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Policy Analysis of Ethiopia's Rural Water Operation and Maintenance Policies

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Diplomityön tiivistelmä

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Tiivistelmä

Maaseudun toimimattomat ennenaikaisesti hajoavat vesipisteet heikentävät huomattavasti kestävän kehityksen tavoitteen 6.1 pyrkimystä saavuttaa turvallinen ja edullinen juomavesi kaikille (SDG 6.1). Tällä hetkellä jopa yksinkertaisten vesijärjestelmien, kuten käsipumppujen, kestävyydessä sekä käytössä ja ylläpidossa on puutteita. Tämän työn teemana oli selvittää, voivatko SDG 6.1:n edellyttämät kehittyneemmät vesijärjestelmät tuottaa ei-toivottuna seurauksena vesijärjestelmien toimimattomuutta tulevaisuudessa.

Tätä laajempaa teemaa tutkittiin kolmella tutkimuskysymyksellä ja Etiopian vesipolitiikan tapaustutkimuksella. Menetelmänä käytettiin kvalitatiivista poliittisten asiakirjojen analyysia Etiopian kansallisesta vesipolitiikasta (n = 3) ja modifioitua Triple-S viitekehystä. Asiakirja-analyysi kolmioitiin Etiopian maaseudun vesialan ammattilaisten kyselyillä (n = 11) ja haastatteluilla (n = 3) kattamaan kokonaisuudessaan kolme hallinnollista tasoa.

Etiopian politiikan havaittiin ottavan hyvin huomioon Triple-S viitekehyksen rakennuspalikoihin liittyviä käyttö- ja kunnossapitonäkökulmia. Politiikan täytäntöönpano on kuitenkin heikkoa. Rahoituksen ja inhimillisten valmiuksien puutteiden havaittiin olevan kestävän käytön ja kunnossapidon toteutumisen suurimpia pullonkauloja. Yksinkertaisempien vesijärjestelmien nykyiset tiedossa olevat käyttö- ja kunnossapitohaasteet herättävät huolta suurempia ja kehittyneempiä vesijärjestelmiä suosivasta suuntauksesta.

Käyttö- ja kunnossapitotoimintaan liittyvän politiikan täytäntöönpano ja valvonta olisi asetettava etusijalle. Koska tämä vaatii resursseja, olisi hyödyllistä ohjata ne politiikkaan, jolla on suurin vaikutus käyttöön ja ylläpitoon. Ehdotuksena on maaseudun vesihuollon valvonta ja sääntely, millä olisi vaikutusta moniin muihin Triple-S rakennuspalikoihin. Lisäksi suositellaan maaseudun vesihuollon institutionaalisten tukirakenteiden (erityisesti inhimillisen ja taloudellisen kapasiteetin) parantamista, ennen kuin edetään kehittyneempiin vesijärjestelmiin laajemmassa mittakaavassa.

Avainsanat maaseudun vesihuolto, kestävyys, käyttö- ja kunnossapito, Triple-S viitekehys, vesipalvelujen toimittaminen, Kestävän kehityksen tavoitteet, toimivuus

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Abstract

Non-functioning rural water systems, prematurely breaking down, severely undermine the efforts to achieve universal and equitable access to safe and affordable drinking water for all (SDG 6.1). The current challenge is that even simple water systems, like hand pumps, are struggling with sustainability, operation and maintenance (O&M). The aim of this thesis was to investigate, if a push towards more advanced rural water systems, prompted by the SDG 6.1, has potential to backfire on rural communities through an increase in non-functionality.

This larger theme was studied through three research questions and a case study of Ethiopia's water policies. The method used qualitative policy document analysis of Ethiopia's national water policies (n = 3) within a modified Triple-S framework. The document analysis was triangulated with 11 surveys and three interviews of Ethiopian rural water professionals, at three different administrative levels.

Ethiopia's policies were found to cover well O&M issues related to the Triple-S building blocks. Nevertheless, the implementation seems to be lacking. The key bottlenecks for more sustainable O&M were found to be finance and human capacity. Currently, even simpler water systems are struggling to be adequately operated and maintained, which raises concerns towards the trend of larger and more advanced water systems.

The implementation and oversight of policies related to O&M should be prioritized. As oversight and implementation of policies requires resources, it would be beneficial to them to policies that would have the greatest impact on O&M. Monitoring and regulation of rural services are suggested, as they are closely linked to many of the Triple-S building blocks. In addition, institutional support structures (especially human and financial capacity) are recommended to be improved before moving toward advanced water systems on a wider scale.

Keywords rural water supply, sustainability, operation and maintenance, Triple-S framework, water service delivery, Sustainable Development Goal, functionality

Preface

I hope this work positively challenges the reader to rethink, how operation and maintenance of rural water systems impacts equitable access and safe drinking water to all. I want to encourage the government of Ethiopia to continue the good work they have been doing towards this goal. We many times underestimate what we can accomplish in the long run and developing anything new is like a marathon. So, keep running the race, one step at a time. When you look back, you will be able to see all the distance you have covered by serving each other. I also want to applaud everyone contributing to the water development sector in Ethiopia and all over the world. The welfare of many lives relies on your persistent work. I want to thank Arto Suominen and Yohannes Melaku from the COWASH project in assisting with the data collection and commenting the work. Many thanks to my supervisor Olli Varis and thesis advisor Venla Niva. Your comments were valuable in sharpening the work.

Espoo 02.07.2021

Sincerely,

Esra Marvin

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Abbreviations and definitions

CBM	Community-Based Management
CMP	Community Managed Project
COWASH	Community-Led Accelerated WASH (bilateral project)
DRA	Demand Responsive Approach
GDP	Gross Domestic Product
GNI	Gross National Income
GTP	Growth and Transformation Plan
HDI	Human Development Index
ICT	Information and Communication Technology
MDG	Millennium Development Goal
M&E	Monitoring and Evaluation
MIS	Management Information System
MoU	Memorandum of Understanding
MSE	Micro and Small Enterprise
NGO	Non-Governmental Organization
NWP	National Water Policy Draft
O&M	Operation and Maintenance
OMSF	Operation and Maintenance Strategic Framework
OWNP	One WASH National Programme
RPS	Rural Piped System
RWS	Rural Water Supply
RWSN	Rural Water Supply Network
RWSS	Rural Water supply System
SDM	Service Delivery Model
SDG	Sustainable Development Goal
WASH	Water, Sanitation and Hygiene
WASHCO	Water, Sanitation and Hygiene Committees
WRMP	Water Resources Management Policy
WIF	WASH Implementation Framework
WSSP	Water and Sanitation Safety Plan
WSS	Water Supply Systems

Advanced Water Systems or Complex Water Systems: systems that are technically more complex than public wells or bore holes equipped with hand pumps (improved drinking water source).

To fulfill the Sustainable Development Goal (SDG) 6.1 definition (free from contamination, available on demand and at premises) more advanced water supply systems (WSS) may be needed.

These can include motorized pumps, pump or gravity fed piped water systems, water storage, valves, water meters and other network control components. Also, WSS with physical or chemical treatment may be needed.

1 Introduction

During the Millennium Development Goal (MDG) period of 1990-2015, 91% of global population has gained access to improved drinking water sources (JMP, 2015). Likewise, Ethiopia's progress in drinking water during the same period has been very successful. In 2015 Ethiopia reached its MDG 7C goal of 57% of the population having gained access to improved drinking water (Wossen, 2015). This is a significant improvement from the baseline year of 1990 (14%).

With good progress in the MDGs, there might be an increased enthusiasm to continue full steam towards Agenda 2030 and the Sustainable Development Goal (SDG) target 6.1 (universal and equitable access to safely managed drinking water sources). Ethiopia's Growth and Transformation plan II (GTP II) for example, shows a renewed interest in expanding rural piped water to 20% by year 2025 (MoFED, 2014; Lockwood and Butterworth, 2016). On the other hand, the success with MDG 7C might be misleading as it uses an infrastructure-based approach in its definition of safe drinking water. The monitoring includes population with access to facilities, theoretically, providing water. It does not address if the facilities are actually functioning, providing the intended service, or if the water is safe. For example, a study by Bain et al. (2012) indicated that when water quality was considered in access to safe drinking water, the national percentage of Ethiopia's MDG 7C dropped by 11%.

Table 1 Comparison of Sustainable Development Goal and Millennium Development Goal drinking water targets. The Sustainable Development Goal is more ambitious, and it uses a "service" indicator.

	SDG 6 Ensure access to water and sanitation for all	MDG 7 Ensure Environmental sustainability
Target	6.1 Safe and affordable drinking water	7C Safe drinking water and basic sanitation
Goal	By 2030 achieve **universal and equitable access** to safe and affordable drinking water for all	By 2015, **halve the proportion of people** without sustainable access to safe drinking water and basic sanitation
Indicator	6.1.1 Proportion of population using **safely managed drinking water services**	Proportion of the population using an **improved drinking water source** and the proportion of the population using an improved sanitation facility

The issues with the MDG goals have been, to some degree, improved in the SDG 6.1 goals and indicators (Table 1). The SDG 6.1 indicator guides monitoring towards the overall quality of service provided (Génevaux, 2018). Although the updates in the SDGs are positive, the push towards the MDC 7C should act as a cautionary example of the possible negative impacts these goals can have. Speeding towards coverage can lead to sub-standard water systems and neglect of existing infra, which in turn increases the non-functionality in the long term (Truslove et al., 2019).

The challenge with moving forward, without addressing existing issues of non-functionality, are twofold. Firstly, the SDG target 6.1 of safely managed drinking water, by definition, requires technically more advanced water systems than those achieved with the MDGs. Yet, even these simpler improved water systems have been struggling with sustainability and operation and maintenance (O&M) issues as reported by several studies (Foster, 2013; Banks and Furey, 2016).

Secondly, the estimated capital investment needed, to reach the SDG targets 6.1 and 6.2 globally, is over three times the level of investment that was used to reach the MDGs (Hutton and Varughese, 2016). Having a constant pool of water points needing rehabilitation is diverting investments from these goals (reaching the unserved and improving existing water systems from basic to safely managed). Thus, it is crucial that the large capital investment in water infrastructure is secured by improving O&M throughout the life cycle. The non-functionality of water projects is a waste of capital investment. The rehabilitation of severely damaged infrastructure requires new capital investment, which is many times higher than the cost to upkeep existing infra (Rioja, 2013).

Many issues with sustainability, functionality and operation and maintenance (O&M) of rural water have been studied within the water development sector. The literature on the topics are comprised of both practice-focused grey literature and academic articles. They span a wide range of study approaches. For example, Anthonj et al. (2018) carried out a bivariate regression analysis on factors associated with functional water points in Ethiopia. One of the findings was that speeding repair times is deemed important in the sustainability of the water point. Another study, by Klug et al. (2017) identified hardware and management rehabilitation pathways through a qualitative study. A key finding was that pathways requiring external technical and financial support were more prevalent with advanced water systems. Despite numerous studies and reports regarding sustainability of rural water projects across the globe, the issues with sustainability seem to persist. One of the latest functionality studies estimated that over 25% of hand pumps in sub-Saharan Africa are non-functional at any given time (Foster et al., 2020).

Whaley and Cleaver (2017) brought up several concerns regarding existing studies on sustainability of rural water supply (RWS). The first criticism is that the literature is focused on the local community level, without considering the larger social, political, economic, and institutional contexts they operate in. Secondly, studies that do recognize a socio-technical interface may only consider one of these aspects.

