Opportunities and Tensions to Advance Data Ecosystem in the Water Sector: The Case of Ethiopia

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Introduction

The Joint Monitoring Program (JMP) for Water Supply, Sanitation and Hygiene formally declared that the Millennium Development Goal for halving the number of people without access to clean drinking water has been achieved in November 2014, nine months ahead of schedule[1]. Ethiopia has also been one of the countries that has achieved this MDG target on water ahead of time. This is one manifestation that the country has been registering extensive improvements and measurable progresses during the MDG period. Sustaining the achievements and upscaling its quality aspect through improvement of water service levels is one of the major anticipated milestones for the current Sustainable Development Goal 6 (SDG6). The value of data in monitoring the progress towards national and global goals has become more demanding than ever. The value of a reliable water data ecosystem is a key driver to the decision-making process when it exists to support the actors. Nevertheless, water-supply data archiving, exchanging, updating and its use for informed decision making has been dragging over a period of decades despite huge efforts, investments and aspirations of the government and non-governmental organizations working in the Water, Sanitation and Hygiene (WASH) sector in Ethiopia.

The existence of persistent opportunities on one hand and the failure to deploy even a loosely functional data supply chain in comparison with other "WASH sectors," like health and education, has become a dilemma faced by WASH sector actors. The observed tensions both within the water supply sector and horizontal collaborators provides an opportunity that has never been tapped adequately. The absence of "boots on the ground" in the water sector is among the key contributors of the tension in, and lack of attention to the data ecosystem. Education and health sectors have the resources to collect, verify and report sector data at schools and health facilities trained and closely monitored by a chain of supervisors. Unfortunately, this is not the case in the water sector, which apparently has made it difficult for years to implement a functional water supply data exchange, analysis and utilization at the required depth and breadth. Possibilities tried and tested by the Ministry of Water, Irrigation and Electricity (MoWIE) have served as a one-off data collection effort without the needed transition to a management information system (MIS). To date, data collection efforts by government and non-governmental organizations have not been translated into a systematic MIS with the required surveillance capability. Hence, while these efforts have met their reporting purpose, they

1 *Ethiopia celebrates achievement in MDG target of water supply (FBC)*

has not served the required purpose of evidence-based decision making in the sector.

While the aspiration for data and the theoretical possibilities about its power in decision making is widely and passionately discussed in classrooms and workshops, no breakthrough has been realized so far in Ethiopia. National water inventories conducted in 2011 and 2018 could have provided a reliable baseline to get started. It is still feasible to be hopeful about the ongoing work to systematize the 2018 inventory as "relative reliable data" (but also an "obsolete baseline") to establish a potential water-data ecosystem. It might become a reliable baseline if it is updated in coming years.

The contradictions between knowledge and pragmatism are inherent problems within many developing countries and specifically within the water sector in Ethiopia, which needs to be supported with in-depth, inward and sustainable solutions that lead to a reliable WASH data ecosystem.

Data Ecosystem in the Water Sector

The term data ecosystem refers to the programming languages, packages, algorithms, cloud-computing services and general infrastructure an organization uses to collect, store, analyze and leverage data[2]. Data ecosystem is a complex subject that requires the involvement and active contribution of various disciplines, experts and stakeholders. The complex aspect of the data ecosystem also offers the potential to resolve multiple layers of problems.

Water data ecosystems require the engagement of several sectors, including agriculture, health, environmental health, meteorology and education. Nevertheless, it is the water sector that owns the processing and publishing of water sector data with limited involvement and engagement of other sectors. Water data is typically collected by government, NGO, private and other sectors. For instance, the agriculture sector records the volume of water used for irrigation and the amount of water returned to the environment. Mining and energy sectors also collect data on volume of water extracted, as well as the quality and quantity of water returned. Water utilities are engaged in principle in monitoring the environment around their sources of water for their customers.

The use of one entity to coordinate and service the facilitation around water data collection, analysis and exchange would create a convenient avenue and attain a fair level of efficiency as well. For instance, the MoWIE in Ethiopia has played the role of coordinator during National WASH Inventory (NWI) I and II. However, the lack of input in the form of technical expertise from Environmental Protection, Integrated Water Resource Management (IWRM), weather forecasters and others eventually affects data analysis, exchange and efficient utilization.

