

Unlocking the Potential of Information Communications Technology to Improve Water and Sanitation Services

Summary of Findings and Recommendations

Mouhamed Fadel Ndaw

July 2015



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About the Author



Mouhamed Fadel Ndaw, a Water and Sanitation Engineer is best known for his role over 15 years (1996-2011), as the coordinator in Senegal of the urban water sector reform and the water MDGs program (PEPAM). He then joined the African Water Association of utilities as the coordinator of the Water Operators Partnership-WOP Africa, a program based in Johannesburg.

Fadel joined WSP Africa in July 2012 as a Sr. Regional Water & Sanitation Specialist based in Ouagadougou (Burkina Faso) and is coordinating WSP Africa's work on improving access to water supply services in rural areas and small towns with special focus on domestic private sector participation. He recently completed a WSP study examining the impact of the use of ICTs in the management of water and sanitation sector in African countries.

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Preface

This knowledge product is a summary of findings from the Water and Sanitation Program (WSP) Study “Unlocking the Potential of ICT Services in the Water and Sanitation Sector”. The study builds on and complements the World Bank’s Africa Regional Strategy (2011) as well as 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 ICTs 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, particularly through its contribution to financing the mWater pilot platform in Senegal, Mali, Niger and Benin, Akvo Flow and Fulcrum in Liberia and Sierra Leone and Maji Voice in Kenya. Given the interest manifested by many sector stakeholders to learn from these pilot interventions, it is necessary to improve the documentation on the latter and propose the practical modalities for scale-up. There is a very strong drive around the use of ICT in the WASH sector and a growing interest among external partners. Engagement in ICT developments requires strong collaboration with external resources and drivers of innovations. In this regard, there is a need to develop clearer partnership platforms with

both short- (project specific) and medium-term objectives, understand the potential information that can be generated through ICTs, increase access to and use of the said information, and ensure that ICT-generated information is implemented more sustainably in support of WASH objectives.

The complete set of the twelve reports that make up the findings from this knowledge product was coordinated by Mouhamed Fadel Ndaw, Senior Water and Sanitation Specialist at the Water and Sanitation Program of the World Bank, and principal author of this Summary of Findings and Recommendations report. Contributors include Gordon Amoako, Hosea Arito, Musa Chemisto, Maxim Fortin, Abdoulaye Kanté, Adama Sanogo, Lassina Togola, Richard Labelle, Erica Menchetti, Dorothy Kobel, Lillian Muhebwa, Fiona Ssozi, Ulrike Rivett, Lauren Intven from Cowater International Inc. and the University of Cape Town iCOMMS. Appreciation is extended to the following World Bank staff peer reviewers: Matar Fall, Lead Water and Sanitation Specialist, GWADR; Tim Kelly, Lead ICT Policy Specialist, GTIDR; Eija Pehu, Lead Agricultural Specialist, GFADR; Mariana T. Felicio, Social Development Specialist, GSURR; Pierre Xavier Boulenger, Senior Water and Sanitation Specialist, GWADR; and Andreas Rohde, Senior Sanitary Engineer, GWADR.

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Acronyms and Abbreviations

ACWUA	Arab Countries Water Utilities Association
AfDB	African Development Bank
AMR	Automated Meter Reading
ASUFOR	Association des Usagers des Forages (Borehole Users' Association)
ATTI	Africa Technology & Transparency Initiative
CHW	Community Health Worker
DFID	United Kingdom's Department for International Development
DGPRES	Direction de la Gestion et de la Planification des Ressources en Eau (Directorate of Water Resource Management and Planning)
DWO	District Water Officer
EMIS	Education Management Information System
FLOW	Field Level Operations Watch
GCCN	Government Common Core Network
GDP	Gross Domestic Product
GFADR	Agricultural Global Practice
GIS	Geographic Information System
GIZ	Gesellschaft für Internationale Zusammenarbeit (German International Cooperation Agency for Development)
GPS	Global Positioning System
GSM	Global System for Mobile Communication
GSURR	Global Practice for Social, Urban, Rural and Resilience
GTIDR	Transport & Information and Communication Technology (ICT) Global Practice
GWADR	Water Global Practice
HIV	Human Immunodeficiency Virus
ICT	Information and Communication Technology
ICT4D	ICT for Development
KCC	Korea Communications Commission
KWT	Kiamumbi Water Trust
M4W	Mobiles 4 Water
MDG	Millennium Development Goal
MHA	Ministère de l'Hydraulique et de l'Assainissement (Ministry of Water and Sanitation)
MoUD	Ministry of Urban Development
NCWSC	Nairobi City Water and Sewerage Company
NFC	Near-Field Communication
NGO	Non-Governmental Organization
NOFBI	National Optic Fibre Backbone Infrastructure
NREN	National Research Education Networks
ODF	Open Defecation Free
ONAS	Office National de l'Assainissement (National Sanitation Office)
PCMC	Pimpri Chinchwad Municipal Corporation
PEPAM	Programme eau potable et assainissement pour le millénaire (Millennium Water and Sanitation Program)
PPP	Public-Private Partnership
RFID	Radio Frequency Identification Technology
RTI	Radar Technologies International
RWSS	Rural Water Supply System

SDE	Sénégalaise Des Eaux (Senegal's Private Water Utility)
SIASAR	Sistema de Información de Agua y Saneamiento Rural (Rural Water and Sanitation Information System)
SMS	Short message service
SWM	Smart water meter
ULB	Urban Local Body
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USD	United States Dollar
WASH	Water, Sanitation and Hygiene
WASREB	Water Services Regulatory Board
WB	World Bank
WfP	Water for People
WPM	Water Point Mapping
WQR	Water Quality Reporter
WSP	Water and Sanitation Program
WSP	Water Service Provider
WSTF	Water Services Trust Fund Kenya
ZAWA	Zanzibar Water Authority

Foreword

Since the first Short Message Service (SMS) text was sent in 1992, the proliferation of mobile technology and its derivative uses has been both massive and extremely rapid. According to a recent Groupe Speciale Mobile Association (GSMA) report, in 2014, 52 percent of all global mobile money deployments took place in sub-Saharan Africa and 82 percent of Africans had access to Global System for Mobile (GSM) communications coverage compared to 63 percent who had access to improved water supply and 32 percent to electricity. How can other sectors, in this case the water supply and sanitation services sector, make best use of this increasingly ubiquitous access to mobile technology? And what opportunities might exist to harness mobile technology in order to help bridge the gap of water and sanitation services to the poor or currently underserved populations?

Recent experience from around the world has demonstrated that the water and sanitation sector has not been immune to the innovative use of Information and Communication Technology (ICT) as evidenced by the many examples currently being rolled out. We may only be witnessing the first wave of technology innovations for water and sanitation service delivery, however, and have much to learn regarding the best way to adopt, quickly operationalize, and continue to innovate in successive stages.

While ICT can be a key enabler for institutional transformation to address the demand for improved water and sanitation service, especially for hard-to-reach poor populations in rural and urban areas, it will never be the silver bullet. In order to maximize its transformational role in the sector, ICT should be recognized as a conduit or tool that needs to be continuously managed well in order to help achieve a solution. Impact and success need to be measured not merely in terms of implementation or uptake of the new technology, but more importantly with regards to achieving the Water, Sanitation and Hygiene (WASH) sector's goals and priorities.

This 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 seven African countries (Kenya, Uganda, Tanzania, Senegal, Benin, Niger and Liberia), complemented by experiences from other regions (Latin America, North America, South Asia and East Asia) and analyzes 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.

This study sought to not only document experiences of ICT use in the WASH sector, but also analyze them within the framework of enabling factors and barriers in terms of vision, process, customer/user, service delivery, human capacity, governance and finance.

Mirroring the dynamic evolution of ICT solutions and applications, we hope this analysis provides an important entry-point to our evolving understanding of the best way to harness ICT solutions for water and sanitation.



Glenn Pearce-Oroz
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World Bank

Executive Summary

A. BACKGROUND AND CONTEXT

Information Communications Technology (ICT) growth and uptake is changing the landscape of developing countries. Initial applications are showing how ICTs can further WASH goals and priorities, including increasing access, improving service delivery and improving governance. There already exists a substantial knowledge base on the use of ICTs for Development (ICT4D). However, too often the knowledge base focuses on the technological innovation itself, rather than how it can be embedded into sector management and governance systems. This study, therefore, aims to take stock and reflect on the findings from key ICT applications and experiences both in other sectors as well as in the WASH sector itself. By documenting and analyzing past successes, failures, enablers and barriers of the key applications and experiences, it is possible to significantly advance the areas of policy development, guidelines, implementation, and scale up of ICT in the WASH sector.

Objectives of the Study

The specific objectives of the study were to:

- take stock of emerging uses of ICT across sectors, including agriculture, health, education and governance;
- document the relevant experiences of key ICT applications (both failures and good practices) in the water and sanitation sector globally and in selected African countries;
- identify binding constraints impacting ICT adoption and scale-up as well as the role of different actors (private, public, development community, civil society);
- develop policy and guidelines for the at-scale use of ICTs in the water and sanitation sector, including opportunities for public/private partnership; and
- facilitate country peer-to-peer exchanges and regional learning network.

B. METHODOLOGY AND PROCESS

In order to achieve the above objectives, the methodology and process of the study were broken down into six key activities that generated input reports or analyses, as follows:

- **Lessons Learnt from Other Sectors:** ICT has seen phenomenal growth throughout Africa over the last decade. Applications in the sectors of agriculture, health, education and governance have illustrated the benefits ICTs can provide in collecting information, streamlining information flow and improving work processes. The first objective of the study was to take stock of emerging uses of ICT across other sectors in order to translate lessons learnt into recommendations applicable to the WASH sector. This was accomplished through a desk review entitled *Lessons Learnt from Other Sectors*.
- **Experiences of ICT Use in the Water and Sanitation Sector and Country Case Studies:** With increasing support and infrastructure development, the global WASH sector is seeing heightened ICT interventions. In order to address two of the key objectives of the study: 1) Document relevant experiences of key ICT applications in the water and sanitation sector, highlighting the strengths and weaknesses of current initiatives, and 2) Identify binding constraints impacting ICT adoption and scale-up, a second desk review was conducted, *Desk Review: Experience of ICT use in the WASH Sector*, and a report entitled *Experience of ICT use in the WASH Sector: Case Studies* prepared, based on field visits and case studies in seven African countries.

As part of the *Desk Review: Experience of ICT use in the WASH Sector*, a survey of ICT applications was conducted (see Annex 1 for a detailed list and summary of the applications included) which detailed the experiences of ICT in the WASH sector to date, highlighting the strengths and weaknesses of different pilot operations in Africa and other regions. As part of *Experience of ICT use in the WASH Sector: Case Studies*,

case studies were prepared based on consultations, interviews and focus group discussions with key water sector stakeholders in each of the seven case study countries (Benin, Liberia, Niger, Senegal, Kenya, Tanzania and Uganda), including implementers and project participants. The case studies were assessed using an evaluation and monitoring framework, based on the two assessment frameworks described in the Analytical Report, and amended to the specific requirements of this study.

- **Analytical Report:** The Analytical Report aligned the role of ICTs with water and sanitation goals and priorities by identifying opportunities and challenges, translating enabling factors of success into assessment criteria and developing analytical pieces of work on strategic issues. Lessons learnt supported the development of analytical pieces of work on different issues, including how to use ICT to strengthen planning and programming, ICT and service delivery improvements, ICT and operational efficiencies improvements, financing of ICT, ICT and governance, ICT to strengthen the consumer voice, and ICT and service delivery to the poor. Two frameworks for assessment were tested under this study. The first framework, the **Balance Scorecard Approach**¹, breaks down the process of ICT implementation into key dimensions. This framework is valuable as it supports an analysis of the various mechanisms at work during the initial design and implementation stages. However, an evaluation framework should not only define the success of ICT tools by the uptake or scale-up of the technology, but also by the impact that the technology has had on the specific WASH goal or target. Additionally, focus on the improved capabilities within the user group or the beneficiaries of the tool is an important consideration. The second framework, the **ICT Impact Chain**², therefore looked at the impact of the tool after implementation. The frameworks for assessment are based on tested methodologies in the

ICT field and can – where necessary — be amended to provide an appropriate analytical framework for the specific needs of a study.

- **Guidelines and Policy Notes:** Building on the work done in previous components, Development of Guidelines and Policy Notes were prepared in order to propose strategies and policy recommendations to guide the design and implementation of appropriate and sustainable ICT components for WASH sector projects and to evaluate the impact of these interventions. Guidelines and Policy Notes included recommendations on data integration and mainstreaming; ICT evaluation; recommendations for policymakers and regulators; and policy and operation recommendations for service providers.
- **Online Tool:** An interactive online tool was established and maintained throughout the study to disseminate materials developed for the study.

C. LANDSCAPE ANALYSIS AND FINDINGS OF THE STUDY

The first desk review of the study, *Lessons Learnt from Other Sectors*, translated key lessons learnt from the sectors of agriculture, health, education and governance into recommendations applicable to the WASH sector. Key highlights from the lessons learnt include:

- Involve citizens in the design and use of the tool to encourage successful implementation.
- Align ICT interventions with the community setting and the local resource environment; simple technologies that require less technical support and work well in resource-constrained environments have a higher potential of being successfully scaled up.
- Use of universally available technology can accelerate uptake and ICT platforms that are cost-effective, particularly in resource-constrained settings. This strategy allows for a bigger share of the budget to be channeled directly to the service of consumers.
- Improve communication infrastructure to allow all citizens to benefit and participate.
- Invest in sector and ICT infrastructure with a focus on alternative energy sources.

¹ Kaplan, R., & Norton, D. P. (1992) *The Balanced Scorecard – Measures That Drive Performance*. Harvard Business Review, P. 71-79.

²Gigler 2011, “*Informational Capabilities – The Missing Link for the Impact of ICT on development*”, Working Paper Series No.1; E-Transform Knowledge Platform, Working Paper, The World Bank

- Assess the performance and impact of the ICT intervention, develop assessment/evaluation tools to regularly monitor the impact of ICT in the sector.
- Enable user feedback loops to periodically monitor and evaluate, and continually refine the ICT intervention over time.
- Ensure technological and procedural flexibility.
- Develop comprehensive sector strategies, national policies, standards and regulatory frameworks.
- Support the development of human and institutional capacities in terms of policy implementation, provision of regulatory frameworks and managing policies.

As part of the *Desk Review: Experience of ICT use in the WASH Sector*, a survey of ICT applications in the WASH sector was conducted. The various ICT WASH applications presented in the report can be summarized based on three main WASH priority areas: increasing access, improving service delivery and improving governance.

Although the global WASH sector is witnessing heightened ICT interventions, the low sustainability rate of ICT interventions combined with the high frequency of failure in scaling applications beyond the pilot phase remains a major concern. All ICT applications are driven by the desire to bring change to their areas of implementation. However, with reliability and cost-effectiveness of the WASH sector still hampered by poverty, weak institutions and poor infrastructure, it must be understood that incorporating ICT solutions in the water and sanitation sector is not a 'magic pill', but rather ICTs should be viewed as strategic research and development tools that must be used in partnership with traditional sector approaches. The key principles for sustainability that came out of the desk review were summarized under the following themes: a) User-Centered Design, Participation and Experience b) Choice of Technology and c) Finance and Program Design.

As part of the analytical work of the study, the following eight key thematic areas were assessed:

1. Using ICTs to strengthen monitoring and inventory of infrastructure.
2. Sustaining ICT-based planning and programming initiatives.
3. ICT and operational efficiency improvements.
4. ICT and service delivery improvements (particularly for the poor).
5. ICT to strengthen the consumer Voice.
6. ICT and governance.
7. Financing of ICTs.
8. Public-Private Partnerships.

ICTs can be a key enabler for institutional transformation to address the demand for improved water and sanitation services for both rural and urban communities. However, in order to maximize the transformational role of ICT in the WASH sector, ICTs need to be perceived as merely conduits or contributing forces rather than as development impacts or solutions in themselves. Impact and success need to be measured not simply in terms of implementation or uptake of the new technology but more importantly in regards to achieving WASH sector goals and priorities.

In addition to documenting experiences on the use of ICTs in the WASH sector³, this study sought to examine them through specific design and evaluation frameworks.⁴ The process facilitated the identification of enabling factors and barriers in terms of vision, process, customer/user, human capacity and finance. The analysis was also an opportunity to track the progress of the said factors in the ICT Impact Chain⁵ as well as provide guidelines and policy notes on the inclusion of ICTs in Water and Sanitation Policy and Planning to the sector's stakeholders.⁶

³ See ICTs in the WASH Sector Desk Review

⁴ See the Analytical Report for a description of the frameworks used and detailed discussion on enabling factors and barriers

⁵ See all seven of the Case Study Reports to see the implementation of the assessment frameworks on the case studies

⁶ See Development of Guidelines and Policy Notes which includes Recommendations on Data Integration and Mainstreaming; ICT Evaluation; Recommendations for Policy Makers and Regulators; and Policy and Operation Recommendations for Service Providers.