Nevertheless, the sector has seen good progress in wider approaches towards sustainability of RWS (Whaley and Cleaver, 2017). For example, Behailu, Hukka and Katko (2017) incorporated a wide range of factors like social, economic, instutional and environmental in their study of non-functioning water points. The sustainability of Ethiopia's rural water has also been studied as part of the World Bank Group's multi-country global study on sustainable service delivery models (Lockwood and Butterworth, 2016). The study considered a wider perspective on sustainability by including the country and sector context over a scale of actors. This framework is known as Triple-S and it is comprised of 10 "building blocks", which have been found to contribute towards sustainable rural water service delivery (Lockwood and Smits, 2011).

The aim of this study is to address the "elephant in the room" regarding the Sustainable Development Goal (SDG) 6.1 target and sustainability of rural water systems. Can a push towards advanced rural water systems backfire on the poor and unserved rural populations, as they are unable to operate and maintain them in the years to come? This is done through a case study of Ethiopia, and it seeks to consider Whaley and Cleavers (2017) suggestion for a wider approach by considering technical, social and policy aspects.

The objective of this study is to explore how Ethiopia's water policies and guidelines address operation and maintenance (O&M) in the context of rural water. Qualitative interviews and survey are triangulated with the policy content analysis to identify gaps and bottlenecks. O&M issues are explored more specifically through the following research questions:

(1) How well are the Triple-S building blocks covered in Ethiopia's national water policies and guidelines related to O&M issues?

(2) How do WASH professionals view O&M in Ethiopia and what are the biggest bottlenecks?

(3) How do WASH professionals view the SDG 6.1 goals from an O&M perspective and the capacity of communities to operate and maintain more complex water systems?

The first research question (1) will qualitatively compare Ethiopia's O&M water sector policies to selected Triple-S sustainability blocks. The second question (2) compares the content of policies to the WASH professional views of the biggest bottlenecks for sustainable O&M. The third research question (3) attempts to identify possible challenges and to get a glimpse of the WASH professionals' perceptions on the ability of community managed water schemes to manage more complex water systems compared to basic improved water sources. In this study, "ability to manage" refers mainly to the human capacity of communities but also includes the existing external support structures like capacity of local authorities, access to mechanics and spare parts. WASH professionals refer to national, regional and local level experts working in the rural water sector. In Ethiopia the local level administrative unit is known as a woreda. The woreda is comparable to a municipal level administration.

Ethiopia is an interesting case study as it has put significant effort to develop their rural water schemes during the Millennium Development Goal period. At the same time, they have worked diligently to reform and harmonize the water sector by implementing the One WASH National Programme (OWNP). The OWNP is a sector wide approach to improve access to water, sanitation and hygiene (National WCO, 2016).

Ethiopia has ambitious goals of becoming a middle-income country by the year 2025 and they are currently at the end of their OWNP phase two (July 2015 to June 2020). This provides a good opportunity to evaluate what policies have been implemented, and what can still be done to improve the sustainability and access to rural water. The rural water sector in Ethiopia will most likely remain significant for some time to come, as the demographics are composed of a large rural population (Behailu, 2016; CIA, 2021).

The outcome of this thesis will hopefully act as a platform for policy makers, water sector experts and practitioners to further discuss and realize the importance of operation and maintenance (O&M). Especially its significance in reaching the Sustainable Development Goal (SDG) 6.1 target in a financially sustainable manner. It also gives Ethiopia's water sector professionals a check for possible inconsistencies, gaps and bottlenecks in current policies related to O&M. It can help Ethiopia's water sector actors to align on O&M issues and help prioritize improvements before steaming towards SDG targets (advanced water systems) at a larger scale.

2 Background and research context

2.1 Challenges of rural water

Infrastructure investments are typically characterized by a long design life span and large upfront cost. The World Bank estimates that $114 billion annual capital investment is required to reach the Sustainable Development Goal 6 targets of universal access to water, sanitation and hygiene (WASH) services (Hutton and Varughese, 2016). This estimation of capital costs does not include the finances required to sustain the services in the long term. Once infrastructure is built the capital cost decreases over time, but the maintenance cost to keep the service at desired levels increases. The operation and maintenance (O&M) investment to sustain SDG targets 6.1 and 6.2 are estimated to exceed the capital investment needs by year 2030 (Hutton and Varughese, 2016), see Figure 1 below.

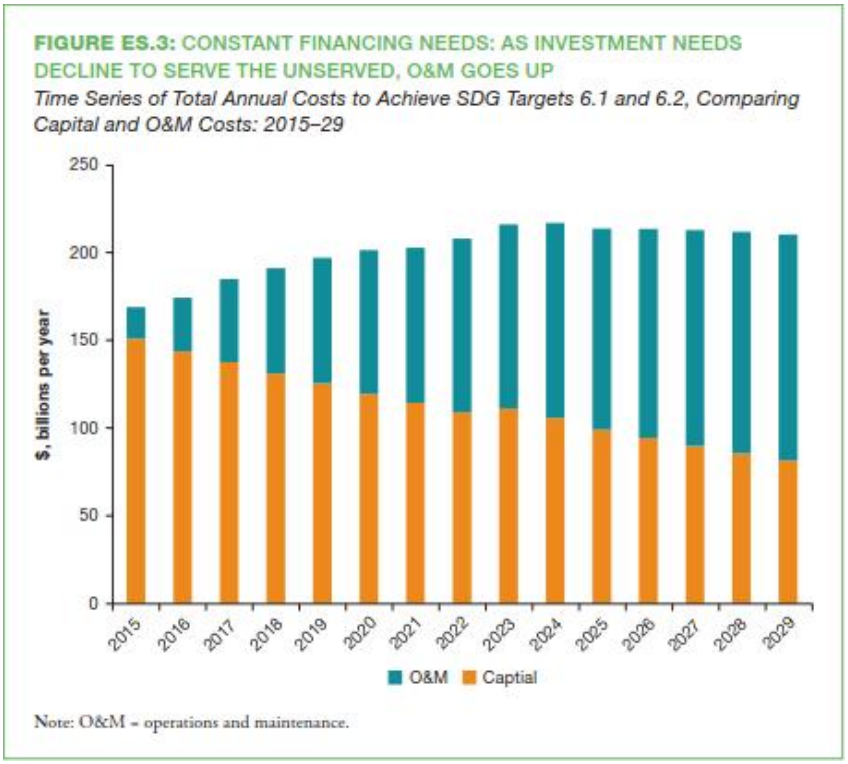

Figure 1 Operation and maintenance investment needs increases with time. The investment needs are estimated to overtake the capital investments by 2030. This highlights the need to increase focus on operation and maintenance issues. Figure from (Hutton and Varughese, 2016)

One of the continuing discourses of development projects is the long-term sustainability once projects are completed and subsidized funding ceases. The Rural Water Supply Network (RWSN) reports, that even the simplest technology of hand pumps have a high degree of non-functionality after two years (Banks and Furey, 2016; Foster et al., 2020). A quarter of water points being nonfunctional before their predicted lifetime (Figure 2) indicates fundamental issues with the sustainability of water points. The O&M activities have been clearly neglected. The predicted lifetime of hand pumps can be more than 20 years when properly designed, installed and maintained (Furey, 2014).

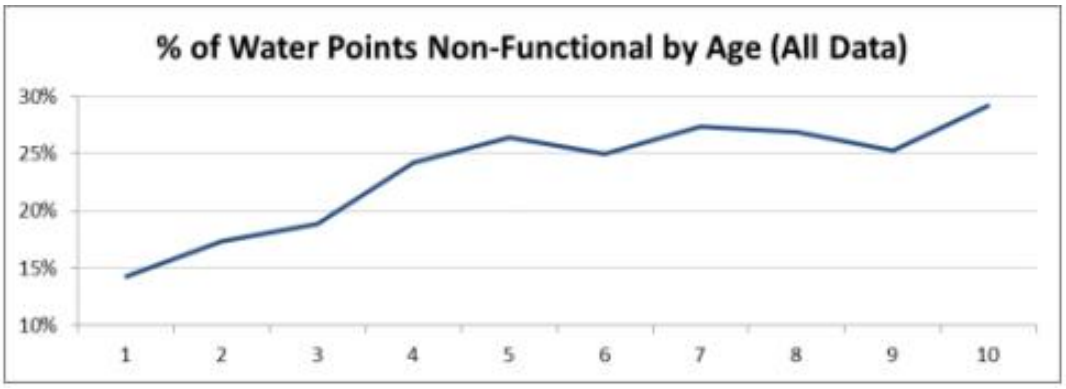

Figure 2 A quarter of rural water points are non-functional by the time they reach a quarter of their design lifetime. This highlights issues with operation and maintenance of rural water systems in the water development sector. Figure from (Banks and Furey, 2016)

2.2 Sustainable Service Delivery

The idea of service delivery is that sustainable water supply is more than just the physical infrastructure. It entails everything, from government policies to the nuts and bolts, that are required for a water point to continually deliver water at a predetermined service level to its customers (Lockwood and Smits, 2011; Lockwood, 2019).

Despite the past struggles for sustainability in water development projects, the sector has seen improvement in its approach during the past decades (World Bank Group, 2017). The focus has shifted from project-based to sector-wide approaches (Moriarty et al., 2002; Lockwood and Smits, 2011). And from infrastructure delivery to a more holistic approach of service delivery (Lockwood and Smits, 2011).

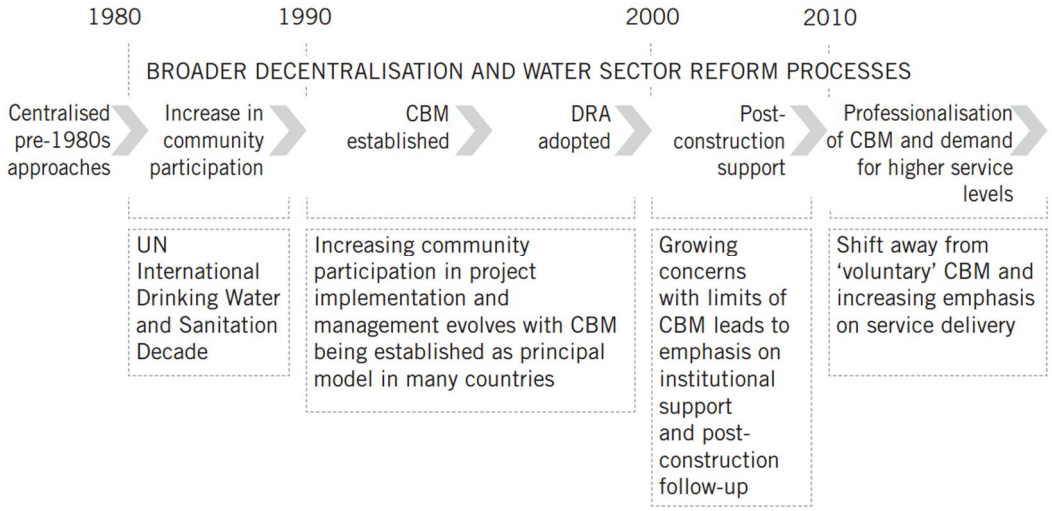

Figure 3 Overview of the common development trends in the rural water sector. Due to limitations of communities to manage water systems, the trend is towards more professional management arrangements. Figure from (Lockwood and Smits, 2011)

The development trends in Figure 3 should be viewed as building on each other, rather than independent stages. The service delivery approach incorporates community participation, community-based management (CBM), demand responsive approach (DRA) and post construction support. In other words, service delivery approach can be viewed as the latest evolution of all the previous sector reforms.