The water data ecosystem in Ethiopia has been at loggerheads despite the presence of a flagship program, skillful leadership and collaboration within the sector. It is highly likely that the lack of expertise from concerned sectors beyond MoWIE could have exacerbated problems in analyzing and availing water data to the public and key actors.

This limited collaboration of concerned sectors in collecting, exchanging, analyzing and utilizing data for decision making is a key challenge faced. However, other factors have also affected Ethiopa's water data ecosystem, including the country's vast geographic landscape, poor infrastructure development, dispersed settlement pattern, and inadequately staffed and equipped water sector personnel at the grassroots level. Addressing these challenges and creating a functional data ecosystem will be resource intensive but not unattainable.

The role of infrastrure expansion, like electricity and internet, is fundamental to improving the water data ecosystem. The rugged topography of Ethiopia, coupled with a sparse settlement pattern, have left only 15% of the population with access to the

2 5 key elements of a data ecosystem (2021)

internet. The continued effort of the government to expand vital infrastrure facilities is a commendable job that should be upscaled to make a meaningful transformation of the water data ecosystem and other related work nationwide. Nevertheless, given the current pace of infrastructure expansion and the elapsing SDG timeline, the task of monitoring the progress of SDG6 with a reliable data ecosystem will require the extraordinary effort of everyone beyond the government.

Six years after the launch of the SDGs, the water sector in Ethiopia has yet to fully integrate its monitoring indicators and data with SDG service-level monitoring. A regional monitoring and evaluation specialist stated that regional-level actors (micro stratum) are not very knowledgeable about SDG6, because implementation and data analysis are still based on Growth and Transformation Plan (GTP) II indicators. Thus, the effects of the SDGs on data collection and analysis at the regional level are not yet clear, according to the informant (Eilis 2021).

Existing Efforts to Advance the Water Information System

There is increasing recognition that sustainable WASH services cannot be achieved through infrastructure development alone; they also need to be supported by investments in areas such as planning, budgeting, monitoring and coordination (WaterAid, 2019). This type of recognition is needed at different levels and stakeholders to bring about the desired result during the SDG period.

The data need for resource prioritization, planning and prediction is becoming much clearer and more convincing. Emergency-response needs aggravated by public health problems have also created increased awareness and readiness by government and non-government agencies in recent years. In recent decades, government of Ethiopia has been trying all feasible efforts within the context of poor infrastructure and available human resource to resolve problems with the water data-management information system.

A key step taken in the last decade was the 2011 launch of NWI, the first of its kind in the country. Though NWI's paper-based inventory had many drawbacks in terms of efficiency, it was a commendable milestone in terms of building lessons in the sector. Some of the challenges faced during the NWI included security concerns that hindered inventory in Somali region, where data quality has been compromised at the collection, entry and cleaning stages. With these lessons learned, a digital data collection effort in 2014 began to address missing data from the Somali region. This effort has proven to be more efficient with the use of the digital data-collection platform, Akvo FLOW. The shift from paper-based data collection to digital smartphone technology was a major development in terms of data quality and overall efficiency. For instance, 5,696 surveys were completed in three months' time in the Somali region through Akvo FLOW, compared to the extensive time and human resources required to collect water data from 92,588 rural water supply schemes, 1,605 town water supply schemes, 30,000 schools, 20,000 health institutions and 12 million households.

Regardless of the major milestone registered in conducting the 2011 NWI, it took more than nine years to conduct another NWI because of the lack of publicly shared water data and meaningful analysis. Data quality and a lack of qualified human resources to manage such big data were among the hinderances encountered by the sector.

Knowledge management in the WASH sector at large is not well developed in Ethiopia and is believed to have contributed to the slow improvement in water data information management. The second NWI was carried out in 2018 with technical and managerial support from Coffey consultants, who had been deployed for the project implementation in March 2015 by the Department for International Development (DFID).