With the desire to further support the implementation and scale-up of ICTs in the WASH sector, it is essential to move beyond support for specific tools or technologies and look more broadly at supporting the elimination of barriers and providing enabling environments. Of the common barriers

identified in the study, three stand out as potential areas where high-level support could be beneficial:

- lack of sector level policy and regulatory frameworks.
- lack of sustainable financial models.
- lack of monitoring and evaluation of the implementation and impact of ICTs in the WASH sector.

A. Background and Context

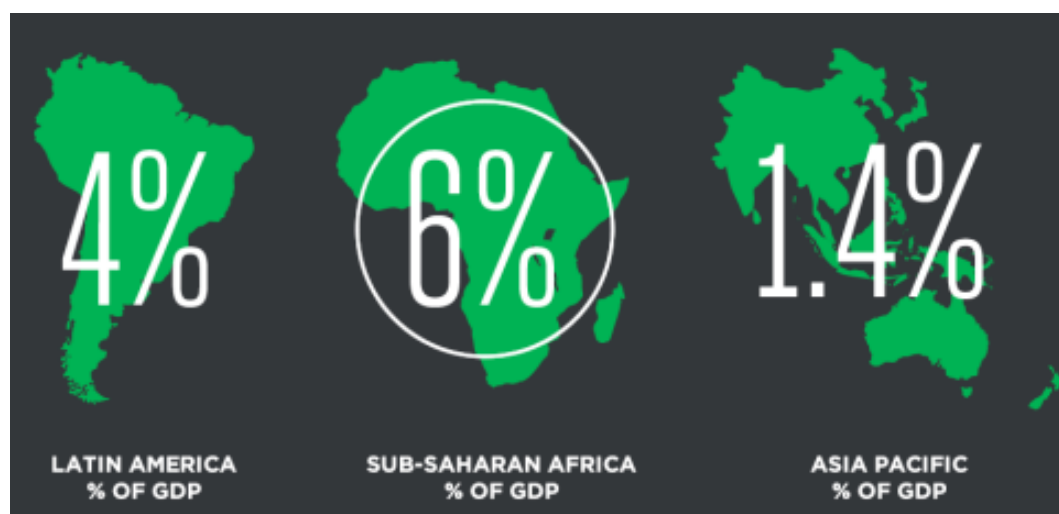
A1: Context of the Study

Information Communications Technology (ICT) growth and adoption is changing the landscape of developing countries. The acknowledged potential that ICTs hold in helping to boost economic growth and reduce poverty can be attributed in part to how ICTs have been incorporated into the thriving economies of Africa^{7,8}. The “Sub-Saharan Africa Mobile Economy 2013” report by GSMA Intelligence shows that mobile technology contributes over six percent of the GDP of Sub-Saharan Africa, higher than any other comparable region globally, and by 2020 it is expected to rise to over eight percent. Evidence from countries like South Africa and Kenya shows that ICTs have played an important role in their economic growth⁹.

As Mthuli Ncube, Chief Economist and Vice President of the African Development Bank (AfDB), puts it: “We have seen potential and an opportunity in technology-driven entrepreneurship across Africa especially among young people. ICTs are playing a significant role in transforming African economies”.¹⁰

The lack of data and information on existing water and sanitation assets and their current management constitute a barrier for the extension of the services to the poor. Additionally, the poorest lack adequate platforms to hold their service providers accountable and to be heard by decision-makers. Initial applications are showing how ICTs can further WASH goals and priorities, including increasing access, improving service delivery and improving governance.

FIGURE 1: MOBILE TECHNOLOGY’S CONTRIBUTION TO LATIN AMERICAN, SUB-SAHARAN AFRICA AND ASIAN GDPs



(Source: www.gsmamobileeconomyafrica.com)

⁷ APF, 2008. ICT in Africa: Boosting Economic Growth and Poverty Reduction

⁸ Fleshman, M., Essoungou, A. & Gillespie, J., 2011. Investing in Africa: Digging deep for new opportunities. *Africa Renewal*, (April). Available at: <http://www.un.org/africarenewal/sites/dt7.un.org.africarenewal/files/Africa-Renewal-April-2011-en.pdf>.

⁹ Heeks, R., 2011. ICT and Economic Growth: Evidence from Kenya. *ICT4D*. Available at: <http://ict4dblog.wordpress.com/2011/06/26/ict-and-economic-growth-evidence-from-kenya/> [Accessed August 16, 2014].

¹⁰ <http://www.afdb.org/en/news-and-events/article/afdb-envisages-the-power-of-ict-for-africas-transformation-13080/>

There already exists a substantial knowledge base on the use of ICTs for Development (ICT4D). However, too often the knowledge base focuses on the technological innovation itself, rather than how it can be embedded into sector management and governance systems. As such, this study aims to take stock and reflect on the findings from key ICT applications and experiences both in other sectors, as well as in the WASH sector itself. By documenting and analyzing past successes, failures, enablers and barriers of the key applications and experiences, it is possible to significantly advance the areas of policy development, guidelines, implementation, and scale-up of ICT in the WASH sector.

A2: Objectives of the Study

The specific objectives of the study were to:

- take stock of emerging uses of ICT across sectors including agriculture, health, education and governance.
- document the relevant experiences of key ICT applications (both failures and good practices) in the water and sanitation sector globally and in selected African countries.
- identify binding constraints impacting ICT adoption and scale-up as well as the role of different actors (private, public, development community, civil society).
- develop policy and guidelines for the at-scale use of ICTs in the water and sanitation sector, including opportunities for public/private partnerships.
- facilitate country peer-to-peer exchanges and regional learning network.

B. Methodology and Process

In order to achieve the specific objectives, as defined above, the methodology and process of the study consisted of six key activities:

- **Lessons Learnt from Other Sectors:** ICT has seen phenomenal growth throughout Africa over the last decade. Applications in the sectors of agriculture, health, education and governance have illustrated the benefits ICT can provide in collecting information, streamlining information flow and improving work processes. The first objective of the study was to take stock of emerging uses of ICT across other sectors in order to translate lessons learnt into recommendations applicable to the WASH sector. This was accomplished through a desk review entitled *Lessons Learnt from Other Sectors*. Section C1 summarizes the findings from the first desk review in tabular form, wherein the potential successes, key barriers and lessons learnt from each of the four sectors are highlighted.
- **Experiences of ICT Use in the Water and Sanitation Sector and Country Case Studies:** With increasing support and infrastructure development, the global WASH sector is seeing heightened ICT interventions. In order to address two of the key objectives of the study: 1) Document relevant experiences of key ICT applications in the water and sanitation sector, highlighting the strengths and weaknesses of current initiatives, and 2) Identify binding constraints impacting ICT adoption and scale-up, a second desk review was completed, *Desk Review: Experience of ICT use in the WASH Sector*, and an *Experience of ICT use in the WASH Sector: Case Studies* report was prepared based on field visits and case studies in seven African countries.

In *Desk Review: Experience of ICT use in the WASH Sector*, a survey of ICT applications was conducted (see Annex 1 for a detailed list and summary of the applications included in the desk review) which detailed the experiences of ICT in the WASH sector to date, highlighting strengths and weaknesses of different pilot operations in Africa and other regions. As part of *Experience of ICT use in the WASH Sector: Case Studies*

case studies were prepared based on consultations, interviews and focus group discussions with key water sector stakeholders in each of the seven case study countries (Benin, Liberia, Niger, Senegal, Kenya, Tanzania and Uganda), including implementers and project participants. The case studies were assessed using an evaluation and monitoring framework, based on the two assessment frameworks described in the Analytical Report, and amended to the specific requirements of this study.

- **Analytical Report:** The Analytical Report aligned the role of ICT with water and sanitation goals and priorities by identifying opportunities and challenges, translating enabling factors of success into assessment criteria and developing analytical pieces of work on strategic issues. Lessons learnt supported the development of analytical pieces of work on different issues, including how to use ICT to strengthen planning and programming, ICT and service delivery improvements, ICT and operational efficiencies improvements, financing of ICT, ICT and governance, ICT to strengthen consumer voice, and ICT and service delivery to the poor. Two frameworks for assessment were tested as part of this study. The first framework, the **Balance Scorecard Approach**¹¹, breaks down the process of ICT implementation into key dimensions. This framework is valuable as it supports an analysis of the various mechanisms at work during the initial design and implementation stages. However, an evaluation framework should not only define the success of ICT tools by the uptake or scale-up of the technology, but by the impact that the technology has had on the specific WASH goal or target. Additionally, focus on the improved capabilities within the user group or the beneficiaries of the tool is an important consideration. The second framework, the **ICT Impact Chain**¹², therefore looked at the impact of the tool

¹¹ Kaplan, R., & Norton, D. P. (1992) *The Balanced Scorecard – Measures That Drive Performance*. Harvard Business Review, P. 71-79.

¹² Gigler 2011, “*Informational Capabilities – The Missing Link for the Impact of ICT on development*”, Working Paper Series No.1; E-Transform Knowledge Platform, Working Paper, The World Bank

after implementation. The frameworks for assessment are based on tested methodologies in the ICT field and can – where necessary - be amended to provide an appropriate analytical framework for the specific needs of a study.

- **Guidelines and Policy Notes:** Building on the work done in previous components, guidelines and policy notes were prepared in order to propose strategies and policy recommendations to guide the design and implementation of appropriate and sustainable ICT components for WASH sector projects and to evaluate the impact of these interventions. Guidelines and Policy Notes included recommendations on data integration and mainstreaming ICT evaluation, recommendations for policymakers and regulators and policy and operation recommendations for service providers.

- **Online Tool:** An interactive on line tool was established and maintained throughout the study to disseminate materials developed as part of the study.

An effort was made to ensure knowledge building and learning opportunities among key stakeholders, targeting in particular WASH sector experts and ICT innovators. Prior to the commencement of the study, a workshop was held¹³ and attended by approximately 50 participants to:

- Enable different stakeholders to develop a common platform for stock-taking;
- Promote exchange on the proposed methodology, analytical framework and work plan in order to achieve maximum results of the case studies in the seven target countries (Benin, Kenya, Liberia, Niger, Senegal, Tanzania, Uganda); and
- Provide early exposure of the WASH ICT tools developed in East and West Africa.

¹³ The workshop took place in Nairobi from 7 to 8 July 2014. Nearly 50 participants from Benin, Burkina Faso, Kenya, Liberia, Niger, Senegal, Tanzania and Uganda attended. The key stakeholder groups were representatives of regulators, water ministries, municipalities, partners and ICT4D actors present in Kenya (GIZ, SUWASA, IRC, IBM, GSMA, WAG, iHub, University of Nairobi, Kenya CSO Network) as well as the Consortium of Consultants: Cowater (Canada) and iComms - University of Cape Town (South Africa).

C. Landscape Analysis and Findings of the Study

C1: Lessons Learnt from Other Sectors

ICT has experienced phenomenal growth over the last decade. Applications in the sectors of agriculture, health, education and governance have illustrated the benefits that ICT can provide in collecting information, streamlining information flow and improving work processes. The first

objective of the study was to take stock of emerging uses of ICT across other sectors in order to translate lessons learnt into recommendations applicable to the WASH sector. This objective was accomplished through a desk review entitled *Lessons Learnt from Other Sectors*. The table below summarizes the findings from the first desk review.

Agriculture		
The agriculture sector is rife with innovations and ICTs for varying tasks and purposes, including FM radio stations, mobile phones, Radio Frequency Identification Technology (RFID), Global Positioning System (GPS), Geographic Information Systems (GIS) and other web-based applications.		
Potential for Success	Key Barriers	Lessons Learnt
<ul style="list-style-type: none"> • Reduced transaction costs • Increased access to information and markets • Improved productivity and supply chain management • Increased negotiating power and revenue of farmers 	<ul style="list-style-type: none"> • Lack of infrastructure (connectivity, access to technology) • Lack of sector-specific ICT policies • Gender barriers to participation 	<ul style="list-style-type: none"> • Have local stakeholders facilitate the delivery of ICT-enabled services • Use the lowest cost and simplest technology • Assess performance and impact of the ICT intervention • Develop a comprehensive sector strategy • Highlight the positive link between women's livelihoods and ICTs
Health		
The prevalence of ICT use in the health sector is substantial. There are currently 1,125 and counting m-health deployments globally.		
Potential for Success	Key Barriers	Lessons Learnt
<ul style="list-style-type: none"> • Improved quality and safety of treatment through the provision of timely information • Decreased prevalence of counterfeit drugs • Expanded reach of health care to underserved and rural communities • Increased productivity and reduced costs 	<ul style="list-style-type: none"> • Limited or short-term funding • Low mobile and Internet penetration • Lack of sector-specific policies and regulatory frameworks • Shortage of skilled workers • Lack of standard mechanisms and indicators to evaluate ICT interventions 	<ul style="list-style-type: none"> • Invest in sector and ICT infrastructure with a focus on alternative energy sources • Development of national policies, standards and regulatory frameworks • Alignment of ICT interventions with the community setting and the local resource environment • Enable user feedback loops to periodically monitor and evaluate and to continually refine the ICT intervention over time • Use of simple technologies that require less technical support and work well in resource-constrained environments have a higher potential of being successfully scaled up • ICT platforms that are cost-effective, particularly in resource-constrained settings, allow a bigger share of the budget to be channeled directly to the service consumers • Ensure technological and procedural flexibility

Education		
Key priority areas for ICTs in the education sector include professional development for teachers, digital learning resources, affordable technologies, Education Management Information Systems (EMIS) and National Research Education Networks (NRENs).		
Potential for Success	Key Barriers	Lessons Learnt
<ul style="list-style-type: none"> Reach underserved and under-resourced communities Contribute to universal access and quality learning and teaching 	<ul style="list-style-type: none"> Lack of financing, specifically for human resources Poor infrastructure and connectivity Lack of gender equity Lack of policies that support the integration of ICTs into pedagogical practice 	<ul style="list-style-type: none"> Need to incorporate ICTs into national policies and strategies Need to develop assessment/evaluation tools to regularly monitor the impact of ICT in the sector Need to prioritize the development, review and updating of local content to incentivize users
Governance		
Advances in ICTs have created opportunities for improved participation and are being exploited to improve governance. ICTs have strengthened partnerships between institutions such as parliaments, media and civil society organizations through interactive platforms or fora that support information sharing and collaboration. Systems that allow citizens to report graft or misuse of public funds have contributed to the fight against corruption and have created better mechanisms for ensuring government accountability of public resources and transparency in the delivery of services.		
Potential for Success	Key Barriers	Lessons Learnt
<ul style="list-style-type: none"> Poverty reduction with more reliable services to the poor Empowerment of individuals Capacity building (skills and networks through education) Improving the quality of service delivery Inspiring new governance mechanisms Reinforcing participation 	<ul style="list-style-type: none"> Poor infrastructure Limited access to technology Low literacy Rigid regulatory frameworks that limit the ability of governance structures to respond to the continuous and dynamic changes prompted by the introduction of new technologies 	<ul style="list-style-type: none"> Need to improve communication infrastructure to allow all citizens to benefit and participate Use of universally available technology can accelerate uptake Setting up of community resource centers can improve individual access to ICTs Extending ICT services to local governments can improve service delivery and support local economic development Involving citizens in the design and use of the tool is critical for successful implementation ICTs must be understood as merely tools Need to support the development of human and institutional capacities in terms of policy implementation, provision of regulatory frameworks and managing policies

C2: Aligning the Role of ICT with Water and Sanitation Goals and Priorities

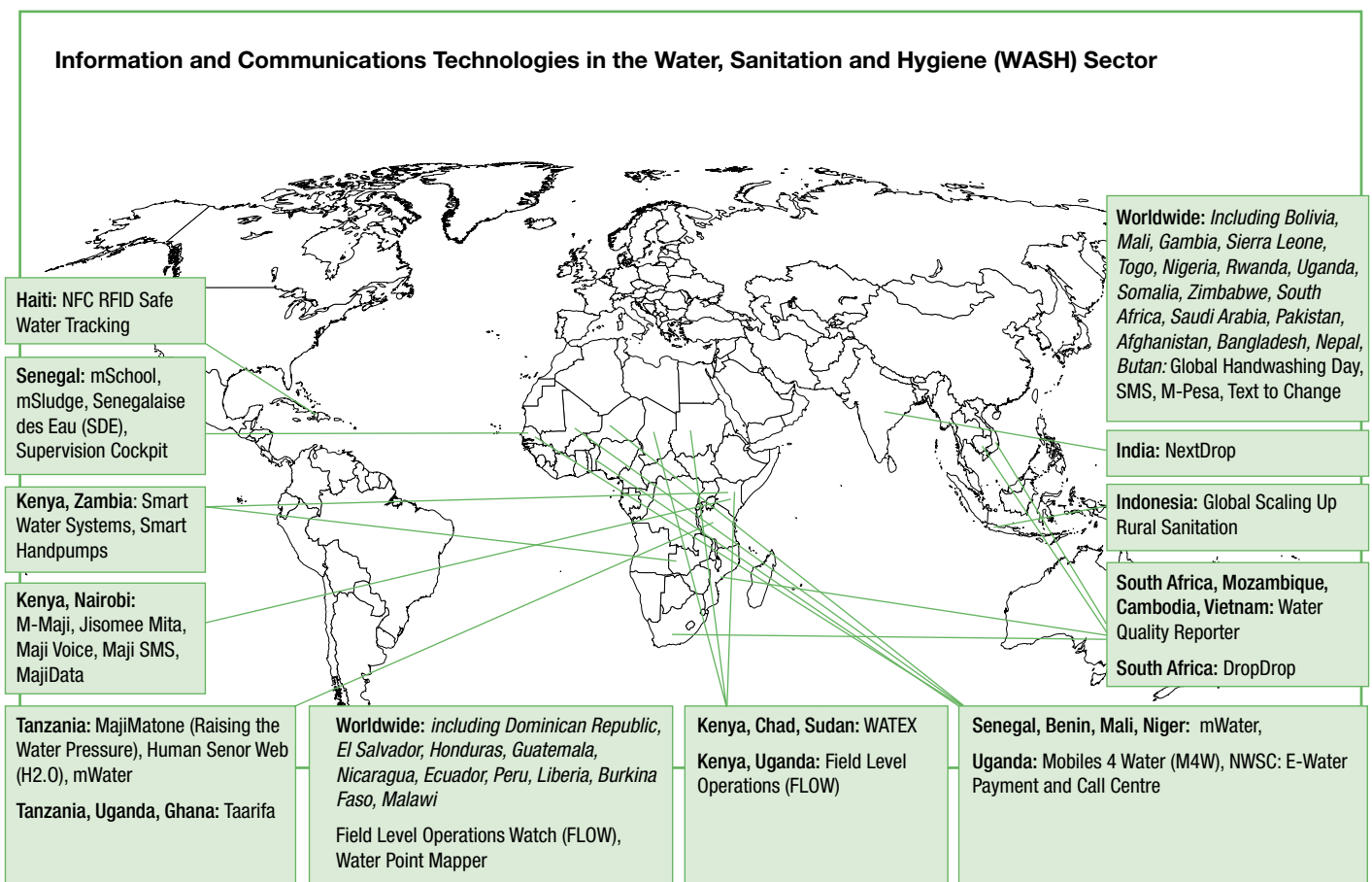
With increasing support and infrastructure development, the global WASH sector is witnessing more ICT interventions. In order to address two of the key objectives of the study: 1) Document relevant experiences of key ICT applications in the water and sanitation sector, highlighting the strengths and weaknesses of current initiatives, and 2)

Identify binding constraints impacting ICT adoption and scale-up, a second desk review was conducted to document experience of ICT use in the WASH Sector, *Desk Review: Experience of ICT use in the WASH Sector*, and an *Experience of ICT use in the WASH Sector: Case Studies* report was drafted based on field visits and case studies in seven African countries.

