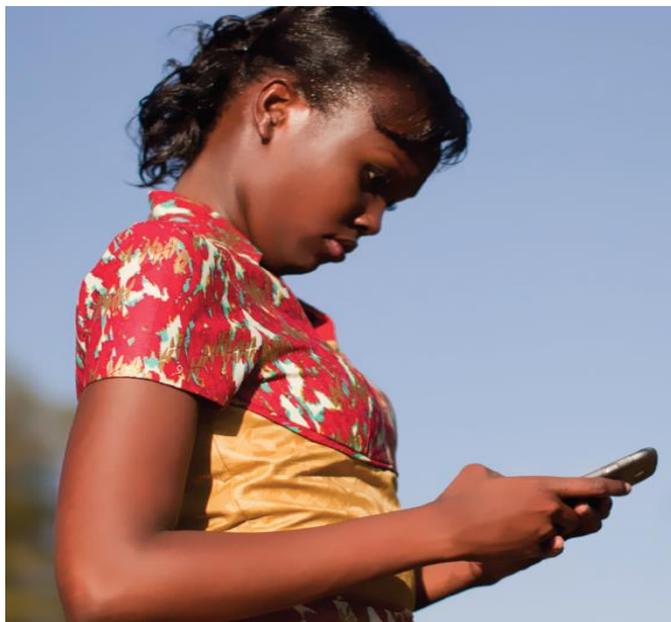# UNLOCKING THE POTENTIAL OF INFORMATION COMMUNICATIONS TECHNOLOGY TO IMPROVE WATER AND SANITATION SERVICES

LIBERIA CASE STUDY

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PREFACE

This report has been prepared for the Water and Sanitation Program (WSP) Study on "Unlocking the Potential of ICT Services in the Water and Sanitation Sector". The study builds on and complements the World Banks' Africa Regional Strategy (2011) and the World Bank Group's Information and Communication Technology (ICT) strategy (2012). It further complements the E-Transform Africa series, a collaboration between the African Development Bank, the World Bank and the African Union, which captures the existing use of ICT in six sectors (agriculture, climate change, education, health, financial services, government) and two cross-cutting themes (regional trade and integration, ICT competitiveness).

WSP has spearheaded the use of ICT in many countries in particular with its contribution in financing the use of the mWater pilot platform in countries such as Senegal, Mali, Niger and Benin, Akvo Flow and Fulcrum in Liberia and Sierra Leone and Maji Voice in Kenya. As many sector stakeholders are interested to learn from these pilot interventions, it is necessary to improve the documentation on these experiences and propose practical modalities for scale-up.

There is also a very strong drive around the use of ICT in the WASH sector and a growing interest among external partners. As such, there is a need to develop clearer partnership platforms with both short- (i.e. project specific) and medium-term objectives, to understand the potential information that can be generated through ICT, increase accessibility to and use of that information, and ensure that ICT generated information is implemented more sustainably in support of WASH objectives.

The study was carried out by the Water and Sanitation Program (WSP) of the World Bank to fill a gap in understanding how the potential of ICT can improve water and sanitation services globally with a particular emphasis in Africa. It covers a global desk review and case studies in 7 African countries (Kenya, Uganda, Tanzania, Senegal, Benin, Niger and Liberia), complemented by cases from other regions (Latin America, North America, South Asia and East Asia) and analyses strengths and weaknesses of existing ICT tools. It also provides evidence on how ICT can be used to leapfrog the water and sanitation sector towards more sustainable service delivery.

As such, this study sought to not only document experiences of ICT use in the WASH sector but also analyze them within a framework of enabling factors and barriers in terms of Vision, Process, Customer/User, Service Delivery, Human Capacity, Governance and Finance.

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ACRONYMS

3G	third generation of mobile telecommunications technology
4G	fourth generation of mobile telecommunications technology
ACE	Africa Coast to Europe: marine fiber cable between the West coast of Africa
ACF	Action Contre la Faim
CBO	Community Based Organisations
CLTS	Community-Led Total Sanitation
CLWSA	Community Led Water and Sanitation Activities
CSO	civil society organization
EFSVL	Emergency Food Security and Vulnerable Livelihoods (Oxfam programme)
FLOW	Field Level Operations Watch
GIS	geographic information system
GNI	Gross National Income
GPS	global positioning systems
GSM	Global System for Mobile Communications
ICT	information and communication technology
IT	information technology
KAP	Knowledge, Attitude and Practice
LISGIS	Liberia Institute of Statistics & Geo-Information Services
LTA	Liberia Telecommunications Authority
LWC	Liberia WASH Consortium
LWSC	Liberia Water and Sewerage Corporation
MB	Mega Bites
MDGs	Millennium Development Goals
M&E	Monitoring and Evaluation
MOPT	Ministry of Post and Telecommunications
NGO	non-governmental organization
NTCU	National Technical Coordinating Unit
NWSHPC	National Water Sanitation and Hygiene Promotion Committee
SCADA	Supervisory control and data acquisition
SD	Secure Digital memory card
SPSS	Software package for statistical analysis
UNDP	United Nations Development Program
UNICEF	United Nations Infant and Children Fund
USD	United States Dollar
WASH	Water, Sanitation and Hygiene
Wi-Fi	A local wireless technology or wireless network
WHO	World Health Organization
WSP	Water and Sanitation Program

1 INTRODUCTION

ICTs are used to enhance process efficiency, governance and transparency and have a direct role in promoting economic development. These technologies encourage greater competitiveness and facilitate new ways to organize production[i]. ICTs also have an important role to play in social and human development.