There are several studies of service delivery models (SDMs) and their performance in improving the functionality of water services in the rural development context (Lockwood and Smits, 2011; World Bank Group, 2017; Lockwood, 2019). Lockwood (2019) highlights monitoring as one of the challenges that have been identified. Monitoring and data collection are key in providing information, that can drive efficiencies to the way rural water supply is operated. It also increases transparency in a sector with many actors and provides valuable information for decision makers (Lockwood, 2019). At the same time, it should be noted that the SDMs in themselves are not a turnkey solution. The efficiency and sustainability at which a model can be implemented depends on the local enabling environment like governance, legislation, regulation, economics, institutional capacity and frameworks (World Bank Group, 2017).

2.3 The Triple-S Sustainable service at scale

The service delivery approach concept has been maturing since the early 2000s (Moriarty et al., 2013). Building on research by multiple authors, the service delivery approach reached its current form in (Lockwood and Smits, 2011) study and the Sustainable Services at Scale (Triple-S) global learning initiative which was a six year project from 2008-2014 lead by the International Water and Sanitation Center (IRC). The Triple-S project lead to the development of 10 building block towards sustainable rural water service delivery, which have become known as the Triple-S sustainable service delivery building blocks, see Figure 4.

TABLE B2.2.1. Ten Building Blocks for Sustainable Service Provision as identified in Triple-S project

Professionalization of community management with policy embedding, adequate legal frameworks; move away from voluntarism	**Support to service providers** with technical, admin, and institutional support to and monitoring of community and other service providers
Recognition and promotion of alternative service provider options beyond community management model (self-supply, PPPs)	**Capacity support to local governments** to enable them to fulfil their roles (for example, planning, asset management, monitoring and regulation)
Monitoring service delivery and sustainability with systems that track indicators of functionality, performance, and service levels	**Asset management** through systematic planning, inventory updates, and financial forecasting for assets with asset ownership clearly defined
Harmonization and coordination among development partners and government, and alignment with national policies and systems	**Regulation of rural services and service providers** with performance through mechanisms appropriate for small rural operators
Learning and adaptive management supported at national and decentralized levels to enable the sector to adapt based on experience	**Financing to cover all life cycle costs**, especially capital maintenance, support to service authorities and service providers, monitoring and regulation

Figure 4 Triple-S building blocks, developed through the Sustainable Services at Scale (Triple-S) global learning initiative by the International Water and Sanitation Center (IRC). Modified from (WBG, 2017)

The Triple-S building blocks have become the latest framework for sustainability of rural water supply. The Triple-S framework takes a wider approach compared to previous work, that concentrated more on sustainability at the community level (Moriarty et al., 2013). The Triple-S framework considers the whole enabling environment at all levels of governance. This allows to look at the sustainability in a more holistic way, which is beyond the specific ways a project is implemented. The most recent studies of service delivery models (SDM) show that even though good progress and acknowledgement of the Triple-S sustainability building blocks are recognized, their implementation is many times lacking especially in the areas of operation, maintenance and monitoring (Lockwood and Butterworth, 2016; World Bank Group, 2017; Lockwood, 2019)

3 Methodology

3.1 Research Approach and Framework

The larger theme in this study is the sustainability of rural water schemes from an operation and maintenance (O&M) perspective. The approach in this thesis is adopted from a study published by the World Bank Group (Lockwood and Butterworth, 2016; World Bank Group, 2017). The study assessed the sustainability of rural water service delivery in 16 countries, using five consolidated Triple-S building blocks. The Triple-S sustainability framework considers how the institutional levels, the country context and sector governance have an overall effect on sustainability of water services delivery.

For this study, six Triple-S building blocks were specifically selected and analyzed at three institutional levels: 1) national sector, 2) service authority and 3) service provider levels (
Figure 5). The Triple-S building blocks selected for this study were some of the lowest scoring in previous studies (Le Gouais and Wach, 2013; Lockwood and Butterworth, 2016).

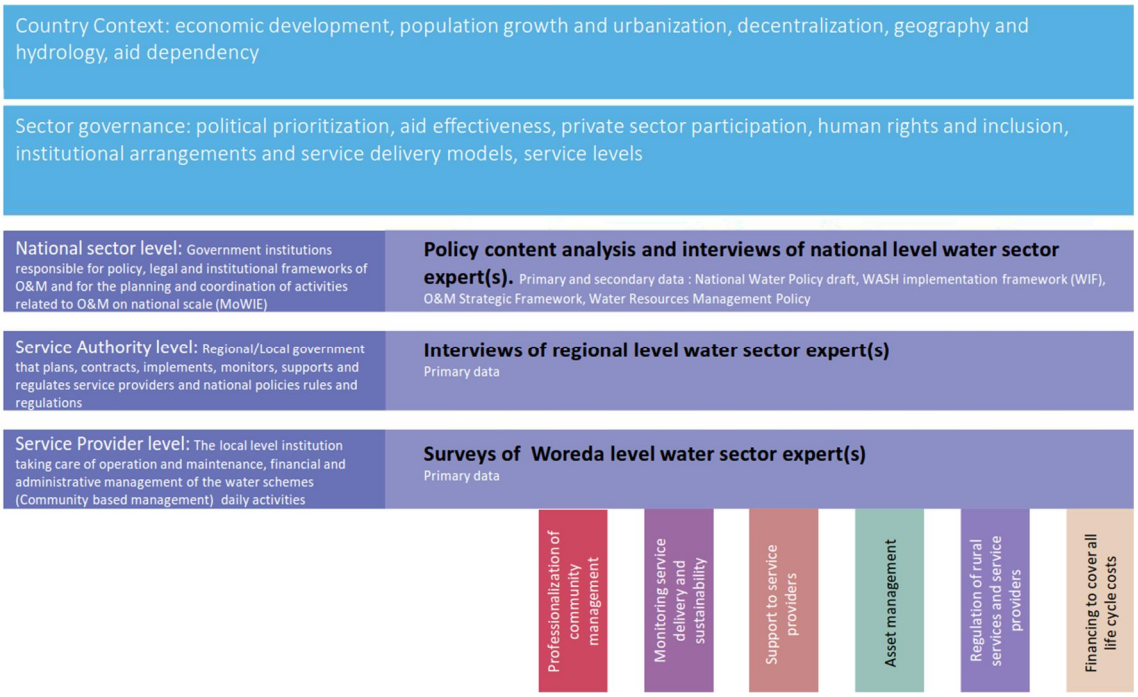

Figure 5 Triple-S sustainability framework used in this study. Six selected Triple-S building are utilized to addresse the research questions and aims of the study. The building blocks are filtered through three institutional levels, the overall country context and sector governance to better understand the underlying issues of sustainable water services. Modified from (World Bank Group, 2017)

As in the World Bank Group (2017), this study uses a deductive approach by combining qualitative document analysis with primary data from interviews and surveys in a Triple-S sustainability framework. More specifically, we combine qualitative policy document analysis and a thematic analysis of semi-structured interviews applied to a case study of Ethiopia.

Qualitative document analysis can be useful and provide understanding and insight when triangulated with other data sources (Le Gouais and Wach, 2013). Thus, each three institutional levels were investigated through different data: The primary data collected through woreda level surveys (Level 3: service provider) and expert interviews (Level 2: service authority) was triangulated with secondary data from the policy document analysis (Level 1: national sector) (Figure 6).

This hierarchy allows to gain a better understanding of how the written policies and guidelines are implemented and viewed on the actor level. Secondary data, such as published articles of case studies of rural water in Ethiopia were used to further reflect and discuss the findings of this study.

Figure 6 Policy documents were triangulated with primary data from interviews and surveys to provide insight and understanding to the research questions.

Case studies are typically chosen when insight, discovery and interpretation are in the focus of research instead of hypothesis testing (Merriam, 2009). This is precisely true for this study. The findings are bounded to their emergence in the context of Ethiopia, but they can offer insight, discovery and learning of the larger theme that can be applied to low- and middle-income countries developing their rural water supply.

3.2 Methods

3.2.1 National level - policy documents

Policy documents were analyzed systematically to understand how the selected building blocks are covered in national policies. Qualitative document analysis is a systematic way to analyze how a specific theme or issue is covered in documents (Le Gouais and Wach, 2013). The focus in this study was to understand the underlying meaning and impact of text more than the quantitative appearance of a certain theme.

The document analysis process is presented in Figure 7. The analyzed policy documents were coded in ATLAS.ti 8 software. Both manual and auto coding were utilized, as one of the available documents did not function with auto coding. The coded text segments were reviewed and annotated. After annotation, data from ATLAS.ti was synthesized thematically into word documents for each policy document. The results presented in chapter 4.1 were finally compiled from the synthesis documents of the most important and repeating aspects of each theme.

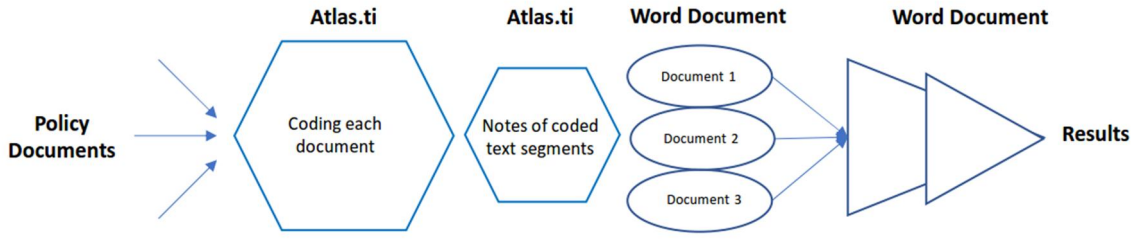

Figure 7 The policy document analysis process used in this study. Each block in the process represents a stage of qualitative analysis. The results from the policy document analysis have gone through multiple stages of analysis before reaching their final form in this study.

3.2.2 Service provider level – woreda surveys

The surveyed woredas were selected as representative of their region by COWASH staff. and scaled to the COWASH region size. The larger regions of Amhara and Oromia were represented by 3 woredas per region. The smaller regions were represented by 1-2 woredas per region. The surveys were prepared to cover each of the preselected themes with several questions. The survey was more structured than the interviews, but it also had a possibility to provide additional information. The surveys were filled out over the phone by COWASH staff. The survey results were tabulated into excel for an overview of the expert's collective view on the different themes.

The woreda respondents had an average experience in rural water supply of 11 years ranging from 4 to 20 years and an average experience of 6 years in operation and maintenance (O&M) ranging from under a year to 11 years. The position of respondents ranged from various experts of different fields to team leaders and water facility process owners. One of the surveys was filled out in a group with the head of the Woreda Water Development and Energy office and two O&M experts.

3.2.3 Service authority level – expert interview

The aim for the regional level water sector expert interviews was to have all COWASH regions represented, but only 3 regions (Amhara, Oromia and Benishangul-Gumus) actualized when including the pilot interview. The pilot interview was carried out with a COWASH project employee from the Benishangul-Gumuz region in preparation of the interview questions and guide. Only one national level interview actualized by having the interviewee fill out the interview guide independently.

The regional level interviews and woreda surveys were carried out by COWASH staff in Ethiopia. Like the surveys, the interviews were prepared to cover each of the preselected themes with several questions. The interviews were not analyzed in a rigorous manner but were used to give further meaning and understanding to the findings from the policy documents and woreda surveys.

3.3 Data

Primary and secondary data (Table 2) were utilized in this study. Primary data was collected through structured and semi-structured expert interviews of regional and national level water sector experts. In addition, a survey was conducted of woreda level experts. Secondary data, in the form of research articles, consultant reports and other grey literature were collected through scientific search engines such as Scopus and Google Scholar.

Table 2. The primary and secondary data used in the study covers all three institutional levels of the Triple-S framework. The planned interviews and surveys are presented in parentheses. Actualized interviews are in bolded font.