As part of the *Desk Review: Experience of ICT use in the WASH Sector*, a survey of ICT applications was conducted (see Annex 1 for a detailed list and summary of the applications in the desk review) which detailed the experiences of ICT in the WASH sector to date, highlighting the strengths and weaknesses of different pilot operations in Africa and other regions. As part of *Experience of ICT use in the WASH Sector: Case Studies*, studies were prepared based on consultations, interviews and focus group discussions with key water sector stakeholders in each of the seven case study countries

(Benin, Liberia,¹⁴ Niger, Senegal, Kenya, Tanzania and Uganda), including implementers and project participants, along with supporting documentation where available. The table in Annex 2 lists the main tools assessed as part of the *Experience of ICT use in the WASH Sector: Case Studies*. The table is based on the ICT Impact Chain further discussed in the *Analytical Report* and summarizes various aspects of the development, implementation and application of the ICT tools in use in the WASH Sector.

FIGURE 2: ICTs IN THE WASH SECTOR



(Source: Revised from original source of Hutchings & Dev, 2012)

¹⁴ Liberia was not physically visited by the team as a result of the Ebola outbreak that occurred over the study period. Instead interviews with key sector stakeholders were done via phone and Skype.

Initial applications are showing how ICTs can further WASH goals and priorities. While the ICT WASH applications presented in the reports are diverse, they can be summarized according to three main WASH priority areas: increasing access, improving service delivery and improving governance.

C2 (a): Increasing Access to Water and Sanitation Services

Increasing access to improved water sources and sanitation is a key global priority recognized as MDG Target 7.C: Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation.

The first key challenge in increasing access to water and sanitation services is the possession of accurate data on coverage and functionality. Inventorying the current levels of infrastructure, creating baselines, identifying areas where interventions/resources are required and demonstrating progress are all dependent on data collection, monitoring, presentation and analysis. Although multiple manual and automated options exist to verify data, ICT projects, especially mobile phone applications, have the potential to improve the quality and quantity of data that is collected in the long term. They can make data transfer more efficient, reduce manual data errors, and increase the frequency of monitoring due to their relative cost-effectiveness.

Using ICTs to support mapping and monitoring of infrastructure, such as Water Point Mapping, can facilitate mobilization, planning and allocation of resources in the WASH sector. Depending on the interface, ICTs can also present the data visually to highlight equity issues, support allocation of resources to deliver services where they are most needed, measure performance and progress, indicate the distance to the nearest improved water source and promote increased investment in the sector. ICTs can also be used to identify new sources of water, as is the case with WATEX, a groundwater exploration system that uses remote sensing technologies to locate renewable ground water reserves in arid and semi-arid environments.

C2 (b): Promoting Improved Service Delivery

Even more vital than increasing access to WASH services is ensuring that access is sustained. Monitoring of service provision, in terms of functionality, timely and adequate water supply, water quality and water use management is crucial in ensuring that coverage indicators are giving a true picture of improved access.

ICTs can offer timely and improved access to information. On the consumption side, ICTs can empower underserved communities with better information about water availability, price and quality (M-Maji). Accurate water timing information can reduce long waits, lost workdays and allow individuals to effectively plan their water usage, as is the case with Next Drop. On the supply side, improved access to information can improve water management, allow for real time monitoring of functionality and supply (Smart Handpumps), reduce repair response time (Maji Matone), improve water quality through monitoring, tracking, identifying patterns in contamination and communication to consumers (USAID's mWater).

At the utility level, ICTs can improve daily operations and result in efficiencies: time and financial savings, decreased transportation, payment transactions and administrative costs, improved financial management, increased revenue collection and improved customer management. ICTs also offer the possibility of more flexible payment models contingent on service delivery.

C2 (c): Improved Governance in the WASH Sector

The water sector is facing a number of governance challenges where mobile services can make a difference, especially when it comes to increasing transparency, accountability and participation.¹⁵ Rogers & Hall¹⁶ define water and sanitation governance as the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of these services, at different levels of society.

¹⁵ Hellstrom J., Jaboson M., 2014: 'You can't cheat the community anymore' using mobiles to improve water governance. In I. Niang & C. SHaff, eds. *Proceedings of the 4th International conference on M4D Mobile Communication for Development* Dakar, Senegal pp 48- 59

¹⁶ Rogers P, Hall A.W., 2003: "Effective Water Governance, available at <http://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/4995/TEC%25207.pdf?sequence=1>

ICTs are becoming a dominant force in the way utility providers and customers communicate. ICTs can also be used to encourage citizens to voice their concerns and put pressure on the local government to address problems with their water and sanitation services, increasing government accountability and empowering citizens. ICTs can be used to create a system of transparency and accountability, to promote public participation and collaboration amongst stakeholders in the WASH sector, to improve monitoring and management of WASH projects, and reduce the cost of access to information and service delivery. Improving ICT usage at the local level enhances and supports socio-economic development by empowering community leaders to provide timely, efficient, transparent and accountable services.¹⁷

C3: Lessons Learnt from ICT use within the WASH Sector

The global WASH sector is experiencing heightened ICT interventions, but the low sustainability rate combined with the high frequency of failure in scaling applications beyond the pilot phase is a matter of great concern. All ICT applications are driven by the desire to bring about change to their areas of implementation. However, with reliability and cost-effectiveness of the WASH sector still hampered by poverty, weak institutions and poor infrastructure, it must be understood that incorporating ICT solutions in the water and sanitation sector is not a ‘magic pill’, but rather ICTs should be viewed as strategic research and development tools that must be used in tandem with traditional sector approaches.

The Desk Review: Experience of ICT use in the WASH Sector, involved conducting a survey of ICT applications in the WASH sector.¹⁸ The key principles for sustainability that came out of the desk review are summarized below.

C3 (a): User-Centered Design, Participation and Experience

Social design involves deciding how to recruit and engage users to ensure the system is scalable and sustainable in

the long-term, and also that the data collected are accessed and used by the audiences for which it was intended. Key principles under the first themes are: build the user base with well-planned outreach, ensure the system is easy to use, fulfil a key need (monetary incentives are not necessary) and effectively manage data and demand for data by verifying quality, implementing and promoting user access to the data, shifting focus from data collection and monitoring to reporting and analysis and ensuring service providers/ government agencies respond to generated reports.

C3 (b): Choice of Technology

Technical design, which refers to the appropriateness of the technology platform to meet information needs, is the second key aspect to be taken into consideration. The technological appropriateness and flexibility of the ICT application should be informed by the surroundings (technological as well as socio-cultural, political, legal, economic, and environmental) in which it is to be utilized along with the specific purpose of its application.

Key findings to be kept in mind regarding the choice of technology include: the fact that SMS-based mobile systems offer the potential for universal use as opposed to applications specifically tailored to feature phones or smartphones with limited penetration rates. Submission of data through SMS is shown to be the preferred method, especially when workers and customers act as the data reporters; yet structured and unstructured SMS applications have limitations in comparison to form-based applications, which improve data accuracy. Web-based dashboards are the preferred method for end-user reporting and interfaces; web-based mapping allows for visualization of reports, but maps may prove more useful to utilities and organizations than to individual users. Data formats will be dependent on user needs; and finally dissemination of data back through the mobile phone was noted as the most accessible method for users, but it restricts the way and the amount of information that can be sent and displayed depending on the type of receiving phone. Beyond understanding the benefits and limitations of the various data collection methods, local capacity, both human and infrastructure, must also be taken into consideration in the design of the application.

¹⁷ Misuraca, G., 2007. E-Governance in Africa, from theory to action: a handbook on ICTs for local governance, Trenton, NJ: Africa World Press

¹⁸ See Annex 2 for a detailed list and summary of the applications included in the desk review.

C3 (c): Finance and Program Design

The final aspect - program design - necessitates an effective support structure for longevity and sustainability of the application. There is a need for effective design of the supporting program that ensures the system can be sustained and updated in response to the changing needs of its users as technology evolves and improves.

Financial sustainability is key. Various methods of funding emerged in the survey applications. Heavy reliance on external donor agencies was the most common, while other less common methods included government support, co-funding by stakeholder agencies and internal funds from parent organizations. Initial funding and investments for applications are often time-bound and long-term funding needs to be sought to determine how the system will continuously survive and evolve beyond the initial pilot stage. Financial sustainability can also be supported with strategies such as ensuring key user stakeholders invest in maintaining the project (NGOs, local governments, civil society) or leveraging technical partners to relieve some of the burden of developing, acquiring, and maintaining software or hardware. For most applications to succeed, structured collaboration from different stakeholders is required. Stakeholders can include the government, community and private institutions, such as service providers and telecoms to provide affordable rates for running of the applications or even cost sharing of the project for it to remain sustainable for the users. Finally, short and long-term indicators of success need to be identified and measured. The data collected should then be used to refine system design. The surveyed projects used a variety of metrics to measure the effectiveness of their applications, but few were comprehensive enough to understand how their design and implementation choices impacted success.

C4: Identification of Key Thematic Areas for the Sustainable Use of ICT in WASH

The aim of both the *Desk Review and Case Studies* report was to assess the successes achieved and the challenges faced by ICTs currently in play in the global WASH sector and highlight key principles upon which successful sustainability and scalability models can be constructed. Key findings are presented below, grouped under the following eight major themes:

1. Using ICTs to strengthen monitoring and inventory of infrastructure.
2. Sustaining ICT-based planning and programming initiatives.
3. ICT and operational efficiency improvements.
4. ICT and service delivery improvements. (particularly to the poor).
5. ICT to strengthen the consumer voice.
6. ICT and governance.
7. Financing of ICTs.
8. Public-Private Partnerships.

Theme 1: Using ICT to Strengthen Monitoring and Inventory of Infrastructure

The first key challenge in increasing access to water and sanitation services is the possession of accurate data on coverage and functionality. Inventorying current levels of infrastructure, creating baselines, identifying areas where intervention/resources are required and demonstrating progress all rely on data collection, monitoring, presentation and analysis. While multiple manual and automated options exist to verify data, ICT initiatives, especially mobile phone applications, have the potential to improve the quality and quantity of data collected in the long-term. They can help to make data transfer more efficient, reduce manual data errors, and increase the frequency of monitoring due to relative cost effectiveness. Accurate data and information management systems are a precursor for sound management and decision-support systems.

Akvo FLOW – Africa, Asia, Latin America

FLOW is an open source mapping software used for data collection and monitoring of the functionality of water access points.¹⁹ It was developed by Water for People (WfP) and in 2012 Akvo Foundation took over and continued development of FLOW. The software runs on Android platforms (smartphone), and allows users to take GPS coordinates, fill out text, take pictures and videos, and fill out questionnaires. This information is then translated to Google Earth data and plotted on online maps. FLOW can be used in areas where there is no Internet connectivity. However, when there is internet connectivity, the software automatically transmits the data to the central database and uploads it to Google Earth.²⁰

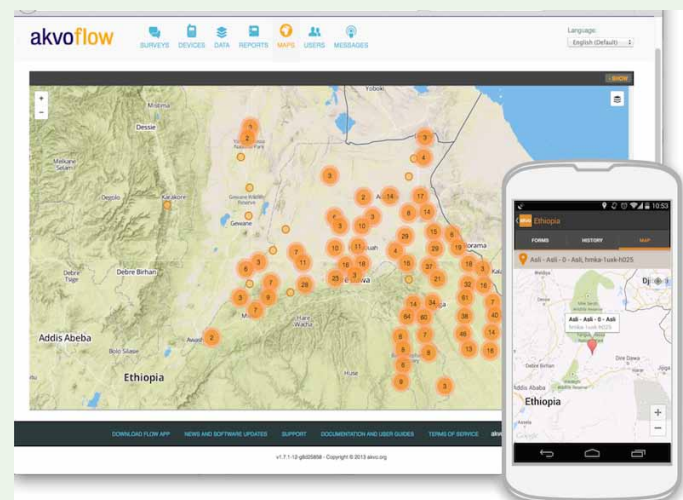
WfP implemented FLOW in a number of countries and thousands of water points were included in the database.²¹ The countries include Malawi, Rwanda, Uganda, Congo, India, Dominican Republic, Honduras, Guatemala, Nicaragua, Ecuador, Bolivia, Peru, Liberia, Nepal, Burkina Faso and Mozambique.²²

In Liberia, the use of FLOW achieved the following results:

- Over 10,000 water points mapped in less than 6 months in 2011.
- A national WASH sector investment plan (USD400 million from 2012 to 2017) identified.

Lessons learnt from the data collection phase included:²³

- Absence of good road infrastructure led to extra costs for transportation of mapping teams.
- The lack of electricity made it necessary to purchase external battery adapters for the FLOW devices.
- Absence of mobile phone network coverage and high costs of mobile data transfer made it necessary to use physical data collection.



Source: <http://flow.readthedocs.org/en/latest/docs/dashboard/6-maps.html#navigating-the-map>

Using ICTs to support mapping and monitoring of infrastructure can facilitate mobilization, planning and allocation of resources in the WASH sector. A recent paper²⁴ compared a tablet- and paper-based survey in Africa and found that costs per completed tablet interview were “74

percent less than the paper-based survey average, and the average time per interview question for the tablet-based survey was 46 percent less than the paper-based survey average”.

¹⁹ https://www.engineeringforchange.org/news/2011/01/22/how_flow_can_change_development_work.html

²⁰ Hellström, J., & Jacobson, M. (2014). “You Can’t Cheat the Community Anymore’—Using Mobiles to Improve Water Governance. In of 4th International Conference on M4D Mobile Communication for Development (pp. 48–59). Dakar, Senegal. Retrieved from <http://www.divaportal.org/smash/get/diva2:709233/FULLTEXT02.pdf#page=51>

²¹ <http://www.waterforpeople.org/what-we-do/#flow>

²² <http://www.waterforpeople.org/what-we-do/#flow>

²³ <http://akvo.org/blog/using-akvo-flow-in-liberia/>

²⁴ <http://www.mdpi.com/2076-0760/3/2/264>

Another recent 2013 study²⁵ analysed the use of mobile-to-web surveying for a survey of 12,000 households and confirmed that it “saved time, was less costly, was at least as accurate as standard paper-based questionnaires [more accurate for GPS coordinates], and was preferred by

experienced paper based data recorders”. In their mobile-to-web data collection in Liberia and Sierra Leone, WSP found that eliminating post-survey transcription alone saved up to 5.7 percent of project costs and over 600 workdays, which was more than offsetting hardware and software costs.

NFC Phones for Water Purification Tracking – Haiti

Near-Field Communication (NFC) phones with Radio-Frequency Identification (RFID) is an application that supports the monitoring of water purification in Haiti. Programmed NFC phones are used by Haitian water technicians to support the tracking of chlorine levels in thousands of households through RFID tags on the drinking water buckets in homes.