Investments in ICTs, especially in broadband, mobile telephony and mobile phone networks, have been demonstrated to promote economic development[ii,iii,iv,5]. It has been estimated that in Africa, South of the Sahara, mobile network operators have had a direct economic impact valued at USD 32 billion, including the payment of USD 12 billion in taxes, and have contributed to 4.4 % of gross domestic product. They have also created the equivalent of more than 35 million full time jobs while at the same time supporting the development of more than 50 innovation centres, techno hubs, laboratories and incubators across the continent[v].

The use of ICTs in the water sector is growing in importance and reach[vi]. Managing the sector requires dealing with large volumes of data from a multitude of components, infrastructures and equipment that generate a complex, large, continuous and ever changing stream ("big data") that is oftentimes unstructured, ever growing and that presents itself in often fragmentary and heterogeneous ways[vii]. The digitization of this data stream helps to better understand and to better manage drinking water resources and the infrastructure upon which water services depend as well as all of the steps in the value chain that are required for managing drinking water to the benefit of all and to do so in an integrated, visual and systematic way.

ICTs help to improve the collection, management, display and sharing of the information that is required by operators, concessionaires, planners and decision makers responsible for the performance of WASH services. Furthermore, ICT use in the WASH sector facilitates easy coordination of different WASH actors on the ground and encourages transparency in aid projects[viii]. Online monitoring also leads to better time management and greater accuracy in data collection. This contributes to more and improved information that has increased accuracy and a reduction in data entry and transcription errors.

The WASH sector in Liberia is fragmented, with split responsibilities. Knowledge on the extent, state and quality of WASH infrastructure and services across the country has been very limited. AkvoFLOW has presented an opportunity to address the information gaps. Since the first introduction of AkvoFLOW the application has been picked up by various stakeholders, it is estimated by Drake Ssenyange, the Programme Coordinator of the Liberia WASH Consortium (LWC) that approximately 50%[1] of the actors in the WASH sector in Liberia are currently using AkvoFLOW, while others continue to rely on alternative tools, excel templates for example, to report to NWSHPC.

This report presents findings of a case study on Liberia[2].The first section offers a landscape analysis of Liberia, looking at the regulatory and operating environment, existing ICT use in the WASH sector and the current state of ICT policy. The second section then looks specifically at the case study of AkvoFLOW. The study is based on consultations with key water sector stakeholders in Liberia, along with literature on ICT for development and the sampled applications. The stakeholders that were consulted during the preparation of this report are presented in Annex A.

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[1] WSP Liberia notes that the figure may be higher as the NWSHPC have stressed that all WASH actors should report to the dashboard.

[2] A field visit originally planned for Liberia in October 2014 was cancelled due to the Ebola outbreak. Instead interviews with key sector stakeholders were conducted over the phone, skype and email.

2 LANDSCAPE ANALYSIS

2.1 Regulatory and Operating Environment

The main ministries involved in the Liberian WASH sector are the Ministry of Public Works and the Ministry of Health. At present, while there is no WASH specific ministry in Liberia, the Government has established a National Water Sanitation and Hygiene Promotion Committee (NWSHPC) working out of the Ministry of Public Works, which has been instituted to drive the sector agenda and coordinate the various stakeholders. The organization of the sector is depicted in Figure 1.

A national WASH Sector Strategic Plan (2012 – 2017) is in place together with the WASH Sector Investment Plan (2012 – 2017) and the WASH Sector Capacity Development Plan (2012 – 2017)[ix]. The National Technical Coordinating Unit (NTCU) is responsible for overall coordination and technical support to Community-Led Total Sanitation (CLTS) activities in Liberia. In February 2013 the first WASH Joint Sector Review was held to review 2012 WASH sector progress. Since then annual WASH JSRs have taken place, during which all stakeholders come together and discuss progress towards sector strategic goals. A list of WASH projects is being compiled by the NWSHPC.