Figure 1:
Administrative Map of Ethiopia

Description	Value
Population in million	100,000
Regions	9
City Administration	2
Woreda	760
Urban town Utilities	973
Estimated number of water supply schemes	200,000
Average number of new water supply schemes constructed annually	10,000

"The SDG 6, and specifically the Integrated Monitoring Initiative for SDG6 (IMI-SDG6), provides a framework, timeline and approaches to monitoring water- and sanitation-related issues. This framework could be cascaded at national and regional levels to cope up with the target (UN Water, 2017).

The overarching goal of IMI-SDG6 is to accelerate the achievement of SDG 6, by increasing the availability of high-quality data for evidence-based policymaking, regulations, planning and investments at all levels. More specifically, IMI-SDG6 aims to:

1. Support countries to collect, analyze and report SDG 6 data.
2. Support policy makers- and decision makers at all levels to use this data.

To achieve these objectives, the Initiative will develop over 15 years through four phases with progressive shifts in focus. Throughout the phases, activities are targeted to global, regional and national levels.

- Phase 1/ Global Baseline: Focused on getting a baseline in place, which requires methodology development and testing, and a first round of global data collection and reporting.
- Phase 2/ Build National Ownership: Focused on intensified outreach and capacity building. This phase relates both to technical issues, as well as cross-cutting and institutional issues. Monitoring methodologies and guidance still need to be refined, in particular looking at the use of novel data sources to cover gaps.
- Phase 3/ Integrate and Mainstream: Coordination and integration at all levels, including the mainstreaming with existing national and regional efforts. Integration and mainstreaming, started in Phase 1 and are important priorities for Phase 2. In Phase 3 it will become the main focus. Phase 3 will also look deeper into analytical work and build further national sustainability for this process by linking it with country-level policy and investment decisions.
- Phase 4/ Consolidate and Sustain: Focused on strengthening the sustainability of the monitoring process at country, regional and global levels, and improving its effectiveness."[3]

3 *https://sdgs.un.org/goals/goal6*

Comparison of Sectors in Data Use for Decision Making

The Integrated Monitoring Guide for SDG6 sub-component G1 (good practices for country monitoring systems) published by UN Water discusses operationalizing SDG6 into practice through cross-sectional cooperation between different levels and across different sectors. The report states that while the goals are defined as "global and aspirational," it is clear that interventions should be tailored to national circumstances through available resources, existing capacity and level of urgency around different issues in the context of each country.

The data ecosystem and its utilization could vary across sectors and places within a given geographic territory. Nevertheless, the potential role data has in hastening evidence-based decision making is significant across sectors and territories. Certain practical factors could differentiate sectors in planning and implementation of a data ecosystem. For instance, the health sector in Ethiopia has advanced in starting, implementing and continuously improving its health data collection, analysis and utilization, compared to the less advanced education and water sectors. However, the education sector has developed an Education Management Information System (EMiS) through a blend of electronic and manual implementations.

The water sector could have reached similar levels of MiS, but the institutional setup for managing water supply systems and available human resources at the grassroots level are at different levels of implementation capacity. Table 1 provides a summary of the variations in institutional setup and human resources across three sectors in Ethiopia.

Another confounding factor is the lack of data and adequate information on existing water infrastructure and management models. The existing community water points are managed by Water, Sanitation and Hygiene Committees (WASHCOs) with no systematically organized data ecosystem. As a result, the decision-making process for ongoing and prospective infrastructure, modeling and innovation is also affected by the lack of information and data.

Due to varying contexts in the type of services provided by the health, education and water sectors, comparing data ecosystems in the three sectors is challenging. For instance, water service delivery is mostly community-managed in rural areas, while health- and education-sector service delivery is part and parcel of the formal government structure. In health and education service delivery, data generation and decision making are largely practiced in formal government offices, as opposed to community- and household-level decisions in water service delivery. Moreover, the key drivers of health and education data generation, collection, analysis, etc., are impacted by the availability of associated infrastructures, like electricity, computer and associated technologies, which are mostly part