The NFC tags augment an existing socio-technical system for providing clean water to households throughout Haiti. Community Health Workers (CHWs) visit households approximately once per month and conduct a test for residual chlorine in stored water. Prior to the NFC and SMS-based questionnaires, paper-based forms were used and it was difficult to establish a regular electronic data entry program. As the CHWs were often in the field for long periods of time, the data entry was delayed to the point of rendering the data irrelevant. Use of NFC phones facilitated the real-time submission of data.

Haiti had difficulty supplying clean drinking water to more than 9.7 million inhabitants, a situation was compounded by devastating earthquakes and a cholera outbreak in 2010, which claimed thousands of lives.^{26,27} The mountainous terrain coupled with poor transportation and communications networks made it challenging to supply clean drinking water. Without regular household visits, the population reverted to drinking unclean water, which resulted in cholera outbreaks and other diarrhoeal infections.²⁸

The project was a collaboration between an industrial research lab (Nokia Research Center, Palo Alto), the Public Health School of University of Carolina Berkeley, and Deep Springs International (DSI), a non-profit organization in Haiti.²⁹ Through NFC and SMS-based questionnaires, technicians spend less time collecting data and more time visiting houses, ensuring that more households have clean water.³⁰ Over 35,000 families in Haiti were reached and incidences of diarrhoea among users were reduced by about 50 percent.³¹

In post-disaster environments left with a fragile or non-existent infrastructure, NFC technology was a fast and cost-effective way of improving water supply and maintenance.³² However, the project faced challenges linked to sustainability and scaling up, including:

- High costs of battery charging.
- Inability to find additional low-end NFC phones.
- Resource constraints.
- Lack of a centralized accounting scheme.

²⁵ <http://goo.gl/AspdvR>

²⁶ Brown, C. (2011). NFC phones help provide clean water to Haiti earthquake victims. Retrieved September 20, 2014, from <http://www.nfcworld.com/2011/03/11/36414/nfc-phones-help-provide-clean-water-to-haiti-earthquake-victims/>

²⁷ Greenemeier, L. (2011). Aqua Plan: Could Cell Phones Help Aid Workers Ensure Haiti’s Supply of Clean Drinking Water? Retrieved September 20, 2014, from <http://www.scientificamerican.com/article/haiti-cholera-clean-water-chlorine/>

²⁸ <http://www.upm.com/EN/MEDIA/All-news/Pages/Battling-cholera-with-NFC-RFID-tracked-drinking-water-in-Haiti.aspx>

²⁹ Kaye, J., Holstius, D., & Seto, E. (2012). Using NFC phones to track water purification in Haiti. CHI’12, 677–689. Retrieved from <http://dl.acm.org/citation.cfm?id=2212839>

³⁰ Harris, J. (2010). Mobile phones are a valuable tool all over the world. Retrieved September 21, 2014, from <http://conversations.nokia.com/2011/08/10/innovative-mobile-applications-for-healthcare/>

³¹ <http://thesmartsense.com/22574>

³² <http://www.nfctags.com/nfc-templates/story-detail.php?id=9>

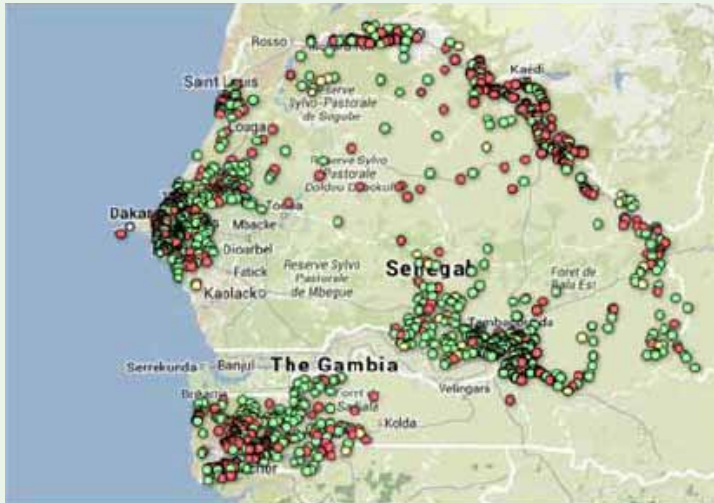
Specifically ICTs can:

- Measure performance and progress.
- Identify marginalized areas and present data visually to highlight equity issues.
- Improved governance achieved through availability of reliable data and knowledge of actual customer base.
- Allow improved access to information by stakeholders for improved planning and decision making.
- Design improvement strategies.
- Indicate the distance required to the nearest improved water source.
- Identify advocacy themes.
- Prioritize intervention areas and better target available and limited resources.
- Improve the quality and evaluation of funding proposals.
- Promote increased investment in the sector. All of which can translate into more people served.
- Quantify actual levels of service needs.
- Monitor water quality.

mWater - Senegal, Mali, Niger and Benin

mWater is a mobile-to-web based application for consumers and water service providers (WSPs) developed as a response to monitoring challenges for the growing number of small-scale water schemes in rural areas and small towns. The application aims to provide water service providers with the ability to remotely control water service delivery and also improve the management of water usage, daily operations as well as the maintenance of the network. As of June 2013, mWater was active in 252 water systems in Senegal, Mali, Niger and Benin.^{33,34}

- 246,900 people served in Niger and 415,900 people served in Mali under the mWater platform, which provides an ICT design structure in which mobile phone applications and web services are developed to support the life cycle of water supply systems, from construction (inventory and cartography) to operation (data collection, technical and financial management) and performance benchmarking.
- In Benin, the use of mWater resulted in new drawings of assets and water networks for 51 rural water point schemes.
- In Senegal, mWater has supported the mapping of 70 percent of existing water schemes (over 28,000 water points).



³³ http://programme2013.worldwaterweek.org/sites/default/files/fadel_stockholm_2013_ict_and_water_governance_fadel_ndaw_september_4.pdf

³⁴ <https://www.wsp.org/sites/wsp.org/files/publications/Presentation-Presenter-Daniel-Annerose.pdf>

Theme 2: Sustaining ICT-Based Planning and Programming Initiatives

Rural Sanitation Monitoring System– Indonesia³⁵

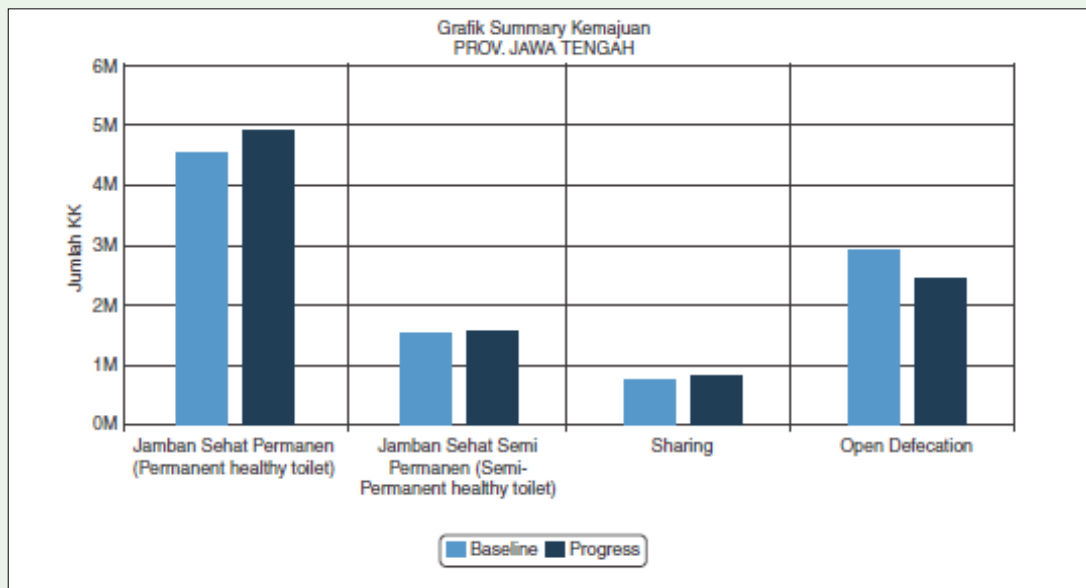
In 2009, with the support of the World Bank’s Water and Sanitation Program (WSP), the Ministry of Health conducted a pilot study to monitor rural sanitation in two districts in East Java using a mobile phone short message service (SMS) text-monitoring (mobile monitoring) system. Information on the community’s progress towards becoming open defecation free (ODF) and changes in households’ access to improved sanitation was collected and sent via SMS and stored in a district-level database.

Based on the success of the pilot, in 2012 the mobile monitoring system was rolled out to all 119 districts and cities in five of the country’s provinces, covering approximately 36 million households and 123 million individuals. The current rollout plan aims to reach all 500 districts in 34 provinces in the country by December 2015.

As of August 2014:

- 3,787 of the 10,559 health center sanitarians in the country had sent village sanitation data via SMS.
- 800 to 1,000 messages per month were received by the central server.
- 50,850 messages with data were collected.
- Data for 20 provinces, including 40,470 villages and 42.9 million households, had been uploaded into the mobile monitoring system

Summary of Progress for the Province of Central Java by Type of Access



Key lessons learnt:

- A structured approach, which allows for adjustments and improvements, is needed in order for real-time village data mobile monitoring to scale up.
- A national harmonized approach to rural sanitation, with sector-wide objectives and monitoring framework, is necessary for scaling up data collection.
- It is possible to increase the use of the monitoring tool as a programming tool by establishing feedback loops, additional data management tools and communication channels to reach target users.
- To increase the use of the monitoring system as a management tool for programming, feedback loop, a larger set of customized data information tools, and channels to reach specific target users could be explored.

³⁵ *Scaling Up Indonesia’s Rural Sanitation Mobile Monitoring System Nationally*. Water and Sanitation Program: Learning Note, 2014.

In order to ensure reliable planning data is obtained and used, a few key elements should be taken into consideration:

- Even with ICTs offering relative cost-effectiveness, the costs associated with data collection remain substantial. All information management initiatives need to therefore be adequately planned for and well resourced.
- A participatory design stage and/or involving key sector players early in the development of the initiative can contribute to early adoption because of the perceived relevance of the data to be provided. If key stakeholders are able to define their requirements, this will facilitate meaningful use of the data and confidence in planning and resource allocation.
- Agreeing upon selected indicators and standard national definitions with sector players is important in ensuring the use of the data, inter-operability, long-term funding and sustainability. For example, a project-funded initiative collecting data using a different definition of coverage than the government would be of little use in terms of national planning.
- Less inter-operability, ease of use and ease of data extraction and analysis will translate into less use of the data. Furthermore, data extraction will be time-consuming and the quality and ownership of the data can be compromised.
- In contrast, facilitating the use of the database or platform by external actors, improving user rights and allowing analysis within the database or application will encourage the use of the data. Increasing linkages increases the value of the data, which in turn will encourage resource allocation in the future.
- Project-based funding can result in data collection largely being driven by the availability of funding from the stakeholders who require the data. Working with short-term funding can result in data quickly becoming outdated. Ideally, planning and programming data collection initiatives should be integrated into the government's annual budget or if donor funding is required, a basket funding approach is appropriate.

Using Mobile-to-Web Monitoring System in Rural Sanitation – India³⁶

The Government of India has invested heavily in programs to achieve universal sanitation coverage. To ensure investments in sanitation lead to commensurate outcomes, the sector needs a reliable and timely monitoring system.

To test the viability of using mobile technology to strengthen monitoring in the rural sanitation sector, a proof of concept was piloted by WSP, through a company involved in technology for development (Oneworld Foundation), in two blocks (sub-districts) of varying socio-economic characteristics. The pilot project covered 23,000 households in a span of two to three months.

This proof of concept demonstrated that:

- Using smartphones can provide quick, credible information on sector outcomes in near real time, unlike that provided by conventional surveys.
- Features such as geo-tagging and photographs of respondents ensure that results are more credible and relevant.
- Presentation of data is user-friendly and maps enable a viewer to grasp the status of rural sanitation in a geographical unit at a glance.
- The process can be replicated on a large scale and at periodic intervals, to address the gaps in the monitoring of usage of sanitation facilities in rural areas.

- Project-based initiatives can also limit the integration process, due to the choice of the hosting institution, the limited scope of indicators, differing indicator definitions or limited data collection, both spatially and time-wise.
- Data and consequently management information systems (MIS) are decision support tools, as such, the quality of data will have a direct correlation with any decision made. Data verification mechanisms need to be put in place to ensure reliability and confidence in the data.

³⁶ Kumar, C. Ajith and Singh, Upneet. *You Manage what you Measure: Using Mobile Phones to Strengthen Outcome Monitoring in rural Sanitation*, New Delhi, India: Water and Sanitation Program, 2012.

Theme 3: ICT and Operational Efficiency Improvements

Urban utilities have been recording significant successes in the implementation of ICTs. The relatively rapid acceptance and adoption of these tools at the urban utility level can, in part, be attributed to the efficiency gains and cost savings being achieved. ICTs have recorded efficiency gains in the following key operational areas.

SDE (Senegalaise Des Eaux) Supervision Cockpit - Senegal³⁷

SDE (Senegalaise Des Eaux) is a private water company that manages the production and distribution of drinking water for Senegal's 56 large urban centers. SDE's major focus is on quality and quantity of water, maintenance of the supply network, efficient billing and recovery, and customer relations management. In a bid to improve customer relations and satisfaction using new technologies, SDE developed the Supervision Cockpit for network interventions.

The cockpit was set up with the following objectives:

- To respond to customer complaints on time.
- To restore services quickly in case of interruptions.
- To increase productivity and reduce water losses.
- To monitor quality of service rendered to the customers.

The Supervision Cockpit includes a modern call center, a computer platform that supports geolocations using GPS/GSM, a direct consultation inventory and a computerized mapping system (installed in vehicles).

The establishment of the Supervision Cockpit has contributed to:

- An increase in network efficiency in areas of reduced leakages, metering and billing improvements.
- Improved customer relations by proving a toll free number that is used to lodge complaints and request for services.

Monitoring of Service Provision: Efficiency gains as a result of improved monitoring and service provision include a shorter response time, reduction in travel distance, reduction in maintenance costs, operations optimization (reduction of production costs, improved energy efficiency) and improved quality of service.

The remote control of water service delivery can improve the management of water usage, daily operations and the maintenance of the network. Next Drop's Live Valve Map system displays the status of water delivery in every part of the city. The customized dashboard helps the local utility to manage staff and infrastructure. Engineers monitor progress on an internal dashboard, which provides information on valve activity and potential diversions due to power and infrastructure issues. Next Drop has helped utility companies and valve agents to manage the over- and under-supply of water through analysis of the collected data.³⁸

Smart Water Meters (SWM)- District of Columbia, USA

SWM is experiencing strong growth throughout the industrialized world mainly in Europe and North America, with annual growth projections varying between 8 percent and 13 percent until 2016.

The fixed-network AMR system implemented by District of Columbia Water and Sewer Authority in 2002 is a good example of the possible dividends that a smart water metering intervention can yield. Reported benefits included reductions in non-revenue water (36 percent to 22 percent), increase in revenue by 7 percent (through debt reduction), reduction in meter reading costs (USD4.15 per meter to <USD1), reduction in costs relating to the investigation of complaints (50 percent lower) and customer call center services (36 percent lower), 20 less field vehicles required, and 106,000 liters of fuel saved every year.³⁹

Billing and Payment: The most common ICTs adopted by utilities are e-payment systems offering payment facilitation, increased reliability in billing and payment recovery, reduced administrative and payment transaction

³⁷ Oxford Business Group, "The Report Senegal 2008," 2008, Pg 132

³⁸ Morazán, M. (2012). *Measuring the Impact of NextDrop's Services on Utility Companies in India* (pp. 1–39). Hubli, India. Retrieved from http://rael.berkeley.edu/sites/default/files/MelissaMorazan_Final_APA_5.1.2012.pdf

³⁹ Hope, R., Foster, T., Krolikowski, A., & Cohen, I. (2011). Mobile water payments in urban Africa: Adoption, implications, and opportunities (p. 35). UK.

costs and improved revenue collection. Further advances in technology offer the potential to combine mobile banking and smart water metering, with a secure, transparent and low-cost flow of funds and information between the consumer, water service provider and delivery system.⁴⁰

M-Pesa water payments - Kiamumbi, Kenya

The Kiamumbi Water Trust (KWT) established an M-Pesa pay bill system in December 2010, enabling 550 households to settle their monthly water bills via the mobile phone. Demand for this option arose due to the inconvenience and costs associated with the traditional mode of water bill payment. Due to security issues, KWT could not accept cash payments on their premises, customers had to settle their bills at the nearest bank – an undertaking involving a 40-minute round trip costing USD0.50 and the opportunity cost of waiting for around one hour in a bank queue. A final trip would then be made to deposit the bank slip at the KWT offices, for a receipt to be issued, and the amount manually entered into a billing database. In the first month, 42 percent of customers had transitioned to the mobile payment channel, rising to 59 percent by the fourth month.