Data	Primary			Secondary		
Level	National	Regional	Local	National	Regional	Local
Source	semi-structured interviews of water sector experts		surveys of woreda	policy documents WRMP, OMSF, NWP		articles and reports
n	**1** (3)	**2** (5) + **pilot**	**11** (11)	**3**		

The policy documents and guidelines of Ethiopia reviewed in this research were chosen for their relevance to rural water supply and O&M. The analyzed documents were: Water Resource Management Policy (MoWR, 1999), Operation and Maintenance Strategic Framework (MoWIE, 2018) and the National Water Policy draft (MoWIE, 2020). The Operation and Maintenance Strategic Framework (OMSF) and Water Resource Management Policy (WRMP) were publicly available online. The National Water Policy (NWP) draft document was obtained through the COWASH project. The NWP is still in the draft stage and it will replace the older Water Resource Management Policy in the near future.

3.4 Study Area

Geography, climate, and water resources

Ethiopia is a land locked country located in East Africa, see Figure 8. The country is diagonally split into two by the East Africa Rift, creating topographically and climatically diverse and distinct regions in the country. The Ethiopian plateau is located to the west of the rift with elevations raging from approximately 4500 to 1000 m above sea level (Asefa et al., 2020). The highest elevation is Ras Dashen in the north, with the latest survey establishing it at 4550 m (Maizlish and Ferranti, 2011). The lowlands are located to the east of the rift and are comprised mainly of the Somali and Afar regions. The lowest elevation of Ethiopia is found here. It is called the Danakil depression and it sits 125 m below sea level (Cumming, 2016).

Due to the extreme variations in topography, the climate varies significantly around the country. In total there are 14 Köppen-Geiger climate types that can be found (Peterson, 2018). The main climate types from west to east are tropical savanna, subtropical highland, hot semi-arid and hot desert. The long-term mean annual rainfall for the whole country is approximately 800 mm varying from 2000 mm in the southwestern highlands to less than 300 mm in the eastern lowlands (Harris and Osborn, 2020).

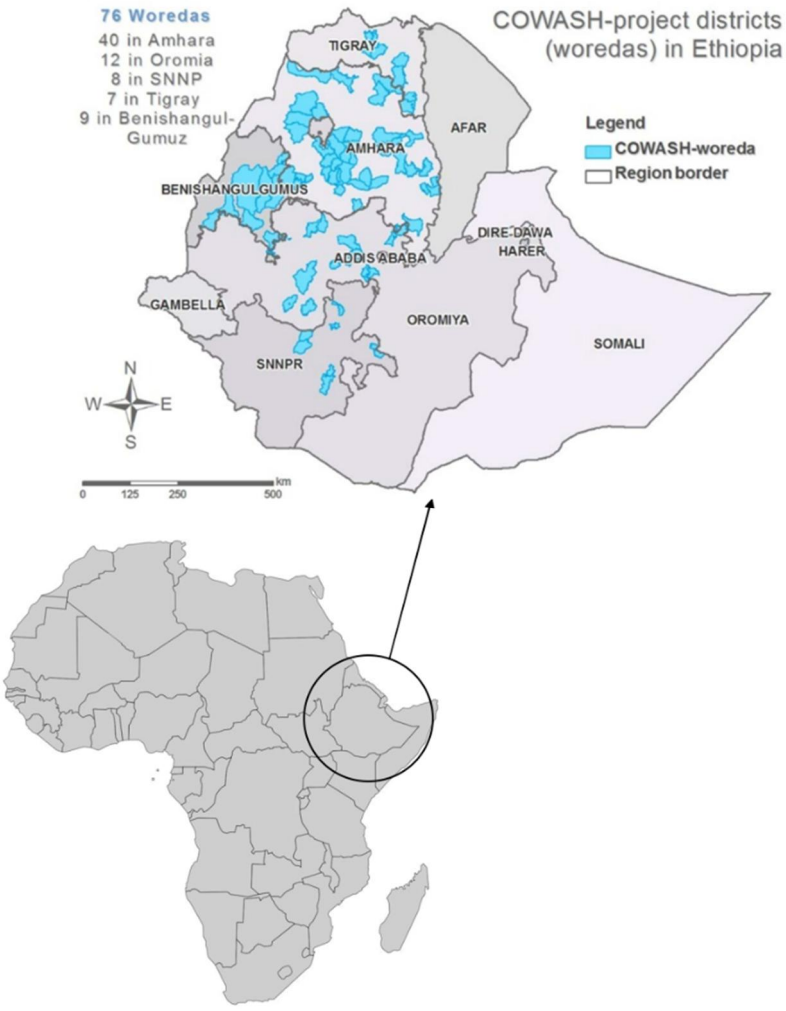

Figure 8 Map of Ethiopia with regions and charter cities. COWASH-project districts map in Ethiopia modified from (COWASH, 2019). Blank map of Africa public domain

Even though the annual average rainfall is relatively high, it is spatially and temporally distributed very unevenly. Most of the rain falls within a short rainy season (World Bank, 2006). The mean annual temperature is 23°C (Harris and Osborn, 2020). In 2019, the measured extreme temperatures varied between -7.7- 48.6°C and the maximum annual rainfall exceeded 3000 mm for some areas (NMA, 2019).

The high elevations of the central mountain ranges result in all rivers flowing radially out of the country, creating an upstream dependency with most of its neighbors. Ethiopia has abundant renewable surface water resources 122 billion m^3 (World Bank, 2006). Yet the per capita annual resources available has decreased from approximately 2 000 m^3 in 1997 to 1 150 in 2017 (Food and Agriculture Organization, 2017). This decrease is mainly due to rapid population growth (USAID, 2020).

Demographics and population

Ethiopia is the second most populous country of Africa after Nigeria, with an estimated population of approximately 112 000 000 in 2019 (The World Bank, 2007). The age structure is typical to many African countries that have a large population of youth (OSAA, 2015). Nearly 60% of Ethiopia's population is aged from 0-24 years of age (CIA, 2021).

Most of the population lives in the more temperate parts of the country like the Ethiopian highlands, Upper rift valley and Eastern highlands. The least densely populated areas are in the far and southeast desert areas. Although a high rate of urbanization (4.63% annual rate of change 2015-20 est.), the development of rural areas will remain a significant task for the nation. Nearly 80% of the population still lives in rural areas (Behailu, 2016; CIA, 2021).

The country is ethnically very diverse with over 80 ethnic groups and tribes with their own languages in the country. The largest two ethnic groups are the Oromo and the Amhara representing over 60% of the total population. The federal states have been formed along the major ethnic groups which still play a significant role in Ethiopia's politics (Adamu, 2013).

Economy and development

Ethiopia is one of the fastest growing economies in the world with an average Gross domestic product (GDP) growth rate of 10.9% between 2004-2014 (World Bank, 2015). Yet today it remains among the poorest with a per capita GDP of $2220 and Human Development Index (HDI) of 0.485 ranking it below 170 in the world in both categories (UNDP, 2020). One of the significant contributors to the low HDI seems to be education. The expected years of schooling is 8.8 years and adult literacy rate is only 51.8%. These result in a low skilled labor force of 6.9% (UNDP, 2020).

Despite the economic and development challenges, Ethiopia has made significant progress towards its goal of becoming a middle-income country. The Gross national income (GNI) per capita gap to middle-income status narrowed from 85% to 54% between 2000-2014 (The World Bank Group, 2016). The country's high public infrastructure investments have been a main component in leading the development of the country and shifting it from low productive agricultural sector to the more productive services and construction sector.

Still the country remains highly agricultural with 70% of the work force working in agriculture (CIA, 2021). Investment in water sector infrastructure is viewed as benefiting the economic and social development of the country as a whole and has been an integral part of Ethiopia's Growth and Transformation plans (GTP) for the past decade (MoFED, 2010).

Governance and water sector

Ethiopia is a federal parliamentary republic, with nine regions and two charter cities Addis Abeba and Dire Dawa, see Figure 8. The regions or states have autonomy and legislative power under constitution. Regions are further divided into woredas and woredas into kebeles. The administrative units of federal government are typically duplicated at the regional level following decentralization policies. The woredas and kebeles work under the region and are the key administrative units implementing services at the local level.

The WASH implementation framework (WIF) describes the need for integration of different ministries and actors in the water sector to achieve Ethiopia's Growth and Transformation Plan (GTP) targets related to water, sanitation and hygiene (MoFED, 2010; FDRE, 2013). Prior to the WIF, water development projects were implemented independently from each other with little coordination. This led to many actors in the WASH sector to be involved in overlapping activities and projects, leading to inefficiencies in the overall development of the sector (FDRE, 2013).

The WIF acts as a basis for the One WASH National Programme (OWNP) which aims to harmonize all WASH sector development activities under one plan, one budget and one report. As part of the WIF a memorandum of understanding (MoU) was signed by four ministries (Water & Energy, Health, Education and Finance & Economic Development). With the MoU the ministries have agreed to work together as described in the WIF and OWNP (FDRE, 2013; National WCO, 2016).

The WIF describes WASH organizational structures and responsibilities of different actors at the national, regional and woreda level (FDRE, 2013). Figure 9 presents the tasks and typical administrative units of Ethiopia's water sector described in the WIF (James, 2011; FDRE, 2013). The organizations at the national and regional level should include representatives of the ministries and bureaus of water, irrigation and energy, education, finance and economic development and health. The regions have autonomy to organize their administrative units independently as long as they are capable of integrating into the mandatory structures of the federal and woreda level and preforming the tasks assigned to them.

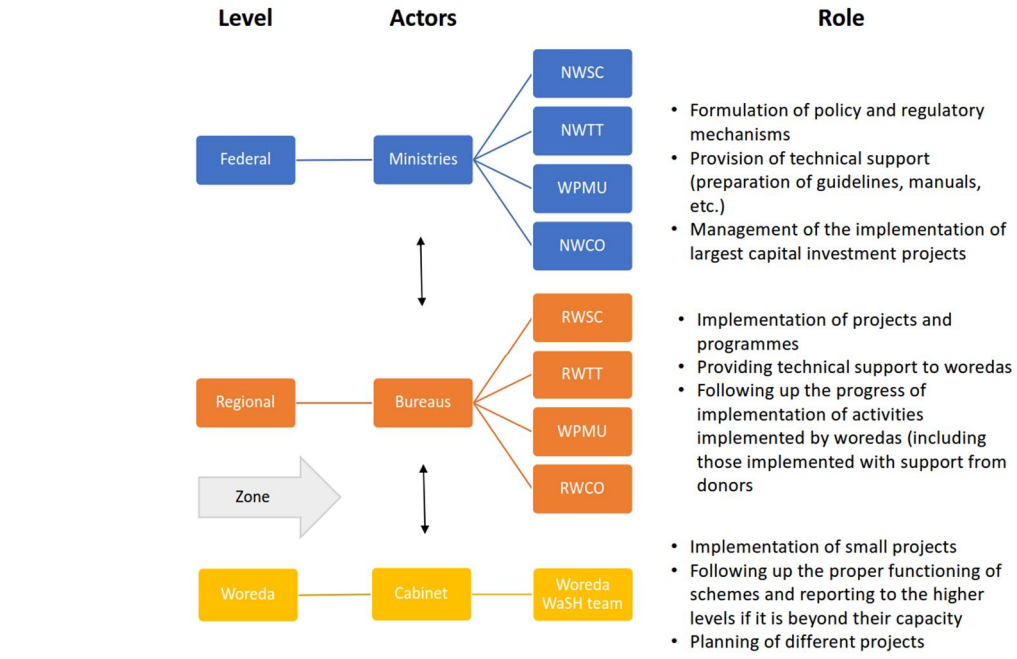

Figure 9 Actors and roles in Ethiopia's water sector. Modified from (James, 2011; FDRE, 2013)

In regard to water development, the task of the federal government is to provide policies and regulatory mechanisms for the regional states to adopt into their legislation (James, 2011). It also provides technical support in the form of guidelines and manuals for the lower administrative units to utilize. The region is the main actor in implementing water development programmes and projects. It provides technical support to the woredas and monitors activities and progress at the woreda level. The woredas implement smaller projects and prepare plans and budget proposals to the regional level. They also have the main responsibility of monitoring the functioning of water schemes and giving support to communities. When the support is beyond the capacity of the woredas, they can turn to the regional level for further assistance.