Figure 1: Organigram of the WASH sector in Liberia[x]
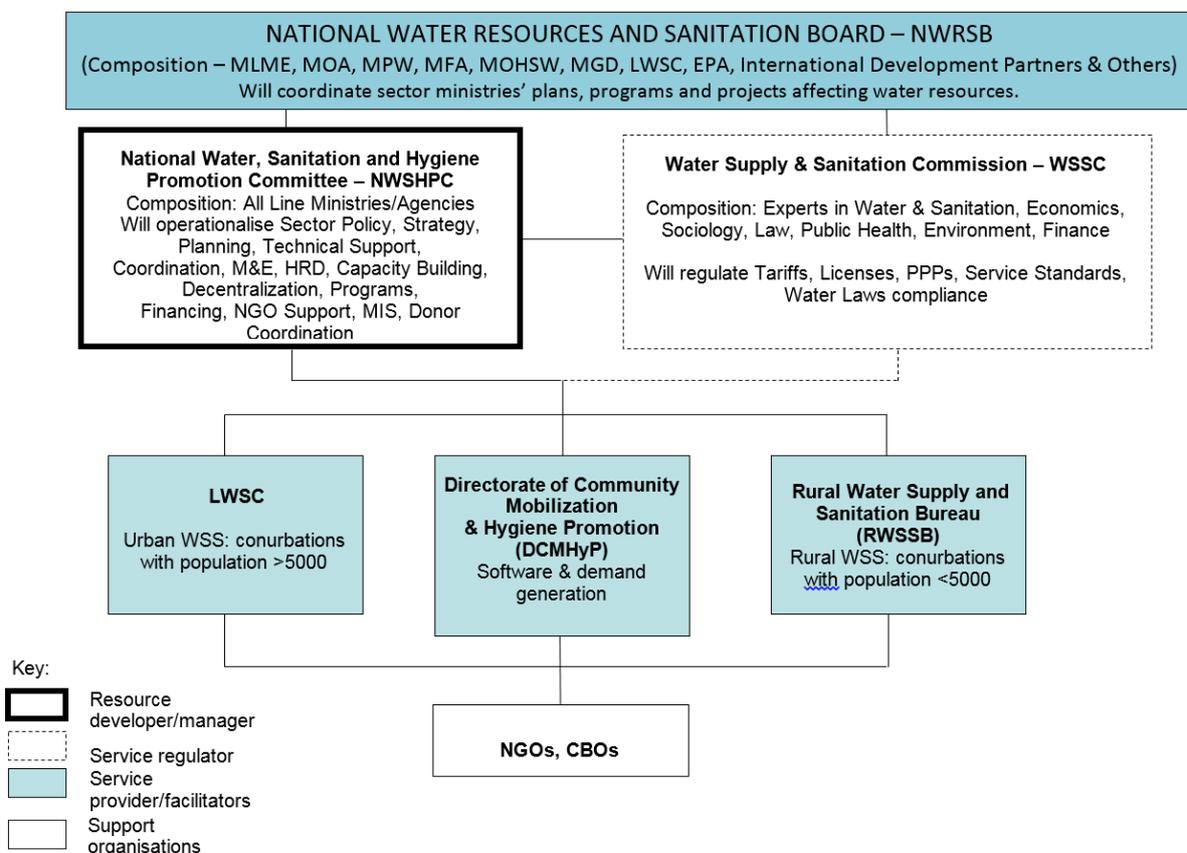
The following government and institutional stakeholders play key roles in the Liberian WASH sector:

- Rural Water Supply: The Ministry of Public Works;
- Urban Water Supply & Sanitation: Liberia Water and Sewer Corporation (LWSC);
- General Hygiene & Sanitation: The Ministry of Health & Social Welfare;

- School Sanitation: Ministry of Education;
- Statistics: Liberia Institute of Statistics & Geo-Information Services (LISGIS); and
- Liberia CSOs WASH Working Group.

There is also a strong presence of international organizations and NGOs:

- The Liberia WASH Consortium (LWC) consists of Oxfam, Concern Worldwide, Tearfund, ACF and WaterAid;
- The World Bank – Water and Sanitation Program;
- UNICEF;
- WaterAid;
- UNDP GoAL WASH;
- CHF Internationa;l and
- USAID Liberia.

The Liberia WASH Consortium was set up in "*2007 as a response to poor Water, Sanitation and Hygiene (WASH) access, lack of harmonization and coordination in the sector, insufficient national policy frameworks and weak sector governance in Liberia. The Liberia WASH Consortium now consists of 6 members: Action Contre la Faim (ACF), Concern Worldwide, Oxfam, Tearfund, WaterAid and Population Services International (PSI). The Consortium also has associate members and local CSO partners including the WASH CSO Network, Youth & Disable Network and the WASH Reporters & Editor Network of Liberia (WASH R&E)*"[xi].

The Liberia Water and Sewerage Corporation (LWSC) leads implementation in urban areas, drawing on substantial government subsidies and donor support, while NGOs generally manage implementation in rural areas.

According to the WHO/UNICEF Joint Monitoring Program 2014 Update, Liberia is on track to achieving its targets under the MDG for water[xii] with 73% of the population having access to drinking water. However, the country is not on track for the improved sanitation target of 18% and unlikely to reach the more ambitious national targets for either water or sanitation.