Challenges

Challenges in maximizing operational efficiency improvements that have been specifically highlighted by utilities include:

- Lack of integration between different ICT systems being used in different parts of their business.
- High development costs.
- Large investments needed for expansions/scale-up.
- Poor Internet connection and low quality of telecommunications service.
- Lack of consistent electrical supply.
- Heavy staff training requirements.

Theme 4: ICT and Service Delivery Improvements (Particularly to the Poor)

ICT applications offer improved service delivery by simplifying the process and facilitating the efficiency, speed,

and timeliness of provision. Further, a major advantage touted for the use of ICTs for development is the means to reach poor, underserved communities. Mobile phones are particularly well-placed to serve the development needs of the poorest and most vulnerable populations because they represent a widespread and relatively low-cost communication option for rapid information transfer and service facilitation whilst eliminating prevalent issues of distance and time. Mobile phones are also more affordable and accessible to users across socio-economic levels.⁴¹ In Africa, the number of people within range of a Global System for Mobile Communication (GSM) signal has already overtaken the number of people with an improved water supply. In India, the number of mobile subscriptions is twice the number of individual piped water connections.⁴²

i. Potential Benefits of ICTs for Low-income, Underserved Communities:

- Increased coverage as a result of mapping initiatives:
 - o Identification of additional sources.
 - o Reliable knowledge of actual customer base and needs based on accurate data.
- Improved mapping and monitoring initiatives can rapidly and accurately identify marginalized areas and present data visually to highlight equity issues and prioritize intervention in these areas.
- Empower under-served communities with better information:
 - o On water availability, price, and quality as shown in the case of M-Maji.
 - o On water timing information to reduce long waits, lost workdays and allow individuals to effectively plan their water usage, as is the case with NextDrop.
- Increased functionality, through:
 - o Improving ease and efficiency in reporting faults of water sources.
 - o Reducing the down-time of water sources that are reported as non-functional.
 - o Providing real time information on the functionality status of water sources.

⁴⁰ Hope, R., Foster, T., Krolikowski, A., & Cohen, I. (2011). Mobile water payments in urban Africa: Adoption, implications, and opportunities (p. 35). UK.

⁴¹ Rashid, A. T., & Elder, L. (2009). Mobile Phones and Development, 1–16. Retrieved from <http://www.ejisd.org/ojs2/index.php/ejisd/article/viewFile/529/265>

⁴² Hope, R., Foster, T., Krolikowski, A. & Cohen, I. (2011). Mobile water payments in urban Africa: Adoption, implications, and opportunities (p. 35). UK.

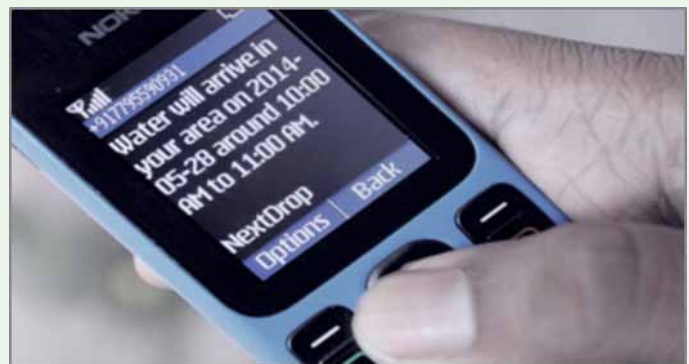
- o Offering utilities/agencies insight into the issues that affect functionality of water sources, especially in rural areas.
- Improved monitoring through measurement and tracking of performance.
- Improved customer relations (and customer confidence in the utility/agency) through increased transparency, provision of information and response to complaints.
- Promotion of price competitiveness (M-Maji and M-Sludge) increases the affordability of water and sanitation services;
- Increased flexibility and affordability of e-payment systems responds to the low and often unpredictable incomes of the poor;
- Reduced costs for utilities in operating non-core activities (such as revenue collection) translate into increased revenues re-invested in the core-functions of the utility, for example core staff and infrastructure development.
- The ease and decreased costs associated with e-payment systems also encourages utilities to invest in poor and traditionally underserved areas; this has been the case with the Nairobi City Water and Sewerage Company (NCWSC) and the *Jisomee Mita* initiative in Nairobi.

NextDrop - India

NextDrop leverages the recent proliferation of mobile phones in India to provide households with accurate and timely information about local piped water delivery, while also enabling water utilities to access real-time information about the status of their distribution system. NextDrop sources this information from water consumers who send SMS notifications when water begins flowing in their area, NextDrop in turn notifies residents in the same locality of the current delivery of water.⁴³ The project is built on the idea of collecting and sharing data as well as engaging communities to advocate for more equitable distribution. NextDrop's Live Valve Map system displays the status of water delivery in every part of the city. The customized dashboard helps the local utility to manage staff and infrastructure. Engineers monitor progress on an internal dashboard, which provides information on valve activity, potential diversions due to power and infrastructure issues.

NextDrop was launched in July 2010, with the first pilot project recruiting over 180 families in five valve areas to provide information and receive free updates in Hubli-Dharwad, Karnataka State, India.⁴⁴ The application provided messages to households every week about the status of water supply and the reasons for non-supply. The immediate positive development was that people living in remote areas no longer had to spend between 20 to 40 hours per month waiting for water.⁴⁵ The socio-economic challenge of having to take a day off work to wait for water was also reduced. NextDrop currently serves over 75,000 citizens in the twin cities of Hubli-Dharwad (with a population of one million⁴⁶) and is working with utility services in Bangalore to provide water management tools to their engineers. In future, it aims to serve all citizens in Hubli-Dharwad, and scale up to the whole of Bangalore⁴⁷.

An example of an SMS from NextDrop sent to a citizen⁴⁸



⁴³ http://www.ischool.berkeley.edu/files/student_projects/nextdrop_final_report.pdf

⁴⁴ Kote, T., & Olmos, A. (2011). NextDrop Final Report. Retrieved from http://www.ischool.berkeley.edu/files/student_projects/nextdrop_final_report.pdf

⁴⁵ <http://www.theguardian.com/environment/terra-india/2013/aug/02/india-water-scarcity-simple-data-solutions>

⁴⁶ Kumpel, E., Sridharan, A., Kote, T., Olmos, A., and Parikh, T. "NextDrop: Using Human Observations to Track Water Distribution." USENIX NSDR '12, Boston, MA, June 12-15, 2012. <http://people.ischool.berkeley.edu/~parikh/papers/nsdr12-final13.pdf>

⁴⁷ <http://www.virgin.com/unite/entrepreneurship/innovation-until-the-last-drop>

⁴⁸ <http://www.nextdrop.org/>

ii. Challenges

- Connectivity in most rural areas remains an issue. If the rural communities are to be encouraged to use ICTs, proper infrastructure, connectivity, electricity and access to the technologies all need to be addressed.
- While ICT offers opportunities to bridge access gaps in infrastructure, if tools are not adequately designed for resource-constrained environments, ICT initiatives can be plagued by the same lack of infrastructure they are trying to overcome.
- In the case of the NFC phones for water purification tracking, charging of phone batteries was identified as the most severe obstacle for effective use. Limited battery life and lack of electricity at home meant users would be required to pay a considerable fraction of their earned income to street vendors to charge their phones.
- Investing in devices that use alternative energy sources, such as solar, ensures the longevity of the devices and offers the possibility for extension or uptake of the ICT intervention in resource-poor areas.

In the case of M4W in Uganda, the low uptake has been caused, in part, by the community users having to meet the cost of the SMS to notify the handpump mechanic of the fault. The developers are working on a new version of the system that will allow users to send SMS to a toll-free number. It is hoped that this will increase usage of the tool among the community members.

Theme 5: ICT to Strengthen the Consumer Voice

ICTs can be used as a tool to encourage citizens to voice their concerns and put pressure on the local government to address problems with their water and sanitation services. While benefits of successfully implemented ICT initiatives include increased governance, empowerment of citizens and increased quality of services, the many unsuccessful initiatives are proof that citizen engagement is an exceptionally difficult task.

MajiVoice – Kenya⁴⁹

MajiVoice is an initiative implemented by the Water Sector and Regulatory Board (WASREB) for Kenya and supported by WSP. It is a platform for communication between citizens and the Nairobi City Water and Sewerage Company (NCWSC), the water service provider for Kenya's capital city.

MajiVoice has been a useful tool for decision-making. The benefits that have been realized through its use include: improved work flow processes, improved response time to customer complaints and as a result improved customer confidence in the utility. The tool has also contributed to a clearer understanding of the business operating environment, informing utilities and WASREB where the main focus of interventions should be. Through the use of the tool, billing was identified as the main challenge for NCWSC, which led to the development of a new meter reading system.

The following results have been noted since the introduction of MajiVoice:⁵⁰

- MajiVoice rolled out to four public water utilities in first year: Nairobi, Nakuru, Nanyuki and Mathira.
- Complaints recorded rose from approx. 400 to over 4,000 per month (Nairobi).
- About 94 percent of submitted complaints were resolved, up from 46 percent in initial months (Nairobi).
- The average time between the lodging and resolution of complaints halved.
- Over 400 employees using the system daily (Nairobi).
- In a recent anonymous personnel survey, the majority reported that MajiVoice “made it easier to deal with and follow up on specific complaints” (93 percent) and “improved the way NCWSC deals with complaints.” (98.1 percent)

⁴⁹ Document name: ICT Case Study – Kenya to be found on the Vula Unlocking ICT Potential site in the “Resources” folder

⁵⁰ <http://pdu.worldbank.org/sites/pdu2/en/about/PDU/EngageCitizens>

The experiences and lessons learnt from different ICT solutions suggest nine key mechanisms in supporting the design and implementation of ICTs aimed at strengthening the consumer voice:

1. Ensure the system is responsive and that applications are connected to a clear mechanism of action that can respond to feedback and complaints.

The “most crucial and challenging element of a social accountability strategy is to be able to elicit a response from public officials and achieve real change”⁵¹.

In the case of MajiVoice, the team made considerable efforts to achieve a near instant automatic confirmation by text message. These are meant to give customers an immediate feeling of receiving a “response” and reassurance that their complaint is taken seriously, as well as providing them with the benefit of being able to track it. More importantly, however, the MajiVoice system is tightly integrated with a clear mechanism-of-action – the utility customer care department – that does, in the majority of cases, successfully resolve individual complaints. Each submitted data point (complaint) is assigned to utility employees for action. Kenyan utilities are subject to binding service provision agreements (SPAs). The SPAs legally oblige utilities to respond to complaints of particular categories in a given time. If they fail to do so, the regulator is empowered to take enforcement action, including the withdrawal of licenses. This clear mechanism of action gives the system a major advantage over social-accountability mechanisms that collect feedback, but fail to achieve concrete action beyond the publication and discussion of data.

2. Identify and use the preferred method of communication of the consumers to ensure that reporting is not limited by the tool of choice.

MajiVoice recognized from the outset that the public preferred calling rather than sending SMSs in regards to problems with water service delivery or lack of information about water service problems from utility providers.

3. Ensure that the technology is easy to use and responsive if changes to promote participation are required.

With NextDrop, during the initial pilot, older people had problems using the SMS system as it required specific code lines. This prompted NextDrop to adopt an Interactive Voice Response (IVR) system.

4. Fulfilling a key need can remove the need for monetary incentives.

As was shown with NextDrop, the application provided monetary incentives during the pilot phase of the project, offering 5-10 rupees for the first person to call, but the use of the application was not affected even after withdrawal the monetary incentive. NextDrop reported that users were incentivized by the ability to receive information as well as the idea of helping the community.

5. Partnering or integration with the media can amplify the voices of consumers.

MajiMatone, while ultimately unsuccessful, did come up with a strategy to amplify consumers’ voices and place additional pressure on the government by forwarding resident-submitted SMSs on non-functional water points to the local media (radio and newspapers).

6. Ensure consumers have the same access to data as the institutions they are trying to hold accountable.

Opportunities are missed when users do not have access to the same data in order for them to agitate for improvements. NextDrop, M4W, MajiVoice and M-Maji all give users a platform to voice complaints and also access service delivery data.

7. Manage priorities and the quality of information.

Information sent by citizens often has to be verified for validity, for example before a technical team can be sent to address a complaint. The design of the system should allow for a verification process.

8. Co-design ICT consumer applications.

In order to create user-friendly systems that respond to local needs, co-design approach should be adopted where the customer is part of the ICT design team. This is particularly important to minimize the design-reality gap.

⁵¹ World Bank Social Accountability Sourcebook http://www.worldbank.org/socialaccountability_sourcebook/

SLB Connect– India⁵²

The SLB Connect project was initiated in early 2012 by the Water and Sanitation Program in consultation with the Ministry of Urban Development (MoUD). Implementation was done in PimpriChinchwad in partnership with the PimpriChinchwad Municipal Corporation (PCMC). There is growing recognition in India of the need to engage citizens in setting service delivery standards and monitoring performance. The aim of the tool was to provide a model for collecting citizens' feedback and integrate the same into the workflow of respective government agencies. Feedback from citizens is obtained not only on satisfaction levels, but also on customer's experience of services. The feedback from citizens is compiled in a scorecard and made available to interested stakeholders who can measure the quality of services provided.

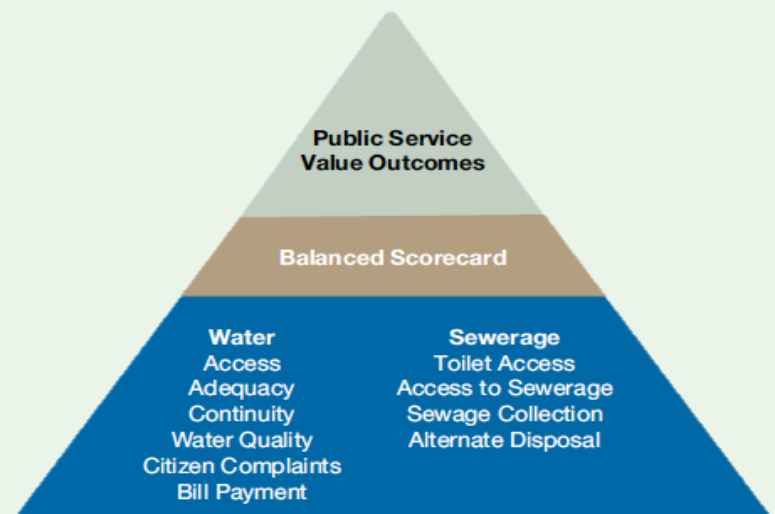
SLB Connect has four major components:

1. Conducting a mobile-based survey of sample households on service aspects.
2. Real-time monitoring of survey quality and timelines using an online survey management module.
3. Real-time analysis of survey results using a web-based Dashboard and data analysis tools.
4. Supporting the Urban Local Body (ULB) to design appropriate reform and response processes based on the findings from the survey.

The implementation of SLB Connect in PimpriChinchwad demonstrated a model that is socially sustainable (relies on voluntary feedback from citizens), institutionally compatible (embedding processes within existing institutional structures), and financially viable (leveraging mobile technology for faster and cost-effective iterations).

Going forward, SLB Connect aims to:

- Replicate the citizen feedback exercise across multiple cities.
- Integrate with state/national investment programs in water supply and sanitation for improved tracking of service outcomes.



⁵² WSP Publications: *SLB Connect Flyer February 2013*; *SLB Connect: Citizen Feedback Survey on Service Delivery using ICTs*. www.slbconnect.in

9. Trust must be established in order to ensure reporting:
- Trust that privacy of data and anonymity will be protected
Before M4W was implemented, users had to write a signed complaint letter outlining their grievances to the Village Local Council official. This process never protected user identity/privacy and was a complicated, time-consuming procedure involving several meetings. M4W was able to solve that through SMS reporting which protected user identity and never involved any meetings.
 - Trust that government agencies or service providers will respond to reports.
One of the major challenges of systems for citizen complaints has been that governments were not able to respond to the complaints and that the system became irrelevant. Low expectations of government services, based on prior unresponsiveness, create the lack of motivation among users to report issues. It is crucial to establish the capacity to respond to queries prior to implementing a system. Service providers and government agencies can gain the trust of their customers and constituents through timely acknowledgement and response to reports, even when a solution is not immediately possible. Projects like MajiVoice, NextDrop, WQR and M4W are clear examples of applications where reporting is linked to responsiveness.
 - Trust in the service provider.
It is important for the service provider to provide feedback if a problem has been resolved. The feedback can be a simple tracking number that allows citizens to follow up or an automated response when the problem will be attended to. In the case of NextDrop it has been reported that trust between customers and water providers has increased through provision of feedback and reliable information on water supply and distribution.

Theme 6: ICTs and Governance

Good governance and public sector management are necessary for development and social transformation.⁵³

Advances in ICTs have created opportunities which are being exploited to improve governance. The integration of ICTs into local governance gives rise to an informed population that can effectively participate in governance. Access to timely and relevant information by citizens improves interaction, builds trust, confidence and participation. ICTs are registering tremendous improvements in building capacities of people previously excluded from the political process, including women, youth and minorities. Family Support Institute in Kenya, for example, is using ICTs to increase the number of women voters.