Table 1:
Summary of Data Flow Chart in Water and Education Sectors

Variables	Health Sector	Education Sector	Water Sector
Institution	The health sector has more than 45,000 health facilities with a formal institutional setup that is largely computerized.	More than 100,000 schools are closely monitored and supported by the formal education system.	The water sector has an estimated number of 100,000 water supply schemes, a major proportion of which are community-managed schemes in rural villages.
Human Resources	110,000 health workers are salaried in public and private facilities.	There were a total of 840,000 teachers in primary and secondary schools in 2012.	The water sector is one of the least staffed in comparison with the health and education sectors. Available personnel have multiple responsibilities in irrigation and energy activities.

of an office setup rather than a community- and household-level practice. Nevertheless, a formal government structure has been mandated to oversee the water sector with a similar level of footing with health and education sectors at the district level.

Constraints of Efficient Data Ecosystem in Ethiopia

The current trend and status of the water data ecosystem has a long route to travel before it serves the intended purpose. It has been more than three years since the NWI II was conducted with huge investments from the government and development partners. However, there is no publicly shared data for stakeholders and the local government on which planning, budgeting and, hence, associated decision making applied. This is another confirmation (in addition to NWI I) that it is not data collection that matters most, but rather follow up actions with big data. The constraint of the water data ecosystem is not collecting the data but the understanding and readiness to utilize the data for decision making.

The coordination role of MoWIE in commissioning NWI I and II is commendable leadership. But the failure to make effective use of the collected big data is an area that should be worked on to avoid similar misuse of energy by sector actors. A couple of NGO partners with a plan and resources to commission asset inventory at the district level postponed or cancelled their plan for years to wait for the NWI II findings. The repeated efforts of the government to come up with a Water Management Information System (WMIS) is an ambition that deserves to be converted to action that results in concrete outputs before the data becomes obsolete. This is the contradiction in the sector that contains both opportunities and tensions.

A range of intertwined problems within Ethiopia's WASH sector and the broader public-service sector has constrained the efficiency of the data ecosystem. One major factor is failure to conceive data generation as part and parcel of a wider ecosystem. Though commendable, the routine habit of data generation through periodic reports gets nowhere as far as systemic archiving, interpretation, planning and similar decision-making practices.

The data that gets reported and collected through formal government structures should be systematically organized to tell a timely story and respond to key questions about how much water is available, how many people are accessing safely managed water services, and demand and supply dilemmas. Currently, this story cannot be communicated with fragmented data collection and restrictions on exchanging water data.

The water sector in Ethiopia cannot guarantee the collected data is being used for decision making. Behavioral science plays a huge role when it comes to decision making using available evidence. This is further complicated by political-economic factors that put data and evidence as secondary and even tertiary variables in the decision-making process. Political economy perspectives on evidence use highlight the importance of understanding the context in which evidence is produced and (mis)used, and on individual actors' values, beliefs and interests (WaterAid 2019). Thus, a variety of intertwined constraints have contributed to the inefficiency of data use for monitoring in the Ethiopian context.

While the government of Ethiopia recognizes and appreciates the contribution that WASH development partners provide, these partners, especially NGOs, are devoid or sidelined from accessing water-related data in a transparent and swiftly accessible setting.

An apparent clustering trend with high unimproved water coverage was observed between regions and among wealth quintiles. This trend indicates priority areas for future resource allocation and the need for regional and national policies to address the issue. Furthermore, promoting households to treat water prior to drinking is essential to reduce health problems[4].

4 Damtew, Y.T., Geremew 2020

Thomas et al. (2018) advocate that new technology – and certainly automated data systems – can improve the reliability of drinking-water services by driving the performance of the service provider, complementing the existing survey-based systems. This finding is an immensely helpful and applicable resolution that could help mitigate most of the challenges faced in dealing with huge data collected from NWI and associated tensions. Nevertheless, new collaborators need to be introduced to the sector, including telecommunications service providers, to complement surveillance using text messages and/or similar platforms adapted to the sector.