Coordination and governance of the sector has much improved over the last 5 years but implementation remains a challenge. Investment in the sector by the Government of Liberia is also minimal, with the bulk of water supply, sanitation and hygiene promotion funded by donors. However there is support for the creation of a WASH ministry with its own budget and planning. Furthermore as a result of the Ebola outbreak, the profile of hygiene promotion has been raised, with increased importance being placed on hand washing and there have been increasingly regular WASH sector meetings.[3]

2.1.1 ICT Policy

According to the International Telecommunication Union (ITU)[xiii], Liberia occupies the 153rd rank out of 166 countries in the ICT Development Index which measures ICT access, use of ICTs, and skills related to ICT use. In 2013, access to mobile broadband services (500MB) cost 113 % of Gross National Income (GNI) per capita, one of the highest in the world.

As a result of damage sustained to the telecom infrastructure during the civil war there is no fixed telecom network in the country[xiv], with the exception of roughly 25 kilometres of fiber optic cable located in and around Monrovia that was established in 2013 following the landing of the ACE cable; the first and only submarine fiber optic cable to land in Liberia to date[xv]. Internet access is extremely slow except for agencies and organizations that are directly connected to the fiber optic infrastructure in and around Monrovia. Telecommunication services in Liberia in general are limited, especially in

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[3] AkvoFLOW, one of the tools highlighted in this report also supported reporting during the outbreak.

rural areas where "*phone calls may not go through for hours, text messages are being delivered days late, and mobile money transfers are taking up to a week to process*[xvi]". There are plans for the creation of a national broadband backbone but as of the end of 2014 implementation had not yet started.

In the absence of a fixed telecommunications infrastructure, the telecommunications market is based nearly exclusively on wireless technologies. Four GSM operators compete for customers. According to analysts, the market is not effectively monitored by the telecommunications regulator, the Liberia Telecommunications Authority (LTA) because of a lack of resources, technical expertise and documentation. It is estimated that mobile penetration is at 78% and internet penetration is at 8.3%[xvii]. High speed 3G as well as 4G wireless services are available. Competition in the mobile sector has led to some of the lowest call prices in all of Africa, even though as mentioned above call quality is an issue.

Liberia adopted a national ICT and telecommunications policy in 2010[xviii] which emphasizes the importance of broadband for national development. The MOPT (Ministry of Post and Telecommunications) is responsible for policy formulation. Until 2013, the country relied on expensive and bandwidth-limited satellite telecommunications for international connectivity. The key players in the telecommunications sector are the private sector mobile network operators, including Lonestar/MTN, Cellcom, Novafone and Libtelco, the Liberia Telecommunications Company, the national telecommunications operator.

ICT use is a limiting factor restraining economic development and investment in Liberia. Given the restricted financial resources available to the Government of Liberia at this time, this will likely remain so for the foreseeable future unless the national broadband deployment strategy is enacted and access to fiber optic is sufficiently deregulated to interest a possible private sector investor. Fiber optic deployment can have a significant impact on economic development and this can drive the commercial interests of investors who may then be persuaded to work with the Government of Liberia to fund the roll out of a national broadband fiber optic network.

2.1.2 ICT use in the WASH sector

There are a number of IT applications in use by stakeholders in the WASH sector. These include GEOSPAGO, an application that is used for sanitation mapping (latrine blocks, drainages, open defecation areas, etc.), and AkvoFLOW used for mapping of water supply systems and describe in detail in Section 3.

The LWSC uses SAGE50 which is an advanced accounting package developed by Peachtree Software but does not make use of any WASH specific IT applications. The LWSC is also currently developing a mobile money application in collaboration with local mobile network operators that will allow its roughly 10,000 customers to pay their bills using their mobile phones.

3 CASE STUDY: AKVOFLOW

3.1 Description of AkvoFLOW

AkvoFLOW is open-source software that is used in the WASH sector for smartphone based field surveys[xix]. FLOW stands for "Field Level Operations Watch". The AkvoFLOW software can be loaded onto any Android smartphone with GPS functionality and a camera to act as an integrated mapping device connected to a central database[xx]. An AkvoFLOW enabled phone can be used to:

- Fill in a survey (e.g., on water points) on the touchscreen,
- Take a picture of the survey object with the phone camera,
- Capture the GPS location of the surveyed object with one click,
- Submit all data to a central server.

AkvoFLOW brings together three elements[xxi]:

1. Handheld data collection
2. A web based dashboard to manage and analyze surveys and data
3. Visual based reporting tools displayed in Google Maps and Google Earth.

3.1.1 Vision

When Liberia emerged from civil war, the national infrastructure was still severely impaired. Many of the 7,500 water points across the country were not functioning. More important, the exact status and location of the water points were not known. While several actors, mostly NGOs, were involved in providing emergency water supplies by sinking boreholes and installing water pumps, these efforts were not coordinated. A need to inventory the water holes and their status was initiated as a first step to understanding the status of water supply across the country in order to improve access to drinking water[xxii]. A national water point mapping exercise was therefore undertaken with the help of the Water and Sanitation Program (WSP) of the World Bank[xxiii].