ICTs are strengthening partnerships between institutions such as parliaments, media and civil society organizations through interactive platforms or fora for supporting information sharing and collaboration. Systems that allow citizens to report graft or misuse of public funds have contributed to the fight against corruption and have created better mechanisms for ensuring government accountability of public resources and transparency in delivery of services. The use of Frontline SMS during presidential elections in Nigeria was embraced by the citizens because it enabled transparent elections by allowing users to report malpractices such as vote rigging.

In order to improve upon successes in the use of ICTs in governance there is a need to enhance communication infrastructure to allow all citizens to benefit and participate in the governance process. The setting up of community resource centers can improve individual access and extending ICT services to local governments can improve service delivery and support local economic development. Involving citizens in the design and use of the tool is critical for successful implementation. Finally, ICTs must be perceived as merely tools; improvements in governance will also need to come from a government's willingness to develop human and institutional capacities in terms of policy implementation, provision of regulatory frameworks and managing policies.

⁵³ Adesida, O., 2001. Governance in Africa: The Role for Information and Communication Technologies Governance in Africa: The Role for Information, Abidjan, Cote d'Ivoire.

SIASAR – Latin America⁵⁴

SIASAR, the Rural Water and Sanitation Information System, was designed to monitor the development and performance of rural water supply and sanitation services in participating Latin American countries. In addition to addressing the needs of stakeholders for updated, complete and trustworthy data, it is also helping countries identify needs, guide sector policies, and enables the continuous knowledge exchange between platform participants. It operates on an interactive web platform adapted for Android cell phones and tablets. It is an ICT-based information system that collects, synthesizes and analyzes data on rural water service delivery, measuring four basic dimensions of service provision: (i) access to services (ii) quality of services (iii) performance of service providers and (iv) the effectiveness of technical assistance. Data collected is verified and automatically processed before performance rankings are published, “grading” each of the four dimensions from A (very good) to D (poor). One of the major aims of the SIASAR initiative is to build the capacity of local technical staff to plan, monitor and manage rural WSS. These rankings help officials to prioritize needs, leading to higher standards in terms of coverage, quality and sustainability.



Challenges

For governance to be inclusive, it must be accessible and open to every citizen

Pre-existing imbalances in access to infrastructure (urban/rural, high/low income) can translate into lack of transparent governance initiates further promoting inequality in access to public services.

- Governments therefore need to **improve communication infrastructure** if all citizens are to benefit and participate in the governance process.
- By **creating mechanism for participation**, governments will become more transparent, accessible, accountable and more involved in meeting the needs of the citizens.
 - o A potential solution is for governments to set up community resource centers to improve or enable access by individuals to ICTs in areas where it is limited.

ICTs are tools, not solutions

The successful implementation of ICTs relies on the stakeholders committing themselves to good governance. Strategic policies must be in place to support the role that ICTs can play in improving the quality of life of citizens while achieving national goals.

- It is therefore essential for governments to develop human and institutional capacities in terms of policy implementation, provision of regulatory frameworks and managing policies to **allow for inclusive access to information by all citizens**.

Rigid regulatory frameworks

Rigid regulatory frameworks limit the ability of governance structures to respond to the continuous and dynamic changes prompted by the introduction of new technologies.

⁵⁴ Pena, Lilian et al., 2013. *Briefing Notes: The SIASAR Initiative: An Information System for more Sustainable Rural Water and Sanitation Services*. Water Partnership Program, World Bank

Low literacy can hamper use

To deal with the issue of low literacy and inability to use the technologies, governments need to look into social issues like basic literacy, poverty and how ICTs can contribute to solving these issues.

The learnings from the use of ICTs in the governance sector are very valuable when translated to the WASH sector, especially as the water sector is facing a number of governance challenges (Hellström & Jacobson, 2014)⁵⁵. Aspects such as governance through citizen participation are particularly important in order to give voices to communities regarding water provision, service interruptions and corruption of officials. ICTs are becoming a dominant force in the way utility providers and customers communicate, as ICTs can directly link the consumer with the service operator, avoiding the need for intermediaries. Equally, citizen participation in making decisions on infrastructure development, expenditure or health warnings can be of major benefit to improve the governance of the WASH sector. ICTs can be used to create a system of transparency and accountability, to promote public participation and collaboration among stakeholders in the WASH sector, to improve monitoring and management of WASH projects, and to reduce the cost of access to information and service delivery. Some of the tools and applications mentioned above could very easily be transformed into applicable solutions for the improvement of governance in the WASH sector.

Theme 7: Financing ICTs**ICT financing at the national scale**

*“ICTs are increasingly recognised as a vital part of the economic, social and political fabric of countries and as the crucial basis for development and poverty reduction.”*⁵⁶

As the European Commission has indicated in its report on Financing ICT for Development⁵⁷, there are three means of national support for ICT.

1. Include ICT as an integral part of development activities. Identifying ICT adoption and use as a means to an end, rather than an end in itself.
2. Identify ICT as a specific element in poverty reduction strategies or national development plans. Uganda, for example, has included an objective in their National Development Plan (2010-2015) promoting science, technology, innovation and ICT in order to enhance competitiveness.
3. Specifically prioritize spending on ICTs, for instance through investment in infrastructure. As the box below illustrates, Kenya is pursuing this method, having invested approximately Sh32 billion (USD307 million) from 2006 to 2013, which represents 3.2 percent of the gross domestic product (GDP).

Financing of ICT - The Case of Kenya⁵⁸

Kenya has adopted ICT as a major thrust and building block to development. ICT is one of the key pillars for development as defined in Kenya’s Vision 2030, the strategic roadmap towards realization of social and economic development by the year 2030. National policy documents and programs supporting the use and development of ICTs to support innovation and improved service delivery attest to this. This is further evidenced by the government spending trends and rate of adoption of ICT use by residents and public institutions. IDC 2014⁵⁹ estimates that there has been an increase of about USD3 billion (about 3.2 percent of GDP) in government spending on ICT over the period 2006 to 2013. The ICT-driven development process has been facilitated by the liberalization of the market and development of key infrastructure including the national optic fibre backbone infrastructure (NOFBI) and a Government Common Core Network (GCCN) intended to serve as a shared and secure interoperable government-wide ICT architecture⁶⁰.

⁵⁵ Hellstrom J., Jaboson M., 2014: ‘You can’t cheat the community anymore’ using mobiles to improve water governance. In I.Niang & C.SHaff, eds. *Proceedings of the 4th international conference on M4D Mobile Communication for Development* Dakar, Senegal pp 48- 59

⁵⁶ [http://www.iicd.org/articles/EU-Financing-ICT4D-\(English\).pdf](http://www.iicd.org/articles/EU-Financing-ICT4D-(English).pdf)

⁵⁷ Document name: ICT Case Study – Kenya to be found on the Vula Unlocking ICT Potential site in the “Resources” folder

⁵⁸ Document name: ICT Case Study – Kenya to be found on the Vula Unlocking ICT Potential site in the “Resources” folder

⁵⁹ IDC 2014. *Breaking barriers with technology: A special report on the Kenyan ICT market. An examination of Kenya’s ongoing technology-powered transformation and push to transition to a Knowledge Society and regional ICT powerhouse.*

⁶⁰ The Kenya National ICT Master Plan – Towards a Digital Kenya 2014. <http://www.scribd.com/doc/217915368/ICT-Masterplan-2014#scribd>

ICT Financing at the Application/Project Scale

The majority of cases examined as part of the study had short-term or *ad hoc* financial models, with applications relying heavily on unsustainable project/donor-based funding. MajiData in Kenya for example was conceptualized in 2008 by GIZ. Since no financing was allocated by the Government of Kenya to support the process, GIZ offered technical and financial resources as part of its support to the Kenya water sector reform process aimed at improving governance in the water sector. The original budget of 1.5 million euros covered 2,000 areas as part of the initial baseline. Beyond the initial areas, scaling up of data collection to other areas was demand-driven, based on funding and data requirements from other stakeholders⁶¹. NextDrop, on the other hand, has been successful in managing its sustainability by continuously re-inventing and growing into other locations, while signing up thousands of households at a small cost of 10 rupees per month for the service.

Many ICTs in the WASH sector rely heavily on external donor agencies. Many of the case study applications relied upon funding from external donors agencies including Human Sensor Web (Google.org, UN-HABITAT); MajiMatone (Twaweza, DfID, Daraja Trust); NextDrop (Gates Foundation, Clinton Global Initiatives, Center for Information Technology Research in the Interest of Society, Knight Foundation, GSM Association); Water Quality Reporter (European Union, Gates Foundation); MajiVoice (World Bank, NCWSC); M4W (SNV, IRC/Triple-S, Gates Foundation, ATTI); mWater (USAID); mSludge (Gates Foundation); M-Maji (Stanford University and Umande Trust).

Few ICTs receive financial support from the government for the planning and implementation phase through to the ongoing maintenance and operation. Huduma and Ufahamu systems received support from the Kenya government, while others mostly received support and co-funding from stakeholder agencies. Some ICT projects used internal funds of their parent organizations to finance their mobile phone projects, for example FLOW, WPM and M4W.

Financial plans need to include both funding for project start-up costs as well as long-term financing for operation and maintenance of the technology. MajiVoice is now operated, managed and used by the NCWSC. NextDrop has been successful in managing its sustainability by continuously re-inventing and growing into other locations while signing up thousands of households at small cost of 10 rupees per month for the service. M4W relies upon HPMs being incentivized by DWO and the NGOs to carry out baseline data collection and assessment of water source. While minor repairs to a water source are paid for by the communities from their monthly user fees collected, major repairs are to be done by the district water office. Agencies responsible for M-Maji and M4W manage the continuous running of the system. Other systems like FLOW were developed by one organization (Water for People), which then sought partnership with another organization (Akvo Foundation) to improve and manage FLOW.

TABLE 1: FINANCING ICTs-UGANDA’S NATIONAL WATER AND SEWERAGE⁶²

Development Costs	The only development costs incurred were on personnel within the utility that developed the system; since the IT department had to recruit software developers to work on the system.
Maintenance Costs	Maintenance of the e-water infrastructure is currently one of the major costs. To manage countrywide connections, it costs the utility approximately UGX 1.5 billion (USD507,000) annually. However in contrast the utility used to spend about UGX 6 billion (USD2 million) annually on bill collection.
Cost to the User	Even with the introduction of a tariff for mobile money payments, the convenience the service provides outweighs the cost. Telecom operators charge a tariff of UGX 1,300 (approximately USD0.40) that is paid by the customer. The cost is deducted off the customer’s mobile money account as soon as payment is made.
Increased Revenue	With the introduction of mobile payments, the bill collections have increased by 15 percent.

⁶¹ Document name: ICT Case Study – Kenya to be found on the Vula Unlocking ICT Potential site in the “Resources” folder

⁶² Document name: ICT Case Study – Uganda to be found on the Vula Unlocking ICT Potential site in the “Resources” folder

Cost Effectiveness of ICT

TABLE 2: TYPICAL COST BENEFIT STREAMS FOR CONSIDERATION IN ICT IMPLEMENTATION

Cost Stream	Benefit Stream
Direct Costs <ul style="list-style-type: none"> Software licenses cost Implementation cost Hardware costs. Network connectivity costs Training costs Documentation development Data conversion 	Direct Benefits <ul style="list-style-type: none"> Reduction in non-revenue water Energy and fuel savings Inventory savings Reduction of arrears, customer dues Improved cash flow Paper, communication saving Revenue increase Optimization of expenses
Indirect Costs <ul style="list-style-type: none"> Staffing time and effort required by the establishment Readiness costs that relates to data preparation 	Indirect Benefits <ul style="list-style-type: none"> Process improvements and enhancement. Improved people (employee) management and efficiency Improved planning and decision-making Reduction of outages Improved information quality

Source: *Information and Communication Technology for Water Utility Management - Best practices and experience sharing among ACWUA members. GIZ Presentation, 2011*⁶³

As noted in the *Financing of ICT – M4W* box, the cost effectiveness of ICTs is very specific to the initiative in question; which is why it is essential to develop a long-term financial plan during the initial stages of conception along with a monitoring and evaluation plan to keep track of the financial health and effectiveness of the ICT initiative. The table above denotes potential direct and indirect costs and benefits streams that can be considered, but it is important to note that some impacts may be more difficult to translate into financial gains, for example, increased consumer awareness on water quality and the location of safe water sources.

⁶³ http://www.acwua.org/sites/default/files/nabil_chemaly.pdf

⁶⁴ Document name: ICT Case Study – Uganda to be found on the Vula Unlocking ICT Potential site in the “Resources” folder

Financing of ICT - M4W⁶⁴

The M4W project was initially financed by the Africa Technology & Transparency Initiative (ATTI) with USD30,000. The majority of this fund was spent on the development of the technology in terms of setting up the infrastructure, paying the developers, purchasing handsets and deployment (including training) in the first five districts. For the subsequent deployment and maintenance, the M4W consortium contributed USD20,000. Currently, the annual running costs of the system are budgeted at UGX 300 million. The major costs include replacement of the mobile phones (each mobile handset costs approximately USD40), and management of the infrastructure and the personnel to maintain the system.

The cost of the SMS sent to report a water point fault is born by the user at approximately USD0.078 (UGX 220). Low uptake by communities has been credited in part with this user associated cost and the developers are working on a new version of the system that will allow users to send SMS to a toll free number.

Summary of the M4W costs

Item	Cost (USD)
Development cost (including purchase of phones for four districts)	30,000
Development cost (including purchase of phones for additional districts and maintenance: 2011-2014)	20,000
Server hosting (outsourced)	720 (annually)
Charging phones (by hand pump mechanics)	~ 5 per month

Since 2011 approximately 715 SMS were sent by water users from Lira and Kabarole districts to the system and 187 water sources (26 percent) were repaired on the basis of these messages. In looking at the initiative in regards to usage/development costs the initiative may not necessarily appear cost-effective. However, in comparison to the traditional means of data collection, there have been great gains in efficiency.

In order to collect the one data set for the WATSUP database update, the Ministry of Water and Environment (Uganda) spent approximately UGX 2 billion. In contrast, the M4W project was able to use the same processes and institutional structures to collect baseline data at a cost of only UGX 600 million.

Theme 8: Public-Private Partnerships

Financing of ICT - The Case of Uganda

Since the 1990s ICT infrastructure has largely been funded by the private sector⁶⁵. In Uganda, the liberalisation of the national ICT Sector has led to increased private investment in the ICT sector in terms of foreign direct investments (FDIs) in the upstream ICT services, as well as local investments in end-user services. The Uganda National Development Plan 2010-2015 states that between 2003 and 2008 the communications sector alone managed to raise annual average investment from USD78 million in 2004 to USD150 million in 2007, which has consequently resulted in a growth in revenues and an increased contribution to GDP.⁶⁶

Role of the Public Sector in Financing of ICT

As highlighted in a number of publications, governments need to create environments which attract private sector investors. This includes developing policy and regulations as well as start-up processes which are supportive to the client and the business. Aspects such as transparency, fair competition processes and skilled human capacity are required to create an investor conducive environment. Donors should see themselves as strategic players who encourage investment in high-risk and low-profit areas through start-up funding, financial assistance and risk mitigation. Donors also have the opportunity to create networks of knowledge and infrastructure across countries and regions in Africa.

The European Commission has highlighted the following key roles of the public sector in financing ICT for development:

- ▶ Attracting private investment
 - Financial assistance and risk mitigation:
 - Low-interest loans or risk guarantees.

- Creation of an enabling environment to attract investors:
 - Enabling legal and regulatory environment.
 - Competition.
 - Start-up costs.
- International collaborations:
 - Building 'backbone' infrastructure linking countries and regions.
- ▶ Ensuring that the communication needs of the poorest and most marginalized are met
 - Through innovative public-private partnerships.
- ▶ Introducing ICT into government functions and services:

The UN Task Force on Financial Mechanisms for ICT for Development emphasised throughout its report that an enabling environment is vital. Without it investment will not be made, or once made it will not be effective in providing services efficiently and at the best price. Each country needs to develop its own policy and strategies, but global communications also require regional and international governance⁶⁷.

mWater – Senegal, Benin, Mali, Niger

mWater is a business service-oriented platform developed as a mobile-to-web monitoring system to improve the management of rural water supply systems. The platform was developed by the Senegalese mobile solutions company Manobi through a public-private partnership (PPP) funded by the WSP in 2008. The tool itself also supports the PPP frameworks that exist between the municipalities and private sector operators⁶⁸.