The WASH implementation framework (WIF) and One WASH National Programme (OWNP) also aim to harmonize and align the work of development partners into the national program. The Community-Led Accelerated WASH (COWASH) is one example of development partner working within the WIF and OWNP. It is a bilateral development project between the governments of Finland and Ethiopia aiming to achieve universal and equitable access to water, sanitation, and hygiene in rural Ethiopia (COWASH, 2013; FCG, 2015). The main support given through the COWASH is capacity development and technical assistance at the national and regional levels in implementing community managed projects (CMP). In the CMP approach, communities manage and carry out the projects with support from the regional and woreda level actors. The first phase of the project started in 2011 and the fourth phase will begin in July 2020.

4 Results

The results are organized according to the six building blocks of the Triple-S framework and the three institutional levels reviewed in this study.

4.1 Policy Documents

4.1.1 Professionalization of community management

Private sector involvement in the operation and maintenance (O&M) of water supply and sanitation technologies is promoted in all the policies (MoWR, 1999; MoWIE, 2018, 2020). Still the new National Water Policy draft (NWP) sees the community as being the lowest decentralized level of management for rural water supply systems (RWSS). There is no similar mandate for RWSS to move away from community management, as there is for urban utilities. The main responsibility for management of RWSS is still seen to be with the community supported by the local woreda and kebele level authorities.

In all the policies the private sector is seen to have an additional role in supporting or taking responsibility of certain areas of O&M (MoWR, 1999; MoWIE, 2018, 2020). Private sector involvement is seen as a complimentary support alongside the work of authorities that should be developed further. The NWP also emphasizes the need to improve the human capacity of the rural water supply (RWS) sector through strengthening education at all levels. For more complex water systems with motorized pumps, major pipelines and water treatment systems, annex 7 in the Operation & Maintenance Strategic Framework (OMSF) does clearly refer that the maintenance of these systems is not expected to be managed by the community.

4.1.2 Monitoring service delivery and sustainability

The Operation & Maintenance Strategic Framework (OMSF) identifies that current roles and responsibilities related to monitoring are still not clear (MoWIE, 2018). There is not enough institutional or logistical capacity to conduct regular monitoring. Low funding, lack of data collection and storage systems at the service provider level, are also identified as challenges for systematic monitoring.

Despite the challenges, monitoring is covered well in all policies and viewed as critical for the overall development of the water sector (MoWR, 1999; MoWIE, 2018, 2020). It is also seen as important for operation and maintenance (O&M). The overall objective of the OMSF in relation to monitoring is quite clearly aligned with the Triple-S definition of "Monitoring Service Delivery" (MoWIE, 2018).

> *To establish a standard based sector-wide monitoring, reporting and documentation system that strengthens accountability and fosters sector learning towards a strong O&M performance by all stakeholders and partners at all levels.*

The need for a reliable monitoring system able to disseminate, analyze and harmonize data that supports decision making is identified (MoWIE, 2018). The policies prioritize developing criteria and indicators for the assessment of service delivery (MoWIE, 2018, 2020). This systematic and harmonized monitoring is seen to support decision making and prioritizing actions at the higher level.

Other implementation plans include for example a national scale ICT based monitoring and evaluation (M&E) and management information systems (MIS) and designing a community-based monitoring system (MoWIE, 2018). There is a national level draft document for water quality monitoring, but it was not included in this study (MoH, 2011).

4.1.3 Support to service providers

The Operation & Maintenance Strategic Framework (OMSF) identifies lack of institutional support as one of the root causes for non-functionality of water points. The lack of support is typically related to insufficient financing of O&M and short project time frames that focus on building and neglect the training of the community and post construction follow up.

One of the main objectives of the OMSF is to provide woredas with policies and guidelines on how to provide effective post construction support to communities. This is suggested to be done through raising awareness of funding needs and clarifying the scope and extent of post construction support (MoWIE, 2018).

Establish a system where O&M management and post construction support is mandatory part of each water sector project supported by the Government and development partners.

In addition to funding, the policies emphasize the need for capacity building of service providers (MoWIE, 2018). This includes capacity building of WASH extension workers at the kebele level and capacity building and capacity gap assessments of WASH committees (WASHCO). More specifically training in preventative maintenance planning and budgeting have also been suggested.

4.1.4 Asset Management

Asset management is not explicitly mentioned, but the principle of asset management according to the Triple-S building block can be found to some degree in all the policies (MoWR, 1999; MoWIE, 2018, 2020). Not planning for operation and maintenance (O&M) and asset management on a wider scale is identified as negatively affecting the sustainability of water supply schemes. The Water Resources Management Policy (WRMP) for example states that all planning in the water sector should include planning for operation, maintenance and replacement activities and budgets (MoWR, 1999).

In the Operation & Maintenance Strategic Framework (OMSF), asset management is understood as the ability to prepare for break downs by having a preventative maintenance plan with schedule for replacement of spare parts. This planning should be included from the start of a new scheme (pre-O&M planning), allowing to budget for resources for the whole life cycle of the water supply system (MoWIE, 2018).

It is important in O&M planning to clearly identify what aspects are to be financed during the construction and after the construction and by whom.

Financial forecasting is included by identifying need to collect financial information on O&M of different water supply systems (MoWIE, 2018). This gives a better idea of real O&M costs for different systems over a long period of time and helps to plan for them. Monitoring is seen closely related to effective asset management as it is needed for realistic planning and timely action (MoWIE, 2018).

Asset ownership is clearly mentioned in the WRMP to be with the community as the lowest level of management and responsible for O&M (MoWR, 1999). Still, one of the identified issues is that many regions have not issued directives and regulations to implement proclamations that would describe the legal ownership of the schemes in detail (MoWIE, 2018). The OMSF addresses this with the strategic objective of strengthening community ownership and promoting the goal of communities to assume full ownership of the water supply systems. At the same time there are some contradictory statements within the OMSF regarding ownership of the WSS (MoWIE, 2018).

Woreda Councils have been entrusted the responsibility of legal ownership of community water supply infrastructure and to coordinate the implementation of all development projects within the sector.

4.1.5 Regulation of Rural Services and Service Providers

The policies clearly promote the creation, improvement and adoption of national standards, regulation and criteria for all activities related to the life cycle of water supply systems, from design to O&M (

Table 3) (MoWR, 1999; MoWIE, 2018, 2020). At the same time no specific regulation for rural services or service providers were found in the policies. The vast amount of regulatory needs identified within the documents indicate that the Triple-S building block for this category are still in progress, but the direction is positive.

Table 3 The National Water Policy Draft and Operation and Maintenance Strategic Framework have identified regulatory improvements that haven't been covered in previous policies. Nevertheless, there is no clear assignment of responsibilities in regard to the development or improvement of these regulations.

Regulatory needs and improvements	WRMP	OMSF	NWP
water tariffs	x	x	x
private sector participation in O&M			x
self-supply			x
ground water abstraction			x
land acquisition		x	
catchment protection		x	x
WSS technologies			x
standards for service delivery			x
regulatory body for standards and codes		x	x
regulatory body for water services			x
regulatory body for water quality monitoring		x	x
legalization of WASHCOs		x	
spare parts supply		x	
regulatory aspects regarding rural water services are being increasingly considered with time	**1999**	**2018**	**2020**

The Operation & Maintenance Strategic Framework (OMSF) identifies challenges with regions giving proclamations, directives, and regulations to implement the national strategies and policies related to water supply systems (MoWIE, 2018). Some regions have given proclamations and regulations, but the contents can vary a lot from region to region. Also, many important aspects of the policies may be missing in the regulations. It is also typical that

urban utilities receive greater attention in the regulations compared to rural water systems and service provision.

At the same time, some of these regulations have been identified as exemplary (MoWIE, 2018). For example, the Southern Nations, Nationalities, and People's (SNNP) region issued a regulation for the establishment of kebele (smallest administrative unit in Ethiopia) Water User Association Federations, that employ Water Agents responsible for all water schemes in their area.

The O&M carried out at this lower administrative level has had benefits in improving the sustainability of water schemes and could be one solution in professionalizing the O&M of scattered rural water schemes (Inter Aide, 2017).

4.1.6 Finance to cover all life cycle costs

The aspect of finance to cover all life cycle costs can be found in all the reviewed policies (MoWR, 1999; MoWIE, 2018, 2020). These life cycle costs are typically understood to include a broad range of activities like policy evaluation, training, and monitoring for example. However, the National Water Policy draft (NWP) does discuss the principles of partial and full cost recovery of capital and operation costs. Rural water systems are only expected to cover operation and maintenance (O&M) costs (MoWIE, 2020).

The implementation plans in the OMSF attempt to clarify and addresses many of the past issues that have affected the ability to recover full costs of WSSs. One of these challenges is the connection with poor maintenance with the willingness to pay for water supply services.

One of the proposed strategies is to shift the perspective from paying for maintenance of a facility to paying for service, which includes the provision of safe, adequate, and accessible water. This perspective better facilitates the concept of full life cycle costs, as the costs needed to provide a service entail a lot more than capital investment and preventative maintenance costs (MoWIE, 2018).

> *The main objective of this strategic direction is to shift thinking from new water supply facilities construction to giving attention for post construction activities and allocating appropriate budget for its implementation to ensure the sustainability of the rural water supply schemes. In other words, shift from focusing fully on construction of schemes, to development of service.*

4.2 Woreda Surveys

4.2.1 Professionalization of community management

The woredas on average thought that access to professional maintenance services is very important (4.5/5) for the sustainability of community managed schemes. Only one woreda scored the question as "slightly important". Even this respondent thought that professional maintenance is needed but it should be provided by the woreda and not the private sector.

Although professional maintenance services were seen as very important, the accessibility to these services varied a lot from woreda to woreda. Three woredas scored the accessibility as either "not accessible at all" or "poorly accessible". On the other hand, there were three woredas that scored accessibility as "very accessible". Two of these three woredas were located in the Tigray region. Two of the woredas that rated the services as "poorly accessible" were located in the Amhara region.

4.2.2 Monitoring service delivery and sustainability

All woredas in the survey had a monitoring system in place and they viewed monitoring functionality and service level of water points as "very important". Several open comments elaborated that a properly working monitoring system is "crucial" or "very important" for the sustainability of schemes. Interestingly, the perception on how well monitoring is working typically dropped by one category, compared to how important it was viewed as.

The data monitored was quite similar for all woredas (Figure 10) with functionality, management and tariff collection being in the focus. The monitoring data is used primarily for maintenance planning and reporting. Water quality monitoring was required from all woredas. At the same time, the descriptions of what data is monitored did not typically include service delivery or performance related aspects.

Only one woreda monitored water quality. Nevertheless, almost all woredas (10/11) had a field test kit available for water quality monitoring but the survey did not reveal how frequently they are being used. Only three woredas had access (or knew of access) to laboratory water quality testing services. Despite the lack of service and performance related data, the woredas viewed it as important to have available for consumers.