From December 2010 to May 2011, the WSP conducted a systematic inventory of water points in Liberia[xxiv]. 150 data collectors were trained and deployed and equipped with phones using AkvoFLOW software to map the rural water points. Since the first introduction of AkvoFLOW the application has been picked up by various other stakeholders, it is estimated by the Liberia WASH Consortium (LWC) that approximately 50% of the actors in the WASH sector in Liberia are using AkvoFLOW.

3.1.2 Process
a) Background

AkvoFLOW was chosen for the task of water point mapping, and by extension of all field level surveying, in order to overcome the limitations faced by traditional data collection methods. In the case of LWC, in the past, each member would conduct their own surveys often times with different approaches, questionnaires and sampling methods. This approach was time consuming and raised difficulties in consolidating data and measuring change. AkvoFLOW is preferred over other technologies because of the limited internet connectivity that exists in Liberia, especially in rural areas. Many applications require Wi-Fi or mobile network connectivity to submit collected survey data which presents a challenge. Similarly, intensive smartphone use requires regular charging and often the purchase of extra batteries. The AkvoFLOW application can run in offline mode using the nonvolatile memory in the smartphone which helps to conserve battery power. Furthermore, smartphone memory capacity is sufficient to accommodate around 1,200 surveys. In the event that more memory is required, Secure Digital (SD) memory cards can be swapped in an out of the smartphone accordingly. SD cards can also be used for backup in the field in case the smartphone breaks down.

b) Methodology/development process

The experience of the Liberia WASH Consortium (LWC)

The acquisition of AkvoFLOW has led to significant changes in the operating procedures and mindset of the LWC, affecting activities even beyond water supply. The LWC also undertakes many assessments related to Ebola and its impact (EFSVL - Emergency Food Security and Vulnerable Livelihoods, gender, etc.), and all of these surveys are now being undertaken using AkvoFLOW.

The efficiency and effectiveness of surveys has been greatly improved. The LWC has developed a user manual and staff have been trained on how to design a simple survey using AkvoFLOW and how to use smartphones for field level data collection. When sufficient data has been acquired or when the surveyor is finished for the day, he or she will proceed to a Wi-Fi or mobile connection point and upload the data to the central AkvoFLOW server on the internet. The data is acquired on the central dashboard instantaneously allowing for immediate analysis, display and sharing of data.

The experience of Unicef Liberia

Unicef Liberia initially started using AkvoFLOW to collect information on water points and later expanded this to also collect data on sanitation activities in the rural areas under the Community Led Total Sanitation (CLTS) programme that is meant for elimination of open defecation and improving sanitation coverage in rural areas. The CLTS activities involve community outreach and encourage community members to build their own latrines. Unicef collects relevant information - including GPS coordinates, community name, district name, etc – for all communities that are being visited for CLTS triggering and later on for all communities that became open defecation free (ODF) and that data is included in the Akvo Dashboard. With the rise of Ebola, Unicef also used AkvoFLOW to assess the WASH situation in health facilities. Enumerators visited health facilities and gathered data on existing water points and latrines using smartphones.

Unicef is still experimenting with AkvoFLOW and seeks to expand its use geographically while also looking at new application areas where AkvoFLOW can be put to use.

c) Scalability

Across Liberia, all 15 counties have Government of Liberia WASH Coordinators who are been equipped with and trained in the use of mobile phones for collecting WASH data. As a result, these government officers are now providing information that is fed into the AkvoFLOW dashboard. The availability of information from all 15 counties will help to provide an ongoing and up-to-date picture of water supply across the country.

As a result of using AkvoFLOW, the coordinating role of the National Water Sanitation and Hygiene Promotion Committee Secretariat has greatly improved. Data is more readily available to all actors in the field and as a result, coordination is easier and has greatly improved.

At the present time, AkvoFLOW is used by the organizations working in the promotion of WASH activities in Liberia, but eventually, it is hoped that the communities themselves will be able to use AkvoFLOW to better manage their water assets.

3.1.3 Customer/User

The immediate users are the enumerators that have been trained by the various WASH stakeholders that have adopted AkvoFLOW. These include the LWC, Unicef, the Ministry of Public Works, Global Communities (USAID), UN Women and a number of other NGOs (Living Water, etc.). It is estimated by the LWC that approximately 50% of the actors in the WASH sector in Liberia are using AkvoFLOW. Local Government of Liberia officials were also trained in the use of AkvoFLOW but without smartphones.

Private sector engagement in the use of AkvoFLOW has been limited. The only private sector operator of significance in the WASH sector is the Liberia Water and Sewerage Corporation and they have not adopted AkvoFLOW to survey the water kiosks in Liberia.