⁶⁵ [http://www.iicd.org/articles/EU-Financing-ICT4D-\(English\).pdf](http://www.iicd.org/articles/EU-Financing-ICT4D-(English).pdf)

⁶⁶ <http://www.undp-alm.org/resources/naps-least-developed-countries-ldcs/uganda%E2%80%99s-national-development-plan-201011-201415-%E2%80%93>

⁶⁷ The Report of the TFFM (Task Force on Financial Mechanisms) for ICT for Development. <http://www.itu.int/wsis/tffm/final-report.doc>

⁶⁸ Economic and Sector Work Unlocking the potential of ICT use in the water and sanitation sector in Africa. Phase 1: Assessment of the mWater platform for the monitoring of rural and small towns piped water schemes in Senegal, Mali, Benin and Niger. WSP 2013

Partnership to link Sub-Saharan Africa

“Africa’s development is hindered by the high cost of communication, which is partly due to the lack of ‘a backbone’ ICT infrastructure between countries in Africa. The cost of providing adequate backbone infrastructure has been estimated at between USD500–1000 million. Initial investment is hard to attract from the private sector or existing soft loan facilities. But if the initial hurdle of the cost of the infrastructure could be overcome, African telecommunications services would quickly become profitable for private operators. Voice and data traffic is predicted to grow by 20 percent a year. (Traffic grew by 19 percent in 2001, 28 percent in 2002, and 37 percent in 2003 – compared with an international average growth rate of 10–12 percent per year). What needs to be done to put the infrastructure in place? The first requirement is strong coordinated strategic leadership by African governments. If they developed a continent-wide plan and guarantee of enabling conditions, they would be able to mobilise a mixture of private finance, soft loans and donor support.” European Commission⁶⁹

Public-Private Partnerships

The private sector is often not incentivised to provide for the needs of the poorest. Infrastructure development in rural or underdeveloped areas is often a major upfront investment which private investors avoid. Greater margins are being made in urban and affluent areas, which results in poorer areas being marginalised. However, private enterprises can be encouraged to consider investing when given incentives. Corporate responsibility projects have shown evidence of such initiative and mobile operators are investing today substantially in socially response projects. To combine the socially responsive project with the ICT implementation requires negotiations between governments, NGOs and business partners. In certain instances – as in the eHealth sector in HIV – tax incentives resulted in an up spur of mobile operators contributing to HIV ICT implementations. However, there are still likely to be market gaps, where government and possibly donor aid may be required⁷⁰. The following three boxes provide examples of Public-Private-Partnerships.

⁶⁹ [http://www.iicd.org/articles/EU-Financing-ICT4D-\(English\).pdf/](http://www.iicd.org/articles/EU-Financing-ICT4D-(English).pdf/)

⁷⁰ [http://www.iicd.org/articles/EU-Financing-ICT4D-\(English\).pdf/](http://www.iicd.org/articles/EU-Financing-ICT4D-(English).pdf/)

Mobile Water Payments

One of the most common PPP ICT4WASH initiatives to date has been the introduction of mobile water payments. Mobile water payment platforms offer mutual benefits to water service providers, mobile network providers and consumers and have the potential to support African utilities to escape the vicious cycle of low cost recovery and poor operational performance⁷¹.

“Mobile money is an electronic payment system that enables money transfers to and from an electronic account that can be accessed via an ordinary mobile phone. Each customer’s account is linked to their mobile phone number by means of an in-built SIM-card application. Physical cash withdrawals and deposits are facilitated by a network of retail agents. While configurations vary across providers, the viability of mobile money is premised upon the cost base associated with an agent network, which is lower and more flexible than establishing ‘bricks and mortar’ bank branches. Mobile money can therefore profitably extend the reach of financial services to those who have traditionally been unbanked, such as low-income or remote households.”



Source: Mobile Water Payment Innovations in Urban Africa

Mobile payment platforms are set up based on agreements between water service providers and mobile network operators. The operators typically charge a fee/tariff for each payment. For water service providers, mobile water payments result in a reduction of costs related to billing, increased revenue collection and improved collection efficiencies. For mobile network operators offering mobile water payments, benefits include direct revenue from fees/tariffs as well as an opportunity to build customer loyalty. For consumers, time and cost savings are the key benefits, although Hope *et al* 2011, caution that these benefits may occur only for wealthier and professional segments of the population with the relative benefits on low-income households unclear.

⁷¹ Hope, R.A., Foster, T., Krolkowski, A. and Cohen, I. (2011) Mobile Water Payment Innovations in Urban Africa. December 2011, School of Geography and the Environment and Skoll Centre for Social Entrepreneurship at Saïd Business School, Oxford University, UK.

C5: Policy and Operation Recommendations for Service Providers

Key policy and operation recommendations for ICT use by WASH services providers are provided below, grouped under the five dimensions of the balance

scorecard approach. Detailed discussions on each of these recommendations can be found in the *Analytical Report*.

Policy and Operation for Service Providers Recommendations Overview

1. Vision

- Define the vision, desired impact, evaluation methods and indicators prior to implementation
- Regularly measure short and long-term indicators of success
- Use the evaluation findings to refine the system
- Share the evaluation findings with the larger ICT4WASH community

2. Process

- Use the lowest cost and simplest technology
- Design for the local environment
- Build on existing ICTs where possible
- Invest in devices that have the capacity of using alternate energy sources
- Allow for tools and data to create value for the tool amongst stakeholders and allow consumers to agitate for improvements
- Allow for offline modes to combat poor connectivity
- Allow for transparency to combat corruption
- Develop partnerships with:
 - Local government to enhance support and ease implementation
 - NGOs and CBOs to build trust and market initiatives at the community level
 - The media to facilitate dissemination of information
 - Technical partners/private sector for technical and financial support

3. Customer

- Develop an outreach plan (for both design and implementation stages) and ensure dedicated funding
- Include a response mechanism to inform the customer that action is being taken by the service provider
- Ensure responsiveness to generated reports to build trust among users, value among stakeholders and encourage uptake
- Include complaints management component
- Ensure privacy of data and anonymity
- Enable feedback loops to allow for continual refinement
- Build a user community through system development and implementation to promote the sharing of experiences and to create a support network

4. Human Capacity

- Ensure the data collection step is technically accessible to the user
- Incorporate learning tools (images, audio-visual clips) to combat low literacy levels
- Understand the socio-cultural context at the community user level
- Limit workflow management changes at the organization level
- Promote the system as a means for furthering personal development goals and increasing job satisfaction to promote buy-in and uptake

5. Finances

- Have a long-term financing plan in place
- Have key user-stakeholders invest in maintaining the project
- Leverage technical partners to relieve some of the burden of developing, acquiring, and maintaining software or hardware

C6: Identification of Strategic Issues for at Scale use of ICT

ICTs can be a key enabler for institutional transformation to address the demand for improved water and sanitation services for both rural and urban communities. However in order to maximize the transformational role of ICT in the WASH sector, ICTs need to be understood as conduits or contributing forces rather than as development impacts or solutions in themselves. Impact and success need to be measured not just in terms of implementation or uptake of the new technology, but more importantly in regards to achieving WASH sector goals and priorities.

This study sought to not only document experiences of ICT use in the WASH sector⁷², but also analyze them using design and evaluation frameworks⁷³ to identify enabling factors and barriers in terms of vision, process, customer/user, service delivery, human capacity, governance and finance. The analysis was also an opportunity to track the progress of the said factors in the ICT Impact Chain⁷⁴ as

well as provide guidelines and policy notes on the inclusion of ICTs in Water and Sanitation Policy and Planning⁷⁵ to the sector's stakeholders.

To further support the implementation and scale-up of ICTs in the WASH sector, it is important to move beyond support for specific tools or technologies and look more broadly at supporting the elimination of barriers and providing enabling environments. Of the common barriers identified in the study, three stand out as potential areas where high-level support could be beneficial.

The *first barrier* is a need for sector-level policy and regulatory frameworks. In the majority of the case study countries, the national ICT policies/frameworks in place were weak, did not specifically address the key issues associated with regulating the use of ICTs in the WASH sector and/or did not have accompanying implementation strategies. Beyond simply providing guidelines towards implementation, as integration of ICTs into the WASH sector continues, key issues such as privacy, right to data and hacking and security threats will need to be addressed.

⁷² See ICTs in the WASH Sector Desk Review

⁷³ See the Analytical Report for a description of the frameworks used and detailed discussion on enabling factors and barriers

⁷⁴ See all seven of the Case Study Reports to see the implementation of the assessment frameworks on the case studies

⁷⁵ See Development of Guidelines and Policy Notes which includes Recommendations on Data Integration and Mainstreaming; ICT Evaluation; Recommendations for Policy Makers and Regulators; and Policy and Operation Recommendations for Service Providers.

There is also a need for increased sector coordination and integration of data. Poor sector coordination and information access have led to fragmented/duplicated implementations, unnecessary delays and have also affected the long-term functionality of installed water points. This is due in part to the multiple and varied nature of WASH sector stakeholders with diverse responsibilities for different levels of government, rural/urban divides, and multiple national and international donor organizations⁷⁶. Data integration and mainstreaming is of utmost importance for the success and long-term sustainability of ICT initiatives and should be championed as a core function of the WASH sector.

A **second major barrier** to the success and sustainability of ICTs identified in the study is the need for sustainable financial models. The majority of cases examined as part of the study had weak or *ad hoc* financial models; applications often relied on unsustainable project/donor-based funding. Many ICTs in the WASH sector rely heavily on external donor agencies.

Few ICTs receive financial support from the government for the planning and implementation phase through to maintenance and operations. Financial plans need to include both funding for project start-up costs as well as long-term financing for operation and maintenance of the technology. MajiVoice is now operated, managed and used by the NCWSC; NextDrop has been successful in managing its sustainability by continuously re-inventing and growing into other locations while signing up

thousands of households at a small cost of 10 rupees per month for the service. M4W relies upon HPMs being incentivized by DWO and NGOs to carry out baseline data collection and assessment of water sources. While minor repairs to a water source are paid for by the communities from their monthly user fees collected, major repairs are handled by the district water office. Donor agencies responsible for M-Maji and M4W fund the management of the systems. Other systems like FLOW were developed by one organization (Water for People), which then sought partnerships with another organization (Akvo Foundation) to improve and manage FLOW.

A **third major barrier** identified in the study is the common lack of monitoring and evaluation of the implementation and impact of ICTs in the WASH sector. Ideally, agreement on a common framework of analysis, such as those proposed in this study, by stakeholders in the WASH sector, or at minimum a common set of indicators, would greatly improve the understanding of the barriers and enabling factors of successful and sustainable initiatives and would greatly support the rate of replication. Region-wide workshops with public and private stakeholders (ministries, developers, potential private partners) could be held to adopt common indicators or frameworks of analysis and evaluation. These evaluation tools would subsequently be developed and promoted, and staff would be trained on how to implement them. Regular meetings could be held to track progress in the sector and share lessons with a view of refining the system in place.

⁷⁶ (O'Meally, 2011); (WaterAid, 2011).

Annex 1: Overview of ICT Tools in the WASH Sector

ICT	Summary		Stakeholders
DropDrop	DropDrop is a mobile application developed by iCOMMS team, from the University of Cape Town. The application runs on Android smart phones and was developed for users to track their water consumption. Users need to enter the water meter readings into DropDrop on a daily or regular basis and the application allows them to access reports on daily water usage and estimated water bill. Information on water conservation methods, the municipal contacts and information on the water systems is also provided.	Tools: Mobile Phones (Android)	iCOMMS, City of Cape Town.
		Country: South Africa	
		Year: 2013	
		Agency: iCOMMS	
URL: http://www.icomms.uct.ac.za/dropdrop_icomms			(Rein, Champanis & Rivett, 2013)
Field Level Operations Watch (FLOW)	FLOW is an open source data collection tool that allows users to create surveys that include text, photos, video and GPS coordinates. Data about the location and functionality of water points as well as access levels of water and sanitation at household and public institution level is collected using Android phones.	Tools: Mobile Phones (SMS), GPS mapping	Cisco; Founder of Craigslist (donation of 20,000 Motorola phones); Hilton Foundation; WaterAid; IRC; Portland State (Evan Thomas); Suite Pilot program for Mercy Corp in Indonesia.
		Country: Uganda, Kenya	
		Year: 2010	
		Agency: Water for People	
URL: http://akvo.org/products/akvoflow/			(Hutchings et al, 2012)
Human Sensor Web (H2.0)	This project is aimed at developing community-driven services for focused and geo-referenced monitoring of water supply and sanitation coverage in Zanzibar. The community used mobile phones to report if a water point was dry, out-of-order, or if the water was not potable.	Tools: Mobile phones	UN Habitat, google.org, GTZ Kenya, Water Services Trust Fund Kenya, WaterAid, Zantel, Zanzibar Water Authority (ZAWA), Upande, iNet/ Zanzibar Datacom Ltd.
		Country: Zanzibar (Tanzania)	
		Year: 2008-2010	
		Agency: University of Twente, Twente Institute for Wireless and Mobile Communications and Initiative for Geospatial Open Source Software	
URL: http://52north.org/resources/references/sensor-web/h20 and http://geonetwork.itc.nl/zanzibar			(Hutchings et al., 2012)

ICT	Summary		Stakeholders
Jisomee Mita	Jisomee Mita enables water consumers to use a mobile phone to query and receive current water bills at a frequency of their convenience by sending their meter reading to NCWSC and receiving instant feedback. A customer takes the meter readings as trained, sends the reading by phone using SMS to NCWSC. NCWSC then calculates the water consumed and sends a response SMS indicating consumption and the amount to be paid.	Tools: Mobile phones, SMS Country: Kenya Year: 2014 Agency: Nairobi City Water and Sewerage Company (NCWSC)	NCWSC, WSP of the World Bank
URL: http://nwater.jambopay.co.ke/accountcheck.php and http://jisomeemita.blogspot.ca/search/label/NairobiCityWaterandSewerageCompanyNCWSC			
M4W (Mobiles for Water)	The M4W project aims to improve water and sanitation in rural parts of Uganda by enabling access to information by various stakeholders and players in the Water and Sanitation sector. The M4W project uses SMS messages and openXdata application on Java-based mobile phones and web interfaces to collect information. Once collected, the data is uploaded to a customized District Water Management Information System (DWMIS) that is hosted on the Internet. This data can be accessed and viewed by all relevant stakeholders.	Tools: Mobile Phones and District Water Management Information System Country: Uganda Year: 2011 Agency: Makerere University	SNV (Uganda), Makerere University, IRC/Triple-S, Water Aid (Uganda)
URL: http://m4water.org/			
MajiData	MajiData is an online database that aims to assist the Water Service Providers (WSPs) and Water Services Boards (WSBs) to prepare tailor-made water supply and sanitation proposals for the urban slums and low income areas located within their service areas.	Tools: Website County: Kenya Year: 2011 Agency: Kenya's Ministry of Water and Irrigation (MWI) and the Water Services Trust Fund (WSTF)	GIZ, UN-Habitat, Google.org, the ITC Faculty of Geo-Information Science and Earth Observation (University of Twente) and Upande (all part of the H2.0 initiative; http://www.h20initiative.org). Website development was funded by UN-Habitat, the German Development Bank (KfW), Google.org, GIZ and the WSTF.
URL: http://wstf.go.ke/toolkit/Downloads/1.%20Introducing%20MajiData%20(brochure).pdf and http://www.majidata.go.ke/			

ICT	Summary		Stakeholders
M-Maji	M-Maji is a mobile application to improve clean water access in the slums. M-Maji enables residents in Kibera to access information about water from vendors. M-Maji provides water information system that aims to empower under-served communities with better information about water availability, price, and quality.	Tools: Mobile phones	Stanford University, Umande Trust
		Country: Kenya, Nairobi	
		Year: 2013	
		Agency: Stanford University, Umande Trust	
URL: https://mmaji.wordpress.com/			(Hellström & Jacobson, 2014)
MajiMatone	MajiMatone is a mobile-enabled technology tool that encouraged citizens to put pressure on local government to address problems with their rural water supplies. SMSs were used to get citizens involved, and the media was used to amplify their voices and increase local government accountability for water services, with a focus on repairing broken down water points and ensuring accountability.	Tools: Mobile Phones	DFID, Twaweza, Daraja and District Water Engineers
		Country: Tanzania	
		Year: 2010 – 2011	
		Agency: Daraja	
URL: http://www.daraja.org/our-work/rtwp			(Hutchings et al., 2012)
MajiVoice	ICT application used to improve communication between citizens and Nairobi City Water and Sewerage Company	Tools: Mobile Phones (SMS)	World Bank, Nairobi City Water and Sewerage Company
		Country: Kenya	
		Year: launched 2013	
		Agency: World Bank, Nairobi City Water and Sewerage Company	
URL: http://www.majivoice.com/Introduction%20to%20MajiVoice			
Mobile field assistant	NCWSC uses a mobile meter reader, the “mobile field assistant” to perform meter reading functions. The mobile field assistant uses smartphones to collect information on geo-references, meter readings and location of households.	Tools: Mobile phones	Nairobi City Water and Sewerage Company
		Country: Kenya	
		Year: 2014	
		Agency: Nairobi City Water and Sewerage Company	
URL: http://www.nairobewater.co.ke/index.html			