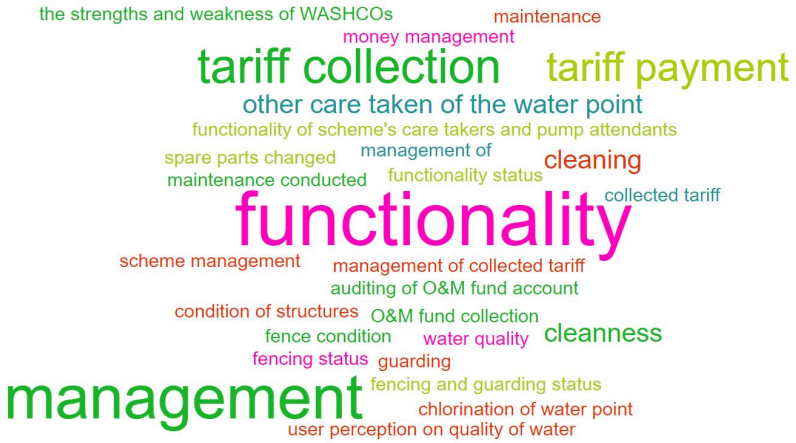

Figure 10 The word cloud presents survey responses to the question of "What data is monitored?" Although aspects of service delivery were mentioned less, there is some level of systematic monitoring of functionality, management, and tariff collection as they were mentioned by most respondents.

4.2.3 Support to service providers

Direct post construction support is provided to some degree in all surveyed woredas. It typically included some aspects of the of Triple-S building block (technical, admin and monitoring). The main challenges in supporting communities or water points include financial constraints, manpower and accessibility of water points.

Financial resources are clearly a bottleneck. The financial resources available for direct support were rated on average as "poor". Only one woreda rated the financial resources as "very good". The human capacity to provide support has also room for improvement. There is no regular budget allocation for capacity building or training the community except for projects that are involving non-governmental organizations (NGO) or bilateral development projects.

As a positive, most woredas (9/11) had at least some experience of support from the regional level. The survey questions do not reveal in detail the quality and quantity of support given and can leave room for interpretation. Aiming to support all schemes may not mean that all are receiving the support they need.

4.2.4 Asset Management

Many aspects of this Triple-S block are present, but the degree to which they are implemented is most likely not enough. All woredas responded having plans for maintaining and replacing existing water points in their area but did not carry out financial forecasting for assets.

Human and financial capacity of the woreda water office was seen as a potential obstacle for the feasibility of community managed schemes to O&M more complex water systems. The main challenges of asset management were either human or financial capacity. For example, there are financial constraints in government funded projects to implement or train communities on O&M responsibilities. The maintenance budgets are also not enough to carry out all the maintenance and rehabilitation plans. Two woredas mentioned that the construction of new schemes is still getting the main attention regarding resources.

On average the woredas rated clarity of asset ownership as "very clear". Still, there was some need to clarify ownership and more work is needed for communities to take full ownership of the assets. For example, the clarity on operation and maintenance (O&M) responsibilities between woreda and communities scored almost one point less on average but still was rated as "clear". Legalization of community managed schemes was viewed as "important" or very "important", but the survey left room for interpretation if woredas were currently working towards legalizing the community managed schemes.

Accessibility of spare parts is also challenging. A common theme in the comments are that smaller spare parts like bearings, seals and fittings are "fairly accessible" but large components and spares for hand pumps are poorly accessible. These can take from weeks to even several months to obtain.

4.2.5 Regulation of Rural Services and Service Providers

All surveyed woredas had received some norms, standards and guidelines for water supply systems and construction administration of the systems. Nevertheless, a common theme in all the comments was that the standards and guidelines only cover simpler technologies like hand dug wells and springs. Most woredas had received some training on the standards and guidelines but the amount of staff trained was not enough, or not all relevant staff were trained.

4.2.6 Finance to cover all life cycle costs

The current water tariffs are viewed as "acceptable" on average in providing cost recovery of the water schemes daily operation and maintenance (O&M) costs. But the tariffs are generally not enough to cover capital costs of replacing water systems in the future. This corresponds well to the current policies and strategies of first applying only partial cost recovery of O&M costs to rural water schemes.

Funds from regional and federal level for major rehabilitation or renewal of schemes was rated as "poorly accessible" on average by the woredas. It is important to note that one woreda had had a very positive experience of requesting and receiving all funds for a rehabilitation projects and rated this section as "very accessible". In other cases, funds for rehabilitation were typically only available for bilateral development projects like COWASH or where other NGOs were involved.

Follow up support was budgeted into the construction of new water supply schemes in all cases except one. Even in this case, follow up support was provided through the COWASH project. There were several comments that the budget allocated for follow up support in the construction of new schemes was typically not enough.

Seven out of eleven woredas had annual work plan with activities related to O&M but it was mentioned that these plans were challenging to execute due to budgets. Nevertheless, the woredas work around their small budgets for O&M by integrating some O&M activities into new scheme construction and having communities contribute through their tariff collection.

4.3 Expert Interviews

The Goals of Sustainable Development Goal (SDG) 6.1 are seen as partially unrealistic by the interviewees. It was viewed as positive in terms of its universal access goal, but on the other hand it was also thought to potentially lead to "over stretched planning". The main challenges, for the SDG 6.1 goals mentioned by the interviewees, were capacity of technical experts, availability of local skilled workers, quality of construction and electro-mechanical equipment, monitoring the SDG 6.1 and financial resources.

Despite the challenges, potential benefits were also noted. One of the interviewees mentioned that improved water services could increase the motivation of the community to increase their tariffs. More advanced water systems were also seen to potentially improve the motivation of technical experts. Another interviewee mentioned that the SDGs have led more attention on water safety planning and improving the water quality.

Although operation and maintenance (O&M) has gained more attention and it is viewed as important, the regional level interviewees noted that the construction of new schemes is clearly prioritized over rehabilitation and allocating enough resources to O&M.

> *"The problem is that in many areas there are already many water supplies, and when these water supplies become non-functional, people ask new water supplies instead of repairing and maintaining the old ones. Before new additional water supplies are constructed into the areas, the old water supplies need to be assessed first and then plan for the new water supplies are to be done." (Amhara)*

4.3.1 Professionalization of community management

Some of the recent trends in the rural water sector were a shift from single point source water projects to larger multivillage or rural piped water schemes. These larger schemes tend to be setup as rural water utilities rather than community managed WASH committees. In these multi-village schemes, there has been a gradual shift from community managed schemes to more professionally managed service provision.

At the same time community-based management is still seen as important part in the community keeping ownership of the schemes. Involving the private sector more and more with close support and supervision is seen as important in addressing issues of sustainability of rural water.

4.3.2 Monitoring service delivery

There is an understanding that new strategies and policies include the concept of monitoring service delivery, but it is not working well on the practical level yet. Monitoring data has not been utilized effectively on the regional level and the quality of monitoring data makes it challenging to utilize effectively on the national level. Functionality is the main indicator, which is seen as something that should be improved in the future.

> *"Functionality is our main indicator at the moment. Water quality is monitored only in the case of complains. The water consumption, break downs are not monitored regularly." (Amhara)*

There were also some differences in monitoring and reporting frequencies between the regions. Amhara produced quarterly woreda reports and Oromia had less frequent reporting. It was suggested that monthly data from water schemes would be needed to react more efficiently to larger breakdowns.

4.3.3 Support to service providers

According to the expert interview there is a shortage of staff even at the national level. Energy, organizational/institutional issues, and manpower are viewed as some of the biggest challenges in terms of sustainability of the rural water supply. To address these issues, there is a feeling that the institutional setup on all levels from federal to scheme level needs to be clarified. Despite the challenges, a wide range of different support systems like micro and small enterprise (MSE), supply chain systems and clustering systems have been tested at pilot scale.

The expert viewed operation and maintenance (O&M) as something that needs to be considered already at the identification and planning stages of a project.

> *"Design problem is the most challenge in operation and maintenance stage. Disregarding of operation and maintenance during planning, construction and testing and commissioning stage. Lack of data on the drilled wells, pumps and generators installed. This is making post- construction support more challenging."*

Woreda support is the basic support given to water schemes. The existing system are not very effective in terms of financial and institutional setup. Post construction support is also challenging, as it competes with support for the construction of new schemes. Many times, the new schemes receive the greater attention. The majority of post construction support like training is outsourced to development partners. Regions do not provide much training. There is no regional budget for postconstruction support.

4.3.4 Asset management

The clarity of ownership varies from region to region. In regions where the legalization of schemes has been established by law, the ownership is clearly defined. In the new strategy the minor and major repairs and responsibilities are well defined according to the national level expert. But on the regional and woreda level it was still seen as unclear in terms of responsibilities related to larger operation and maintenance (O&M) activities.

Asset management is seen as a combined effort of many actors but from the regional perspective there is no clear strategy being applied.

> *"Preventive maintenance planning is practically zero. It does not exist at woreda level and not also at the region level. We have left it to the scheme level, but I think it does not work there."*

For rural piped systems (RPS) and multivillage projects, water and sanitation safety plans (WSSP) and business plans are prepared in the study and design phases of projects. A cost-effective design principle was seen to include not only the initial investment cost, but also the O&M cost for the lifetime of the water system. The national level expert noted that when O&M is implemented, it should be a routine activity carried out according to plan. This reflects that currently O&M is not carried out systematically.

4.3.5 Regulation of rural services providers.

Policies related to rural water tariff and its collection seen as very important. There is no independent regulatory body for rural water, each region has its own laws and regulations. The government is responsible to provide clean water supply services by establishing the systems and institutions up to the community level. The rest may be viewed as the responsibility of the community.

The main documents or policies provided to the regional level are the strategy frameworks, working documents (guidelines) but their effectiveness or importance had not been evaluated to the respondent's knowledge. One of the issues with regulation implementation is the lack of oversight. Yet, there are ongoing initiatives to improve building and quality regulations for water supply systems.

4.3.6 Finance to cover all life cycle

There is a recurrent budget for operation and maintenance (O&M) on national level which includes monitoring, regulation and policy development, capital maintenance, preventative maintenance, capacity building and long-term post construction support. The budget was noted as not currently being enough and it is in revision. Although there are national level budgets for O&M, this is not always the case at the regional level.

The development in financing rural water was seen to be shifting more to the private sector and user communities. The user communities are hoped to be mor involved in the financing once they are economically more developed.

The setting of tariffs of rural water systems is seen as poor and, in most cases doesn't cover all the O&M costs. The quality of parts utilized was additionally seen as closely related to financing O&M, as it directly impacts the sustainability of schemes in the long term.

> *"The tariff in rural water supplies does not include replacement/rehabilitations costs for long-term running of the scheme. But depending on the quality of materials such as electromechanical equipment and maintenance skills and equipment, among other schemes may have long term sustainability once constructed." (Oromia)*

5 Discussion

The research question 1 (How well are the Triple-S building blocks covered in Ethiopia's national water policies and guidelines related to O&M issues?) was addressed mainly through the policy document analysis. The results show that the reviewed policies cover quite well the selected Triple-S building blocks and O&M issues related to them. At the same time, the interview and survey result reveal that implementation is still lacking in several critical areas affecting operation and maintenance (O&M) at the sectoral level.

Similar observations have been made in grey literature (Lockwood and Butterworth, 2016; World Bank Group, 2017; Lockwood, 2019). They show that, even though good progress and acknowledgement of the Triple-S sustainability building blocks are many times recognized, their implementation is lacking especially in the areas of O&M and monitoring.

The survey and interviews were utilized to address the research question 2 (How do WASH professionals view O&M in Ethiopia and what are the biggest bottlenecks?), but the policies themselves also revealed many of the bottlenecks of rural water (MoWR, 1999; MoWIE, 2018, 2020). The issues raised in the interviews and policies agree well with each other. This shows that the challenges related to O&M and sustainability of rural water are well known by local, national, and regional level practitioners in Ethiopia.