At the LWC, stakeholders were involved right from the beginning. The greatest challenge was acclimatizing users to the smartphones. Implementation was achieved using workshops, small group training as well as individual follow-up when tracking data entry. Akvo staff also helped with group and one-on-one training.

LWC members who use AkvoFLOW mentioned easier report preparation and increased satisfaction with the monitoring system. The use of AkvoFLOW has strengthened the Consortium. Based on evidence gathered using AkvoFLOW it is now easier to identify which interventions work and which do not. This builds confidence in development decision making. The net result is a strengthening of organizational capabilities of LWC members.

Unicef Liberia has been largely satisfied with their use of the application. One of the major advantages of using AkvoFLOW has been much better access to data for reporting purposes. AkvoFLOW has been used to help measure progress on the rate at which communities are becoming Open Defecation Free (ODF).

3.1.4   Human Capacity

Training needs were aligned with the resources of the agencies involved, especially those in the LWC. Manuals were developed by the LWC with the help of Akvo and are used by enumerators. The manuals were complemented with smartphone and Akvo training. Once trained and experienced, enumerators felt more confident in their work than they had been when using paper based forms. While there is no official AkvoFLOW user community in Liberia, there are many organizations in the WASH sector using the tool and meeting regularly which facilitates sharing of experiences with AkvoFLOW.

The National Water Sanitation and Hygiene Promotion Committee Secretariat has the capacity to manage the application on a day to day basis without intervention from Akvo, with the exception of minor technical issues. The IT department at Oxfam Liberia has also provided substantial IT assistance, especially in terms of selecting the best smartphone.

3.1.5   Finance

The water point mapping project that took place in late 2010 to mid-2011 was funded by WSP (~60%), UNICEF (~35%) and CHF/USAID (~5%), with considerable logistical and knowledge support coming from the Ministry of Public Works, the Liberian statistical agency LISGIS, the Ministry of Health, the US NGO Water for People, and the local WASH Consortium, in particular OXFAM. WSP's primary government partner was the Ministry of Public Works, which provided office space, local knowledge and contacts, help with recruitment, and official government support and legitimization[xxv].

LWC received an innovation fund grant from Oxfam of USD 50,000 to acquire and pilot the use of AkvoFLOW. The LWC initially underestimated the cost of adopting AkvoFLOW and the demand has grown significantly. A key challenge for the LWC is the recurring fee to be paid to Akvo for the use of the AkvoFLOW dashboard, approximately EUR 10,000 /year. Additional funds are also required for training and re-training to take into consideration staff turnover, for follow-up, for support from Akvo, which is Euro 512/day[4], as well as funds to replace stolen and damaged smartphones. Up to 50% of

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[4] The LWC uses roughly 8-10 days in a year

smartphones are lost and the agency pays for the replacement. There are also costs associated with increased bandwidth use. The LWC estimates annual operating costs at EUR 25,000.

In the future, LWC will be confronted by the payment by results approach where implementation is paid for up front by the Consortium, and reimbursed once the donor has been provided with evidence of the development outcomes contracted for. The advantage of using AkvoFLOW is that it provides the evidence required for payment. In the new business models now being considered to fund development, a tool such as AkvoFLOW has a very important role to play. LWC can also demonstrate to other agencies the usefulness of these tools. Oxfam is now looking at how to upscale the use of AkvoFLOW so that other program areas can benefit from its use.

3.2 DATA ANALYSIS AND KEY FINDINGS

The table below assesses various aspects of the development, implementation and application of AkvoFLOW. The ICT impact chain developed by Gigler (2011)[xxvi] is used to assess the social and human impact of the ICT intervention. This involves an assessment of the information and communication options that have been made available, and the ability of the communities to use these opportunities to improve the quality of their lives.

Table 1: Impact assessment of the AkvoFLOW tool using the Impact chain analysis (Gigler, 2011)

Condition	Dimension	Assessment
Information Needs (existing information ecologies)	Information needs	The Government of Liberia requires basic information on water point infrastructure, especially in rural areas. Paper based assessments are time and resource consuming; results are also a challenge to integrate across the country and between agencies and government.
	Communication needs	
	Communication channels	Communication channels are restricted, given the limited penetration and high cost of mobile telephony services and electricity.
	Information gaps	Knowledge on the extent, state and quality of WASH infrastructure and services across the country has been very limited. This knowledge is essential in combating and preventing disease, including Ebola.
Access to ICTs (ICT Infrastructure)	Access to electricity	Access to electricity is not an issue in Government of Liberia county offices, but it is an issue at the local and community level. However neither electricity nor internet connectivity is required to operate the smartphones with AkvoFLOW. Offline data entry is possible. Remote locations may require enumerators carry more spare smartphone batteries and SD cards for data backup and storage.
	Access to ICT infrastructure	
	Geographic location	
Basic Use of ICTs (Simple ICT use)	Literacy rates	Literacy and education levels of enumerators are not an issue in the use of AkvoFLOW by NGOs, Government of Liberia personnel and other actors in the sector. These could present challenges when and if AkvoFLOW is used at the local and community level. Basic IT training is not an issue. Connectivity costs are high, but offline data collection mitigates this problem. In more remote locations, smartphone batteries and SD cards are essential.
	Level of education	
	Socio-cultural context	
	Basic ICT training Poverty rates Connectivity costs	
Meaningful use of the ICT tool (Level of use of the tool)	ICT Capacity building	AkvoFLOW has been assimilated and integrated into the operations of the organizations and agencies that have adopted it. The National Water Sanitation and Hygiene Promotion Committee Secretariat manages the AkvoFLOW dashboard and uses it extensively. Capacity to use AkvoFLOW is provided by the Secretariat.
	Local and relevant content	
	Technical local appropriation	
	Sustainability	