Time is a variable that helps in comparing trends on water data monitoring. As such, the past few years have seen improvements, increased effort towards integration, alignment of efforts, improved data collection and other commendable work by the WASH sector ministries – MoWIE, MoH, MoE and MoFEC. Nevertheless, a contradiction needs to be recognized and corrected on the understanding and practices of some steps. For instance, a recent study that interviewed respondents noted that the Ethiopian government uses data for quite different purposes than the JMP or donor partners. Indeed, it is an entirely different exercise to collect water sector data for national-level development planning and coordination of government resources than for country-level SDG6 progress evaluation. While the SDGs are a raison d'être of sorts for the JMP, they are not domestic authorities.

Conclusions

The understanding of government decision makers in the water sector about the need for a water data ecosystem in general and WASH monitoring is well beyond satisfactory. The required practical steps in translating the theoretical thinking and understanding have been supported by funding entities like DFID and the other One WASH National Program (OWNP) funders. Though the effort so far to establish a water-management information system has been immense and expensive, it is an undeniable fact that no functional monitoring system is currently available in a country with more than a 100 million people. Population size is an indicator of the possible number of water points and water-supply systems that need close monitoring, surveillance and follow-up support for maintenance, water-quality testing, etc., to assure the availability of 24/7 water supply service.

Recommendations

The memorandum of understanding (MOU) among the four ministerial offices of BoFEC, MoWIE, MoE and MoH is a major milestone for inter-ministerial collaboration in principle. Significant actions have also followed this MoU. Nevertheless, there is insufficient coordination in data sharing and data harmonization among the key technical ministries. It is understandable that each ministry and its key personnel is striving to attain certain results. For instance, the Ministry of Health launched its Health Information Management System a decade ago and replaced it in recent years with the District Health Information System (DHiS). A similar effort in the education sector has been fruitful within the available technological advancement and infrastructure. Unless the high level inter-ministerial MoU is converted into a local district-level partnership with shared databases and an integrated information-management system, it will take several years to establish the type of integrated data-management initiative envisioned by the UN. This is also an area where the funding community for WASH, health and education need to coordinate and influence the requirement for an integrated data management system.

The inter-ministerial partnership should also lead by example when it comes to evidence-based decision making. One of the critical steps to transform the behavior of decision makers at all levels to advance their outlook on data management systems is to utilize available data for decision making. This needs to start at higher levels in a more transparent and objective manner. Though it is difficult to not foresee the influence of political-economic factors, WASH needs to be understood and communicated with from a purely social dimension.

A brief overview presentation from Water Development Commission of Ethiopia acknowledges that civil society organizations were recognized as partners of the OWNP in 2013. This is indeed a step that is not well addressed at the required level. Recognizing "CSOs as a partner" should be understood and translated into action in multiple forms beyond inviting them in selected consultative meetings. The innovations being tried and tested by CSOs need to be upscaled as part of the OWNP. CSOs have multiple ways to enhance the capacity of regional and district authorities as part of the OWNP, especially when there is intentionality in the selection of OWNP districts. Nonetheless, the criteria used in identifying OWNP districts is not done in consultation with CSOs. Rather, OWNP districts are selected using certain criteria that levels out districts where CSOs are implementing WASH projects. Thus, a seamless involvement of CSOs is vital for the efficiency of WASH interventions. This is especially helpful in data sharing and making evidence-informed decisions.

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Acronyms

CSOs	Civil Society Organizations
DFID	Department for International Development
DHiS	District Health Information System
EMiS	Education Management Information System
HMiS	Health Management Information System
GTP	Growth and Transformation Plan
IMI	Integrated Monitoring Initiative
IWRM	Integrated Water Resource Management
JICA	Japan International Cooperation Agency
JMP	Joint Monitoring Program
MDG	Millennium Development Goal
MIS	Management Information System
MoE	Ministry of Education
MoFA	Ministry of Foreign Affairs Finland
MOFEC	Ministry of Finance and Economic Cooperation
MoH	Ministry of Health
MOWIE	Ministry of Water, Irrigation and Energy
NGO	Non-Governmental Organization
NWI	National WASH Inventory
OWNP	One WASH National Program
SDG	Sustainable Development Goal
UN	United Nations
WASH	Water, Sanitation and Hygiene
WASHCO	Water, Sanitation and Hygiene Committee
WMIS	Water Management Information System

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