Research question 3 (How do WASH professionals view the SDG 6.1 goals from an O&M perspective and the capacity of communities to operate and maintain more complex water systems?) attempted to understand if a push towards the SDG 6.1 goal could have potential negative impacts on the sustainability of O&M of rural water in Ethiopia. This question was mainly addressed through the survey and interview results. But similar to research question 2, the policies themselves shed some light on the matter. The study of this question showed that there is a trend towards larger and more advanced water systems in the rural water sector. The communities are not seen as able to O&M these more advanced systems by themselves.

The following sections are arranged according to the selected Triple-S building blocks. They further discuss some of the gaps and bottlenecks that were discovered by triangulating the policy document analysis with interviews and surveys. In addition, several unclear issues or inconsistencies in the policies are raised up for discussion.

5.1 Professionalization of community management

Capacity building and education for water professionals is identified and strongly promoted in the reviewed policies (MoWR, 1999; MoWIE, 2018, 2020). These are directly related to the Triple-S building blocks of "Support to Service Providers" and "Professionalization of Community Management".

The survey comments reveal that some training is carried out, but it is not viewed as sufficient by the practicing water professionals at the local level. One opinion was that more training materials and documents are needed in Amharic or the other local languages. Insufficient training in Ethiopia's rural water sector has also been reported by Behailu, Hukka and Katko (2017), who give some detailed challenges with training of water system caretakers. These challenges agree well with ones mentioned by the woreda survey respondents.

It is not necessarily surprising that capacity building is one of the areas in which there is a gap between policy and practice. Capacity building and training are long term activities that can take time for their benefits to realize (Kanni, 2009). The Operation and Maintenance Strategic Framework (OMSF) is still fairly new from 2018. All respondents of the survey had not yet received training on it. At the same tame this can highlight the slow implementation of the policies.

Training has been shown to contribute to the operational sustainability of water systems (Gurmessa and Mekuriaw, 2019). Thus, it is crucial that attention is paid to the quality and appropriate targeting of training and capacity building. Training is also not a one-off event but a continuous process with refreshers that incorporate the most current learnings from the sector. This need for refresher training was also brought up in the comments of the surveys. One reason for the lack of training on the OMSF may be a combination of high staff turnover and lack of refresher training.

5.2 Monitoring service delivery

The Operation and Maintenance Strategic Framework (OMSF) states: "Lack of monitoring from woreda office is major bottleneck in sustainability". This statement is a bit contradictory to the survey findings, where monitoring seemed to be viewed in very high regards. Most woredas reported monitoring water points surprisingly often, but functionality was one of the main indicators monitored. From this perspective, monitoring service delivery may not be on track with best practices.

An article by Carter and Ross, (2016) raises up some of the challenges with "functionality" as an indicator for monitoring rural water systems. One challenge is that it only provides a status for one point in time without revealing much more useful information. It is possible that the issue with woreda monitoring is not the lack of motivation but lack of resources, clear standards, norms and indicators relating to monitoring. For example in the case of Ethiopia, the lack of a system (ICT) to track and store information has also been pointed out in literature to be one cause for inadequate monitoring (Arsano et al., 2010).

Still, the policies do have a strong emphasis on monitoring and there are efforts to improve the systematic monitoring of the rural water sector. For example, the National Water Policy draft (NWP) mentions the need for a national WASH management information system (MIS) that can be utilized for planning and decision making (MoWIE, 2020). This indicates that current systems are not functioning as intended. The OMSF also calls for planned and coordinated monitoring and identifies that the current WASH MIS is not fulfilling its purpose in collecting meaningful data (MoWIE, 2018). A study by Hemberg (2021), in cooperation with the COWASH project, has been addressing these issues by analyzing data flows of monitoring and evaluation information within the Ethiopian water sector.

There may also be a need to clarify roles and responsibilities of different level actors in relation to monitoring and data collection. Monitoring service delivery is clearly seen as crucial in the policies for being able to give efficient institutional support (learning, budgeting, corrective actions, interventions). There is also a specific framework document for monitoring, but it was not covered in this study (NWCO, 2008).

5.3 Support to service providers

The Water Resource Management Policy (WRMP) states: "conservation of existing water facilities is as feasible as building new schemes". But from the surveys and interviews, it is clear that this is not the case on the local level. Operation and maintenance (O&M) budgets and post construction support must compete for resources allocated to building of new water schemes. New water schemes consistently take priority over keeping existing schemes functioning. This issue may possibly stem from beyond the water sector, as most woreda water experts were found to be in favor of improving existing services before expanding the services.

Lockwood and Smits (2011) explain the concept of political economy as a complex backdrop of competing interests, agendas at different levels of politics and decision making that affect allocation of resources. In their findings, the political economy of rural water typically favors investing in new water infrastructure.

The National Water Policy draft (NWP) reflects this contradiction in the political economy by giving priority to unserved peoples (i.e. new water schemes), while the WRMP states: "Promote and encourage that conservation of existing water systems and efficient utilization of water is as feasible development of new schemes." From this perspective the WRMP could be seen to have a clearer mandate for O&M compared to the NWP that could be interpreted as prioritizing new water schemes.

The World Bank study on sustainable service delivery models confirms the unequitable treatment of O&M and constructing new water infra. It identified that only 6% of the One WASH National Programme (OWNP) rural water component was allocated to long term service delivery activities (Lockwood and Butterworth, 2016). Despite the majority of budget allocated to construction of new facilities, the woreda survey revealed attempts to work around these O&M and post-construction budget constraints. This was similarly observed in the World Bank study, where woredas are described to find ad hoc solutions to financing rehabilitation of existing facilities (Lockwood and Butterworth, 2016).

The responsibilities between community and government are still mentioned to be somewhat unclear in the Operation and Maintenance Strategic Framework (OMSF). For example, the requirement for government to support major repairs has been identified to not be clear and caused misuse of the finances reserved for major rehabilitation (MoWIE, 2018). These are elaborated to some extent in the OMSF, but there could still be a need to further describe these responsibilities in more detail.

Through the Water Resources Management Policy (WRMP) and Growth and Transformation Plan II (GTP), regional and federal government should have the responsibility in supporting major rehabilitations that are outside of the reach of community's abilities (MoWR, 1999; MoFED, 2014). Still, the woredas struggles to provide support in larger capital maintenance due to lack of the funds allocated from the region.

5.4 Asset management

Asset management was one of the more challenging Triple-S building blocks to interpret. Although the results reveal some level of systematic planning from local to national level, the impact of this planning is questionable. The interviews and surveys reveal that the resources, especially financial resources, are many times not enough to carry out these plans. Kumasi, Agbemor and Burr (2019) noted that improving asset management systems are specifically dependent on financial and human resources. If basic water supply systems are converted to piped water schemes, and other more advanced systems, the importance of asset management will only become more relevant (Boulenouar and Schweitzer, 2015). Currently asset management systems are only mentioned in relation to water utilities (MoWIE, 2020).

Nevertheless, asset management should be thought of including both systematic planning and systematic execution of plans. The Triple-S building block definition of asset management, "Asset management involves systematic planning, inventory updates, and financial forecasting for assets carried out, so that asset ownership is clearly defined", perhaps focuses too much on the planning side of asset management.

Accessibility to spare parts were highlighted in the Operation and Maintenance Strategic Framework (MoWIE, 2018). The policies convey that accessibility to spare parts has been a serious bottleneck for operation and maintenance (O&M) of rural water in the past (MoWIE, 2018). The issue of spare parts is not only bounded to Ethiopia. The supply of spare parts, for hand pumps, has been identified as a weak link for sustainability (of rural water) on a wider scale for sub-Saharan Africa (Harvey and Reed, 2006). The positive is that these challenges have been studied and are well understood, which provides strategies to address them. Yet, the surveys do reveal that obtaining some less frequently needed spares is still a challenge. Accessibility of spares is also closely connected to willingness to pay for O&M. This is further discussed in section 5.6.

Another interesting policy related to spare parts was encouraging local technology and regulating or having more oversight over imported water technology (MoWIE, 2020). It is hard to say if this will be feasible or if it would even be beneficial. Harvey and Reed (2006) identified that the supply of spares for the rural water sector was not typically a viable commercial activity for the private sector.

5.5 Regulation of Rural Services and Service Providers

The results showed that many regulatory needs have been identified but are still missing for rural water. The regulation that is in place only covers certain aspect of larger urban utilities. The oversight can also be lacking, with no clear institutions or roles to enforce these regulations. Sometimes local level authorities may even promote practices that go against policies and regulation (Arsano et al., 2010). In this case, Town Water Supply Boards had to supply water at tariffs that did not cover full costs. The relatively extensive autonomy to implement national policies and strategies by regional states may be one reason for this.

The current available guidelines and standards cover only simple water systems managed by communities, as was mentioned by a woreda survey respondent. With an increased interest and trend towards larger rural systems, it would be important to update rural water regulation and standards to cover larger systems with varying O&M arrangements.

The interviews and policies identified that the quality of built infrastructure has a direct link to the future maintainability of water systems. From this perspective, the regulation of rural services and providers are very important to the sector. Standards for water systems and construction works, combined with adequate oversight, are crucial in securing resources invested in water infrastructure (Behailu, Hukka and Katko, 2017). For instance, a rural piped scheme with high non-revenue water (or water loss) has the potential to be counterproductive to the national goals of rural water development and water resources management as the negative impact affects a wider amount of people.

Good regulation and oversight can have many compounding effects towards the sustainability of rural water supply. Many of the issues mentioned have been related to availability of spare parts, quality of construction and capacity of professionals. Clear standards for minimum service delivery, for example, could make monitoring and evaluation clearer. Capacity building might also be improved, as standards, codes and regulation can guide water professionals in their work.

5.6 Finance to cover all life cycle

Cost recovery is seen as a crucial part in Ethiopia's policies for sustainable rural water supply systems (MoWIE, 2018, 2020). The importance of cost recovery can be seen in other countries' policies as well. A study of cost recovery of African water and wastewater utilities by Banerjee et al. (2010) reports, that almost all of 23 studied African utilities had the goal of cost recovery in their policies. The grim reality of practice is that only 9% were recovering full cost.

Similar results were found in this study. The interview and surveys revealed that full cost recovery is not implemented for rural water systems. Operation and maintenance (O&M) cost of only minor maintenance for simple water systems like hand pumps are being recovered currently.

One challenge for cost recovery is setting appropriate tariffs. A case study of Adama district in Ethiopia reported that there are no standard water tariff structures (Tadesse, Bosona and Gebresenbet, 2013). Similar findings were indicated by the woreda surveys in this study. Communities generally set the tariffs themselves. They may receive support in estimating the appropriate amount. Nevertheless, it seems that these estimations only include the everyday O&M and not cost like renewing larger components of the water system. Behailu, Hukka and Katko, (2017) carried out a survey of households which revealed that on average only 0.13 euro was collected per household per month for water. This is was not seen as sufficient to cover even normal O&M.

Another challenge with appropriate tariffs is that they can vary significantly according to technology or geographic location to town centers (Tadesse, Bosona and Gebresenbet, 2013). Knowing the water system O&M costs at the initiation of a water supply project are important for decision making. Ethiopia's policies did identify this need to have better information on O&M and post construction support related costs (MoWIE, 2018).

Although appropriate tariffs are important, having an appropriate tariff does not equate to the tariff being collected and used appropriately. For example, Finland has full cost recovery

in its legislation but is still experiencing significant funding gaps for rehabilitation and replacement of aging infrastructure (Hukka and Katko, 2015). This example emphasizes that there is more to financing maintenance than an appropriate tariff.