Condition	Dimension	Assessment
		Water point mapping provided a baseline in 2011, but data is dated and needs to be revisited. Other WASH indicators need to be included beyond water point data, such as sanitation indicators Using AkvoFLOW has resulted in increased ease of access to baseline and midterm information for donor and government reports; AkvoFLOW users have expressed satisfaction with the monitoring system, and are able to use the information collected to benefit programme design. The data acquired and the analysis of this data has been appropriated by the Government of Liberia and by stakeholders using the application The cost of using AkvoFLOW is significant for NGOs and likely for the Government of Liberia as well. The long term sustainability of using AkvoFLOW depends on Government of Liberia support, which has not been forthcoming. Sustainability still has a ways to go and it is likely that in the short to medium term, donor support will be required to support the ongoing and extended use of AkvoFLOW in the Government of Liberia and among NGOs.
Enhanced Information Capability (multiplier effect)	ICT Capabilities	Usual IT technical capabilities are required to deal with most technical assistance requests. However, more technical issues require the intervention of Akvo specialists in the Netherlands. The National Water Sanitation and Hygiene Promotion Committee Secretariat has acquired the skills to train and equip Government of Liberia staff with AkvoFLOW and smartphones configured for its use.
	Information literacy	
	Communication Capabilities	
	Content Capabilities	
	Local technical & social appropriation	Enumerators do not require much in the way of information literacy but the diffusion of smartphones, which are not heavily used in Liberia has encouraged greater IT literacy.

3.3 Discussion

3.3.1 Trends in the WASH indicators captured by the ICT tool

The WASH indicators captured have been useful to establish a baseline of existing water points and related infrastructure. This information was not available before and now allows the Government of Liberia and its partners in the sector to better plan for strengthening the water supply sector and to start thinking about how a tool such as AkvoFLOW can be used in the sanitation sector, amongst others.

The data is used to understand which WASH indicators are leading or lagging in achieving national development goals and the Millennium Development Goals. It is expected that as AkvoFLOW use expands to other WASH sectors and especially to the sanitation sector, a better understanding of the situation will result and priorities for action will be more readily apparent as a result.

AkvoFLOW can be used in many different sectors where reporting on infrastructure is required. Given the move towards payment by results programming and aid delivery, the use of AkvoFLOW is timely, because it allows development partners and implementers a way to provide quantitative as well as qualitative evidence of performance, achievement and results and to tailor the data collected to meet the specific needs of the client or stakeholder.

3.3.2 Trends in the use and operation of the ICT application itself

AkvoFLOW was purchased off the shelf so the application did not undergo any significant modifications or customization when it was first acquired. However, the users at the LWC have been coordinating with the Akvo staff in Europe to identify concerns and improve the performance and functionality of the application. LWC undertook a learning workshop after one year of using AkvoFLOW. Based on the feedback from this exercise, the GPS function in AkvoFLOW was modified to improve its performance. To date, the LWC has been satisfied with the upgrade. LWC would like more visualization tools to get a more visual picture of things to improve on the existing tables and graphs. For mapping purposes, the LWC uses GOESPAGO to provide geographic information system (GIS) functionality.

AkvoFLOW has been used by many organizations in the WASH sector in Liberia. The National Water Sanitation and Hygiene Promotion Committee uses AkvoFLOW to report regularly to the President's Office on all WASH outputs. The tool has been used to better understand the state of WASH activities in Liberia and the actors involved. AkvoFLOW has also been used to encourage WASH actors to provide timely reports on their work to the other development actors in the sector. Now even Government of Liberia WASH coordinators at the county level are making use of AkvoFLOW.

One issue of concern reported by Unicef is the frequency with which data in the Secretariat AkvoFLOW dashboard is made available to stakeholders in the WASH sector. WASH sector stakeholders do not have direct access to the AkvoFLOW dashboard at the Secretariat; instead they receive reports that are issued periodically by the National Water Sanitation and Hygiene Promotion Committee Secretariat. Stakeholders would appreciate more regular access.

While greater use of AkvoFLOW has been observed at the county level, the updating of water point maps needs to continue on an ongoing basis. Unicef has attempted to assist with this endeavor but has faced a lack of resources and management capacity[xxvii].

