic, an improved, sex-separated, private, with menstrual hygiene facility, accessible to people with disability; limited, an improved facility; and no service, unimproved or no sanitation facility. For hygiene, there is basic, a hand washing facility with soap and water; limited, missing either soap or water and not available at point of care; and no service, no or non-functional hand washing facilities. Table 25 shows the institutional WASH context in the woredas. All the woredas have set the vision of achieving 100% coverage with at least basic WASH services in all schools and HCFs.

Table 25: Institutional WASH service levels

		South Ari	Baka Dawla Ari	Woba Ari	Mille
School WASH	Total number of schools	57	20	23	16
	Water	35%	30%	9%	25%
	Sanitation	19%	20%	9%	6%

	Hygiene	0%	0%	0%	0%
HCF WASH	**Total number of HCF**	**38**	**14**	**12**	**17**
	Water	24%	21%	0%	12%
	Sanitation	0%	0%	0%	0%
	Hygiene	8%	0%	0%	12%
	Waste management	16%	7%	8%	24%
	Environmental cleaning	0%	0%	0%	12%

The challenges and gaps found in institutional WASH include lack of budget to construct own water supply systems or to connect to existing piped systems even when there are pipelines nearby, lack of budget for OpEx, and lack of clarity on criteria for basic WASH, with national criteria differing from the JMP criteria.

Strategies to achieve 100% basic WASH services in schools and HCFs include provision of WASH facilities together with new institutions, ensuring adequate WASH facilities in existing institutions, and ensuring sustainable WASH services through WASH promotion. Total and disaggregated costs to achieve at least 100% basic services by 2030 are included in Table 26 for schools and Table 27 for HCFs.

Table 26: Costs to achieve 100% basic services by 2030 for School WASH

	South Ari	Baka Dawla Ari	Woba Ari	Mille
CapEx	24.22 million ETB (610 thousand USD)	12 million ETB (304 thousand USD)	19.77 million ETB (500 thousand USD)	1.45 million ETB (37 thousand USD)
% CapEx	37%	37%	12%	23%
CapManEx	28.34 million ETB (720 thousand USD)	13.9 million ETB (354 thousand USD)	17.11 million ETB (433 thousand USD)	1.21 million ETB (31 thousand USD)
% CapManEx	43%	43%	11%	19%
OpEx	8.73 million ETB (220 thousand USD)	2.52 million ETB (64 thousand USD)	3.35 million ETB (85 thousand USD)	2.92 million ETB (74 thousand USD)
% OpEx	13%	8%	2%	45%
ExpDS	4.3 million ETB (110 thousand USD)	3.77 million ETB (95 thousand USD)	119.14 million ETB (3.02 million USD)	872 thousand ETB (22 thousand USD)
% ExpDS	7%	12%	75%	13%
Total	**65.6 million ETB (1.66 million USD)**	**32.3 million ETB (817 thousand USD)**	**159.37 million ETB (3.2 million USD)**	**6.5 million ETB (164 thousand USD)**

Table 27: Costs to achieve 100% basic services by 2030 for HCF WASH

	South Ari	Baka Dawla Ari	Woba Ari	Mille
CapEx	35.6 million ETB (900 thousand USD)	12.13 million ETB (307 thousand USD)	12.93 million ETB (327 thousand USD)	6.23 million ETB (158 thousand USD)
% CapEx	41%	45%	47%	27%
CapManEx	25.28 million ETB (640 thousand USD)	9.24 million ETB (234 thousand USD)	8.56 million ETB (217 thousand USD)	3.84 million ETB (97 thousand USD)
% CapManEx	29%	34%	31%	17%
OpEx	12.75 million ETB (320 thousand USD)	2.57 million ETB (65 thousand USD)	2.77 million ETB (70 thousand USD)	2.67 million ETB (68 thousand USD)
% OpEx	15%	9%	11%	12%
ExpDS	12.71 million ETB (320 thousand USD)	3.23 million ETB (82 thousand USD)	3.07 million ETB (78 thousand USD)	10.11 million ETB (256 thousand USD)
% ExpDS	15%	12%	11%	44%
Total	**86 million ETB (3.1 million USD)**	**27.18 million ETB (688 thousand USD)**	**27.54 million ETB (697 thousand USD)**	**22.85 million ETB (578 thousand USD)**

Reflection on learning questions

The research questions to assess the development of the woreda WASH SDG master plans were:

- Did the woreda SDG planning process lead to costed, actionable, and achievable plans?
- Did the SDG planning process contribute to strengthening collaboration between stakeholders?
- Has the SDG plan helped the woreda understand their WASH systems and challenges better?
- What does the SDG plans look like across the four woredas?

The woredas developed fully costed master plans for community and institutional WASH. Based on the baseline and the situation in the woredas, they also decided that it was impossible to aim for 100% safely managed services by 2030 for community WASH. Therefore, the plans aim for at least 100% basic services by 2030 for both community and institutional WASH. The vision of the woredas for 2030 for community WASH is shown in Table 20. For institutional WASH, all the woredas agreed to reach 100% basic WASH services by 2030.

The achievability of the plan depends on the availability of additional financing. The total cost required to achieve the envisioned WASH services, is presented in Table 28. The plans show that each woreda needs 2-5 billion ETB (up to 130 million USD) to achieve their vision allocating 200-500 million ETB (up to 13 million USD) annually. This is very high compared to the present resource allocation practices. The woredas will need support in resource mobilization if they are to achieve their vision by 2030.

Table 28: Total cost required to achieve woreda visions by 2030

	South Ari	Baka Dawla Ari	Woba Ari	Mille
Water	1.41 billion ETB (35.79 million USD)	733 million ETB (18.56 million USD)	468.68 million ETB (11.87 million USD)	1.78 billion ETB (45.12 million USD)
Sanitation and Hygiene	3.2 billion ETB (81 million USD)	2.87 billion ETB (72.6 million USD)	1.48 billion ETB (37.5 million USD)	3.29 billion ETB (83.38 million USD)
School WASH	65.6 million ETB (1.66 million USD)	32.3 million ETB (817 thousand USD)	43.8 million ETB (1.12 million USD)	6.5 million ETB (164 thousand USD)
HCF WASH	89 million ETB (3.1 million USD)	27.2 million ETB (685 thousand USD)	27.5 million ETB (697 thousand USD)	22.8 million ETB (575 thousand USD)
Total	**4.7 billion ETB (120.6 million USD)**	**3.7 billion ETB (92.8 million USD)**	**2.02 billion ETB (51.1 million USD)**	**5.1 billion ETB (129.1 million USD)**

The collaboration between WASH sector offices increased in the planning process. The planning teams drawn from WASH sector offices worked together, WWT and other learning alliance members participated in the process of evaluation and validation. The discussions helped them to understand the opportunities and challenges. The need for coordination during implementation was stressed in the validation workshops. The learning alliances supported in strengthening collaboration between planning team members.

The data collection for the plans helped the woredas update their water asset inventory and establish new baseline information for sanitation, hygiene, and institutional WASH. The WWT participated in the vision setting, planning of the evaluation processes and validation workshops. The planning teams also presented the plans to their respective sector office managements which increased buy-in. In addition, the plans were validated with the participation of learning alliance

members and zone, region, and national sector representatives. The woredas have decided to use the plan for development of the government 10-year plan.