Another example described in the Operation and Maintenance Strategic Framework (OMSF), is the vicious circle of poor maintenance leading to an unwillingness to pay for service (MoWIE, 2018). When repairs can't be done in a timely manner, due to lack of spare parts (or other reasons), it can discourage communities from carrying out maintenance and mobilizing resources for it. The willingness to pay for O&M is also partially related to a sense of ownership, user perceptions of benefits, utilization of funds and other factors like misuse of funds (Behailu, Hukka and Katko, 2017).

Willingness to pay and water tariffs are also closely related to the concept of political economy of rural water, and how it can affect the sustainability of it. Other factors affecting collection and use of funds for O&M on a broader scale could be social structures like rural communities relying on seasonal crops and not having disposable cash for regular tariff collections (Behailu, 2016).

5.7 Mixed messages and unclear roles

Several mixed or unclear messages within the policies were identified in this study. Ethiopia's National Water Policy draft (NWP) calls for decentralization of the management of water supply systems (WSS) to the local level. At the same time, there is a section under institutional arrangements to promote a clustering approach (MoWIE, 2020). It is not completely clear if these aspects necessarily contradict each other. Decentralization to the local level does not automatically exclude clustering of certain functions.

> *"Promote clustering approach in water schemes or infrastructure management to ensure economic viability, effective service delivery and sustainable management"*

Nevertheless, in my view, this was not unequivocally explained in the policies. The decentralization and clustering approach do fit with the trend observed in literature (Lockwood and Smits, 2011). They also noted that in the last decade there has been move away from voluntary community managed schemes in the water development sector (Figure 3). Yet, community management is still strongly promoted in the policies for rural water sector of Ethiopia. There are no clear policies at the moment to move away from community management. Community management has been studied quite extensively but more from the perspective of implementing new water schemes (Mekonta and Boelee, 2013; Behailu, 2016; Beshah *et al.*, 2016).

The national level interviewee also mentioned that clustering of O&M activities is seen as positive. The growing trend is a shift from single point source water projects to larger multivillage or rural piped water schemes. This is similar to Finland, where the trend has been to move away from smaller community managed water systems to public utility companies (Laukkanen, 2020). Still further research is needed into the O&M of more complex water systems like rural piped water schemes.

From my personal experience of visiting several rural piped water schemes in Kenya, the O&M challenges observed were very similar to challenges, in Ethiopia, found in this study. The clustering of water services does not automatically equate to better service delivery. It

shouldn't be expected that larger systems in themselves lead to better functioning water systems, if the basic building blocks of institutional arrangements, financial and human capacity are not in place for sustainable O&M.

It could be beneficial to further research the best approach for rural water in terms of centralization-decentralization and the role of community management and clarify in policies and strategies what aspects of each are promoted. Some research has been done into the governance of Ethiopia's water sector. Arsano et al. (2010) identified the issue of "token decentralization" in which responsibilities are delegated to the lower level institutions without actual power, authority or financing to carry out those responsibilities.

It would also be useful to clarify what aspects of rural water should be clustered. In Finland for example, the trend is to centralize wastewater treatment but decentralize water supply points. Geographically decentralized water supply provides reliability to service delivery from a quality, quantity, and safety aspect. Clustering can also be extremely challenging in remote rural areas where it is not economically viable to cluster water services without subsidies.

The National Water Policy (NWP) draft promotes subsidized tariffs for low income areas. At the same time, subsidized tariffs are in conflict with the NWP policies on cost recovery. Full cost recovery is promoted for urban utilities but at the local level the utilities can be compelled to keep the tariffs lower than the actual operational costs (Arsano et al., 2010).

Subsidized tariffs may be a necessity for equitable access to water, but at the same time it should be made sure that it is well defined. Otherwise water may be overused, or it may be used as justification for low tariffs, as the rural areas in Ethiopia are overall very poor (UNDP, 2020). Hukka and Katko (2015) underline the negative impact underpricing of water has on water infrastructure in the long term. The rural water tariffs are not regulated in Ethiopia, but the need for regulation of tariffs was identified by both policies and the national level expert.

The Water Implementation Framework (WIF) describes Ethiopia's WASH actors, roles and responsibilities at different levels (Figure 9). Also, the One WASH National Programme (OWNP) and other policies have attempted to increase the efficiency of the water sector by clarifying roles and responsibilities of different organizations (FDRE, 2013; National WCO, 2016; MoWIE, 2020). Although this study did not focus on the institutional setup of the water sector it was found to be fairly complex and lead to a sense of needing further clarification. Having multiple actors on the same level with vague or unclear roles could lead to inefficiencies in coordinating activities or not taking responsibility for some task that may be viewed to be someone else's responsibility.

The regions also have autonomy to organize their administrative units independently. This may also partially contribute to the complexity and multitude of actors in Ethiopia's water sector. Arsano et al. (2010) studied the governance and drivers of Ethiopia's water sector and found weak coordination between different service delivery actors. Nevertheless, it could be beneficial to further study the roles and responsibilities of the different actors and determine if there is a need to clarify roles.

5.8 O&M and more advanced rural water infra

The Operation and Maintenance Strategic Framework (OMSF) does clearly state that the maintenance of more complex water systems is not expected to be managed by the community (MoWIE, 2018). The national level expert also confirmed that more complex systems like rural piped schemes are typically not managed by communities. The ability of communities to manage more complex systems also scored relatively low in the surveys, with a few exceptions in cases where there had been good experience of communities successfully managing more complex water systems. At the same time, the expert did point out that the current trend in the rural water sector (RWS) is a shift to larger projects like multi village schemes and piped water which is in line with the Growth and Transformation Plan (GTP II) target of reaching 20% of rural population through piped schemes (MoFED, 2014).

In my opinion, the capacity and current institutional arrangements for post construction support should be a concern and receive high priority in implementing corrective actions. It may be possible to successfully implement more complex systems in pilot studies and individual cases where the projects receive a lot of attention and focus. But on a national level the current RWS sector in my view is not ready for wide scale adoption of more complex water systems like the GTP II aims to achieve as the O&M of even the basic systems like handpumps is lacking with current support structures and financing.

5.9 Uncertainties and limitations

The issues raised in the survey interview and policies correlate well with findings from other research and grey literature. This justifies well the selection of the policy document analysis approach in this study. It proved to be useful in providing learning and insight into Ethiopia's O&M challenges, as stated by (Le Gouais and Wach, 2013).

On the other hand, it does not seem to be successful in providing new major findings or discoveries. The study is limited in primary data and does not give a strong basis for specific corrective actions to improve the O&M of rural water in Ethiopia, or on a broader scale.

In the analysis of the interview and surveys, it was identified that not all of the questions were the clearest. Some left room for interpretation of the answers. However, Merriam (2009) points out the case researcher will pass along some of their own interpretations and relationship of events, while at the same time the reader will make their own filtrations. This can reconstruct knowledge in ways that can be very useful to the reader.

6 Conclusions

The non-functionality and loss of water infrastructure investment partially due to lack of maintenance are challenging and multifaceted issues. They have been in the center of the rural water development discourse for well over a decade. The Triple-S building blocks have been developed to address these issues. They take a more comprehensive approach and view on what contributes to sustainable water services in the development context.

The aim of this study was to explore how Ethiopia's water policies and guidelines address operation and maintenance (O&M), identify bottlenecks affecting O&M and to better understand if a push towards more advanced rural water has potential pitfalls from the O&M perspective. The topic was studied through a framework of six selected Triple-S building blocks. The study combined a qualitative policy document analysis with a thematic analysis of semi-structured interview and survey data of Ethiopian water professionals. The triangulation of qualitative document analysis with surveys and interviews provided the opportunity for deeper insight into the issues of O&M in the context of Ethiopia. Although the study was somewhat limited in the amount of primary data, the method utilized in this study was found to be effective in gaining an overview of the O&M challenges and providing answers to the research questions.

Firstly, the reviewed policies were found to cover well the selected building blocks of the Triple-S sustainability framework which are most relevant from the O&M perspective. Few discrepancies were identified but more importantly the implementation of policies was found to be lacking in many areas. This affects O&M and sustainability of rural water infra at the lowest level of decentralization. Woredas have a good view of the issues that are related to O&M but are not well equipped to carry out all the responsibilities given to them. The implementation of policies may be challenging due to the lack of oversight and the relative autonomy of regional states to implement the policies.

Secondly, the major constraint for effective O&M does not seem to be a lack of awareness or desire to support rural water schemes at the service provider (woreda) level. The woredas were found to consider O&M as very important but had limited capacity to support communities. Even with the limited capacity they were found to work around non existing budgets to carry out some form of post construction support to improve the operation and maintenance (O&M) of community managed water schemes. From the woreda perspective the main bottleneck for effective O&M is the lack of finance and budgets to carry out post construction support. This finding points to "token decentralization", where the mandate and responsibilities of service provision are shifted to the lowest level without providing the power and resources to carry out those activities (Arsano et al., 2010).

The other main bottlenecks found were capacity to O&M more complex water infra, capacity and training of woreda staff, lack of skilled manpower and poor institutional arrangements. There has been a clear attempt to improve the definition of institutional roles and responsibilities in the policies, but they were still found to be somewhat unclear or vague when it comes to O&M or post construction support more broadly. Some of the inconsistencies in policies also leave room for interpretation that may lead to an unaligned approach for the development of the rural water sector.

Thirdly, a growing trend towards more complex water infra in the development of rural water was observed. At the same time, it was recognized that communities are not expected to have

the capacity to operate and maintain (O&M) these more advanced systems. Yet, community management is the main management modality promoted in the policies and the gap in this move towards larger and more complex water schemes has not adequately been addressed.

With even simple water systems struggling with O&M and the gaps in post construction support arrangements, raises severe concerns towards the trend of larger and more complex systems. The breakdown of larger water supply systems can affect a large amount of people at on time. Also, the need and extent of support will only increase with more complex systems. This has the potential to further widen the gap between needed and available finances for O&M. This can severely undermine the attempts to reach unserved people with access to safe water.

Although this study has its' limitations, the following general recommendations for further study are made. As the results showed there is still a need to clarify the roles and responsibilities of many of the actors involved with rural water, it could be beneficial to start with a governance or organizational analysis focusing on institutions involved in post construction support and O&M. It would be important for this study to include national and regional actors, as the local level actors' effectiveness can be constrained by higher level institutions.

Next it could be useful to prioritize policies for implementation and oversight. As this requires resources, it would be beneficial to direct those resources to policies that have the greatest impact towards improving O&M. Monitoring and regulation of rural services are suggested, as they are closely linked to many of the other Tiple-S building blocks. Improving monitoring acts as an important foundation for further improvements by giving a more reliable picture of the O&M situation and tracking interventions.

The ability of community managed water supply systems to be sustainable depends much on the resources human and financial available to support the community. Capacity, institutions, and guidelines should be updated and improved to be able to support more complex systems on a wider scale before increasing and expanding to more complex systems. There is also a need to make sure the political economy of rural water also shifts, so it supports O&M, capacity building and monitoring for service delivery.

Water development monitoring tends to have a limited time frame and focuses on monitoring project implementation. This gives an over positive view of the success of these projects without considering the long-term success of the constructed infra delivering its' intended function for the whole life cycle of that system. The statistics of non-functioning water points and development project infra needing rehabilitation reveal serious challenges and concerns that should be considered in light of the implications that the requirements of the Sustainable Development Goals (SDG) 6.1 targets for universal and equitable access to safely managed drinking water sources has on rural water systems.

This case study of Ethiopia's O&M policies will hopefully draw more attention to the important role O&M has in in reaching SDG 6.1 in a financially sustainable manner. The findings are bound to the case of Ethiopia but can act as a platform for practitioners and researches of the rural water development sector to further discuss, study and research the topic.

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