3.3.3 Disparities in data collection along income/wealth and gender distribution

No disparities in data collection based on gender were recorded in the field. The gender dimension in the data collection was not considered in a systematic way. There are a small number of female data collectors working with the LWC but most are male and no significant disparities were recorded

on this basis. Given that the data being recorded had to do exclusively with community assets such as water points, gender issues were not an overt concern.

Because smartphones are relatively expensive in Liberia, staff were not very familiar with their use and had to be trained accordingly. This was not a major concern as learning was straightforward. Gender specific information is not being collected at this time

Access based on rural or urban locations has not been an issue, apart from the fact that in communities that are remote, updates are challenging for logistical reasons.

3.3.4 Any other gaps in data coverage

There is still room for innovation in the use of AkvoFLOW applied to other WASH related data collection and analysis priorities in Liberia. There is still a ways to go however before AkvoFLOW can be used at the local and community level. Cost of access to AkvoFLOW and to acquire smartphones and maintain them will be an ongoing concern as well, that will limit data coverage.

3.4 Opportunities and Challenges

The WASH sector in Liberia is fragmented, with split responsibilities, water points for example are under the Ministry of Public Works while sanitation falls under the Ministry of Health. The National Water Sanitation and Hygiene Promotion Committee Secretariat is trying to collect all of the WASH related information from the different stakeholders involved, including from Government of Liberia agencies and ministries.

At the government level collecting information is challenging as relevant data is acquired and kept in separate ministries. Bringing this data together to be included in the AkvoFLOW dashboard at the National Water Sanitation and Hygiene Promotion Committee Secretariat has been a challenge. The Secretariat had to persuade health officials to work together with the officials at Public Works and vice versa. The Secretariat was successful in getting agreement whereby both ministries will send the data they collect respectively to the Secretariat and then this data will be made available through the AkvoFLOW dashboard at the Secretariat.

Probably one of the most important opportunities going forward is to further explore the possibilities to extend the use of AkvoFLOW to gather more data related to drinking water, including eventually water quality data, as well as data from the sanitation sector. Along with the water point data collected, the opportunity exists to extend data collection to other users of drinking water such as schools, hospitals and clinics. In the absence of piped water infrastructure in rural areas, AkvoFLOW will be of great value as a simple to use tool to assess the state of existing WASH infrastructure and services. Furthermore, as a result of using the application it is possible to assess infrastructure needs and priorities on a county by county basis and allocate resources accordingly.

4 CONCLUSION

In the era of the payment by results approach to development assistance, the advantage of using tools such as AkvoFLOW becomes apparent. Opportunities to use these and related ICTs will become increasing important.

Continuous experimentation with ICT applications such as AkvoFLOW needs to be encouraged in order to enhance the capacity of the National Water Sanitation and Hygiene Promotion Committee Secretariat, the LWC, Unicef, the WSP and other organizations to understand and recognize opportunities where ICT use can be implemented to address some of the problems facing the WASH sector in Liberia.

Efforts to build a national broadband infrastructure to reach all counties and major centers around the country need to be encouraged. A national broadband infrastructure that works well can be the basis for promoting greater economic, human and social development in general. It can also help the WASH sector in Liberia to move beyond human enumerator driven data gathering. Access to reliable and available mobile telephony services will also establish the foundation upon which more sophisticated and automated ICT systems can be exploited to enhance the management and return on investments in the WASH sector. With large scale broadband access, telemetric tools become available and IT embedded systems, sensors and actuators can be used to manage and monitor continuously and in real time piped water as well as sanitation infrastructure and related WASH infrastructure and services. This can form the basis of further rationalizing WASH infrastructure and services and even enhancing the marketability and commercial viability and private sector interest and investment in these infrastructures and in the basic services that rely on them, to the greater benefit of all, including the Government of Liberia. In essence, the lack of both broadband and WASH infrastructure, and for example, piped water infrastructure in rural areas of Liberia represents an opportunity for the country to leap frog the development of the WASH sector that has been taking place in neighbouring countries.

By developing broadband infrastructure and dependent services at the same time and at the same rate as WASH infrastructure is being developed, the opportunity of embedding smart WASH solutions arises. This is an advantage than can lead to much greater returns on investments in the WASH sector and at the same time, carry the potential for private sector driven investment in this sector throughout the country, but starting with individual rural centers, one at a time, as is the case in countries such as Benin, where smart WASH solutions have already created value in WASH as a result of the greater transparency and efficiency in service delivery that ICTs afford.

ANNEX A: LIST OF STAKEHOLDERS CONSULTED

The case study report has been prepared based on consultations with key water sector stakeholders in Liberia, along with literature on ICT for development and the sampled applications. The table below provides a list of the stakeholders consulted as part of this case study.

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Mussa Uwesu Ramadhani	WASH specialist, muwesu@unicef.org	UNICEF Liberia

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