ICT	Summary		Stakeholders
M-Pesa	M-Pesa is a mobile phone-based money transfer and micro-financing service that was launched in 2007 by Vodafone for Safaricom, the largest mobile network operator in Kenya. M-Pesa allows users with a national ID card or passport to deposit, withdraw, and transfer money easily with a mobile device.	Tools: Mobile phones	Safaricom
		Country: Kenya, Tanzania, South Africa, India, Afghanistan	
		Year: 2007	
		Agency: Safaricom	
(Shared Value Initiative, 2012); (R Hope et al., 2011); (Rob Hope, Foster, Krolkowski, & Cohen, 2011)			
mSchool	mSchool is an SMS tool to report and monitor water and sanitation in schools. It enables students, parents, and teachers to monitor and report on school sanitation facilities. Users send formatted SMSs when school hand-pumps, toilets or hand-washing systems are in need of repair. mSchool forwards alerts to local plumbers and contractors in charge to quickly fix problems. All the information (SMSs) exchanged is mapped in real time on mSchool and on dedicated monitoring and evaluation dashboards for the Ministry of Education, local governments, and civil society to track the complaints made and if they have been met.	Tools: Mobile Phones	Manobi
		Country: Senegal	
		Year: 2013	
		Agency: Manobi	
URL: http://www.nytimes.com/2013/04/19/technology/competition-designed-to-spread-basic-technologies.html?_r=1& and http://appcircus.com/apps/mschool			
mWater (Manobi)	A mobile-to-web based application for consumers and water service providers (WSP) to support management of water access in both peri-urban and rural areas.	Tools: Mobile Phones (SMS)	Manobi
		Country: Senegal, Mali, Benin and Niger	
		Year: 2007	
		Agency: Manobi, WSP, Ministry of Water Senegal	
URL: http://mwater.v3.manobi.com/senegal/			(Smertnik, 2014) (Hellström & Jacobson, 2014)
mWater (USAID)	Low-cost mobile platform tool for testing quality of water	Tools: Mobile Phones (SMS)	USAID
		Country: Tanzania, Rwanda, Ethiopia	
		Year: Launched 2013	
		Agency: USAID	
URL: http://www.humanipo.com/news/30188/usaids-injects-100000-into-mwater-startup/ and http://www.mwater.co/news/water-cooperation/ and http://www.mwater.co/news/div/			

ICT	Summary		Stakeholders
NextDrop	NextDrop is an SMS-based software product that lets citizens know when they are getting water, when there is a delay in supply, when there is pipe damage that might affect supply and when water updates are provided by a community member.	Tools: Google Maps, mobile phones, SMS	Gates Foundation, University of California Berkeley School, Deshpande Foundation, Karnataka Water Board, Hubli-Dharwad Municipal Corporation (HDMC)
		Country: India	
		Year: 2010	
		Agency: NextDrop	
URL: www.nextdrop.org and http://social.yourstory.com/2013/11/american-dropped-college-solve-problem-water-supply-india/ and http://www.ischool.berkeley.edu/files/student_projects/nextdrop_final_report.pdf			
NFC RFID-Tracked Drinking Water	Programmed near-field communication (NFC) phones with radio-frequency identification (RFID) for use by Haitian water technicians are used to track chlorine usage in thousands of households, identified by NFC tags on the drinking water buckets in homes.	Tools: Mobile phones	Nokia Research Center, Palo Alto, Public Health School of a university (UC Berkeley), and Deep Springs International (DSI) Haiti.
		Country: Haiti	
		Year: 2011	
		Agency: Deep Springs International (DSI)	
URL: http://www.nfcworld.com/2011/03/11/36414/nfc-phones-help-provide-clean-water-to-haiti-earthquake-victims/ and http://www.upm.com/EN/MEDIA/All-news/Pages/Battling-cholera-with-NFC-RFID-tracked-drinking-water-in-Haiti.aspx			(Kaye, Holstius, &Seto, 2012)
Smart Handpumps	Smart Handpumps are cell-phone networks based on low-cost technology for automated monitoring of water sources. SIM-cards are placed inside hand pump handles to provide real-time monitoring of hand pump functionality. It introduces the possibility of a shift to fully-automated systems of management and monitoring of water sources.	Tools: Mobile phones and network providers	Oxford University
		Country: Kenya, Zambia	
		Year: 2011	
		Agency: Oxford University	
URL: http://oxwater.co.uk/#/smart-handpumps/4559322273			(Smith School Water Programme, 2014)
Smart Water Metering	Smart water metering refers to a system that measures water consumption or abstraction and communicates that information in an automated fashion for monitoring and billing purposes. Smart meters differ from conventional meters in that they measure consumption in greater detail and transmit that information back to the service provider without the need for manual readings.	Tools: Cell phone networks	UK Department for International Development (DfID)
		Country: Kenya, Zambia	
		Year: 2002	
		Agency: UK Department for International Development (DfID)	
URL: http://r4d.dfid.gov.uk/PDF/Outputs/Water/SmartWaterSystems_FinalReport-Main%28Reduced%29_April2011.pdf		(R Hope et al, 2011), (Oracle, 2009)	

ICT	Summary		Stakeholders
Taarifa	Taarifa is an open source web application that enables public officials to tag and respond to citizen complaints about the delivery of sanitation services. The application focuses on how local councils could increase the quality of their public service and become more responsive to reported problems. It also offers citizens a channel for engaging with local councils.	Tools: Mobile phones	Bill and Melinda Gates Foundation, Nokia, Toilet Hackers.
		Country: Tanzania, Uganda, Ghana	
		Year: 2011	
		Agency: Taarifa	
URL: www.Taarifa.org and http://appcircus.com/apps/taarifa			
Text to Change	TTC is a mobile solution for social change. The idea is based on using mobile phones as a driving force in effective communication and positive change. TTC enables sending and receiving text messages plus analysis and interpretation of the data.	Tools: Mobile phones (SMS)	Text to Change
		Country: worldwide (five continents)	
		Year:	
		Agency: Text to Change	
URL: http://www.ttcmobile.com/			
Water Point Mapper	Tool used to produce maps showing water supply points and their status.	Tools: Google Earth and Microsoft Excel	WaterAid, SNV, Ingeniería Sin Fronteras - ApD, Concern
		Country: Malawi, Ethiopia, Uganda, Kenya, Ghana, Tanzania	
		Year: 2010	
		Agency: WaterAid	
URL: http://en.wikipedia.org/wiki/Water_point_mapping and http://www.waterpointmapper.org/ and http://sustainablewash.org/resource/tool-2			
Water Quality Reporter	Water Quality Reporter (WQR) a low-cost, sustainable water test that can be used widely in low-resource settings in developing countries. The application was designed because monitoring drinking water quality and water sources is critical to the delivery of safe drinking water and yet water quality testing in rural areas is challenging due to the fact that labs for water quality analysis tend to be concentrated in urban areas.	Tools: Mobile phones	University of Bristol, Aquaya Institute, Health Protection Agency, University of Cape Town, PATH, UC Berkeley, University of North Carolina, University of Southampton, and University of Surrey, European Union and Bill and Melinda Gates Foundation
		Country: South Africa, Mozambique, Vietnam and Cambodia	
		Year: 2009	
		Agency: iCOMMS	
URL: www.icomms.uct.ac.za/about_aquatest			(Champanis & Rivett, 2012)

ICT	Summary		Stakeholders
WATEX	WATEX is a groundwater exploration package used to locate renewable ground water reserves in arid and semi-arid environments.	Tools: Satellite	RTI, UNESCO, UNICEF
		Country: Kenya, Chad, Sudan	
		Year: 2004, 2006, 2013	
		Agency: RTI	
URL: www.rtiexploration.com/watex/ and http://eeas.europa.eu/ifs/publications/articles/book2/book%20vol2_part3_chapter41_watex%20-%20a%20new%20approach%20to%20preventing%20water%20based%20conflicts_alain%20gachet.pdf and http://landsat.gsfc.nasa.gov/?p=6404			

Annex 2: Analysis of WASH ICT Tools in Country Case Studies

Condition	Dimension	Case Study – E-Water Payment Platform, Uganda
Information Needs (Existing information ecologies)	<ul style="list-style-type: none"> • Information needs • Communication needs • Communication channels • Information Gaps 	<p>The key driver for the tool was the need for the National Water and Sewerage Corporation (NWSC) to relinquish non-core services and focus more on its core activity of water service provision; coupled with the need to reduce costs associated with running cash offices and bill collections.</p>
Access to ICTs (ICT infrastructure)	<ul style="list-style-type: none"> • Access to electricity • Access to ICT infrastructure • Geographic location 	<p>The areas served by the utility, urban areas and towns, have access to electricity and are covered by all the major telecom providers in Uganda.</p> <p>All telecom providers currently support mobile money payment platforms.</p> <p>The Financial institutions that NWSC partners with are strategically located in the urban centers and towns so customers have access to payment points.</p>
Basic use of ICTs (simple ICT use)	<ul style="list-style-type: none"> • Literacy rates • Level of education • Socio-cultural context • Basic ICT training 	<p>The e-water payment platform is appropriate for the customers served by the utility.</p> <p>Since the utility serves a vast number of users country wide it uses English as opposed to a local language, which has not impeded usage.</p> <p>Residents are either literate or semi-literate, but capable of using technology to make payments or their banks to effect payments to the utility without needing to be trained.</p>
Meaningful use of the ICT tool (level of use of the tool)	<ul style="list-style-type: none"> • ICT capacity building • Local and relevant content • Technical local appropriation • Sustainability 	<p>The closure of cash offices at NWSC forced customers to use the e-water payment system.</p> <p>The existing infrastructure within the financial institutions and telecom providers to support mobile payments has greatly contributed to the sustainability of the payment platform.</p> <p>NWSC has set up a reconciliation unit to deal with exceptions of erroneous payments and has also revamped its customer care center to respond to customer queries.</p> <p>The system is integrated with the billing system and customers are able to request their bills and make payments without physically going to the utility offices but rather using of their phones.</p>
Enhanced information capability (multiplier effect)	<ul style="list-style-type: none"> • ICT capabilities • Information literacy • Communication capabilities • Content capabilities • Local technical and social appropriation 	<p>As a result of the convenience that mobile technology gives to customers, more are using the mobile phones to pay for services instead of walking to the banks or financial institutions. This is also driven by the ability to query how much one owes the utility and immediately proceed to the payment options provided.</p> <p>The service is not complicated and no complaints have been lodged by the utility in terms of the technology itself since the service was extended to support mobile payments.</p> <p>The utility has registered improvements in payments since customers are able to pay outside office hours and on weekends.</p>

Condition	Dimension	Case Study – M4W, Uganda
Information Needs (Existing information ecologies)	<ul style="list-style-type: none"> • Information needs • Communication needs • Communication channels • Information Gaps 	<p>Prior to the development of M4W, SNV (one of the implementers) carried out research on the poor functionality of rural water supply.</p> <p>The need identified was twofold: a lack of reliable information on rural water sources and the need to facilitate reporting and repair of faults in rural communities.</p>
Access to ICTs (ICT infrastructure)	<ul style="list-style-type: none"> • Access to electricity • Access to ICT infrastructure • Geographic location 	<p>The typical users of the M4W initiative are based in rural communities with very limited access to electricity and unstable telecom coverage.</p> <p>Community users and hand pump mechanics have to move to nearby towns (or trading centers) to have their phones charged at a cost.</p> <p>This has resulted in loss of phone batteries as batteries are easily swapped and the phones themselves are stolen at the charging centers, resulting in additional expenses for the implementers.</p>
Basic use of ICTs (simple ICT use)	<ul style="list-style-type: none"> • Literacy rates • Level of education • Socio-cultural context • Basic ICT training 	<p>The community users are typically rural farmers, semi-literate and use their phones for voice calls as opposed to SMS.</p> <p>The M4W application was developed in English and yet many rural handpump mechanics are semi-literate. A number of them were discontinued and replaced with those who could use the phones. In other districts, users had to bring along people who would later re-train them on how to use the phone and the system.</p> <p>This has caused delays in submitting information to the system and has also caused the need for more training, which the implementers are not in a position to continue funding.</p>
Meaningful use of the ICT tool (level of use of the tool)	<ul style="list-style-type: none"> • ICT capacity building • Local and relevant content • Technical local appropriation • Sustainability 	<p>The M4W application has not yet been integrated with the Ministry's information system to support automatic information updates. With no linkages to any other systems, the M4W system is still operated and managed by the developer (Makerere University) and stakeholders are given access to download reports or files that they can use to lobby for funding and for their own planning.</p> <p>The ministry is not yet keen on taking over the M4W initiative and this makes its sustainability and use in the districts very uncertain especially when the implementation or project period for the implementers comes to an end.</p> <p>Failure to create a business model around the use of M4W especially for the hand pump mechanics resulted in low use of the technology. The M4W implementers are certain that if handpump mechanics start to see the M4W phone as a tool that supports their business, since they get paid for repairing community water sources and collecting data, they would have optimum use for this tool and eventually make it sustainable for themselves</p>

<p>Enhanced information capability (multiplier effect)</p>	<ul style="list-style-type: none"> • ICT capabilities • Information literacy • Communication capabilities • Content capabilities • Local technical and social appropriation 	<p>The M4W has been considered a successful initiative because it has demonstrated that mobile-based tools can:</p> <ol style="list-style-type: none"> a. Work in rural settings. b. Offer an approach that is easier, more cost effective and offers more reliable data than current paper-based methods and systems in use by the ministry. c. Provide and update data substantially faster than it took the ministry to compile data in the past. <p>However, the uptake of the tool among community members is low mainly due to the cost of reporting a fault and poor sensitisation on how to report faults. Part of the reason for this is that no funding had been put aside for the sensitisation activities and the districts are not financially able to run the M4W activities without the help of the implementers.</p>
<p>Condition</p>	<p>Dimension</p>	<p>Case Study – MajiData, Kenya</p>
<p>Information needs (Existing information ecologies)</p>	<ul style="list-style-type: none"> • Information needs • Communication needs • Communication channels • Information Gaps 	<p>MajiData was conceptualized in 2008 by GIZ in response to the need for reliable pro-poor planning data that was identified and prioritized as a key undertaking during the 2007 water sector review performance. Before MajiData, information on informal settlements/urban poor was scarce and often unreliable.</p>
<p>Access to ICTs (ICT infrastructure)</p>	<ul style="list-style-type: none"> • Access to electricity • Access to ICT infrastructure • Geographic location 	<p>MajiData is a web-based application that requires Internet connection. GoK has invested heavily in ICT infrastructure and connectivity which facilitates its use.</p> <p>Statistics from KCC indicate an increase of over 18 million Internet subscribers over the last 10 years, an indicator of the high potential of ICT use in Kenya and for MajiData.</p>
<p>Basic use of ICTs (simple ICT use)</p>	<ul style="list-style-type: none"> • Literacy rates • Level of education • Socio-cultural context • Basic ICT training 	<p>The application is currently used by WSPs, CSOs working in urban poor settlements, WSBs and WASREB. All these already use ICTs in their operations, so can easily navigate and use the tool, which is simple and user-friendly, especially given that the current user rights outside WSTF are limited to viewing reports and data sets.</p> <p>However, with service provision devolved to counties, their capacity to use web-based applications needs to be established.</p> <p>Currently there is no linkage or direct interoperability between applications in use and MajiData; all users outside WSTF have to extract data from the MajiData platform and perform any required analysis using other tools. This is time-consuming and compromises ownership of information provided.</p>

<p>Meaningful use of the ICT tool (level of use of the tool)</p>	<ul style="list-style-type: none"> • ICT capacity building • Local and relevant content • Technical local appropriation • Sustainability 	<p>MajiData provided a comprehensive database on urban poor statistics. However as the initiative was project driven, no updates have been made to the data since 2011, which raises questions in terms of its continued relevance.</p> <p>Application development and deployment was done in a participatory manner. Key stakeholders were able to define their requirements. This facilitated meaningful use of the data and confidence in the planning and resource allocation at the time.</p> <p>MajiData user rights are limited, with only WSTF having full rights to directly manipulate data on the platform. However, users (WASREB, CSOs as represented by KEWASNET and WSPs) are currently manually exporting data to undertake analytical assessments as part of their performance reporting and advocacy work.</p>
<p>Enhanced information capability (multiplier effect)</p>	<ul style="list-style-type: none"> • ICT capabilities • Information literacy • Communication capabilities • Content capabilities • Local technical and social appropriation 	<p>The MajiData experience has helped highlight the need for reliable information - strengthening the M&E systems and support the increase in size and technical capacity of the WSTF IT department.</p> <p>WSTF funding is now better targeted and beneficiaries (WSPs) are able to attract funding even outside WSTF because of the increased confidence in data provided to justify their funding proposal.</p> <p>The application enabled availability of reliable planning data and provided the WSTF a basis for evaluation of funding proposals to ensure equity of access as well as better targeting of available and limited resources. WSTF has reported increased value for money and transparency of its finance allocations.</p> <p>In the future KEWASNET intends to build a knowledge management center and anticipates using MajiData as one of its information bases.</p>
<p>Condition</p>	<p>Dimension</p>	<p>Case Study – mWater, Tanzania</p>
<p>Information needs (Existing information ecologies)</p>	<ul style="list-style-type: none"> • Information needs • Communication needs • Communication channels • Information Gaps 	<p>mWater is a smartphone application that was developed to serve a dual function: to update the functionality status of water points and to monitor the water quality of the water point.</p> <p>A baseline study revealed the need for water quality information to influence the choice of safe water sources with the communities.</p>
<p>Access to ICTs (ICT infrastructure)</p>	<ul style="list-style-type: none"> • Access to electricity • Access to ICT infrastructure • Geographic location 	<p>Access to mobile phones in Mwanza is high, which favored the development and use of the mWater app.</p> <p>The geographical location of the project area was also an enabling factor. The project area consisted of a mix of piped water supply and point water sources. In addition, the communities behavioral practice of using multiple water sources, created the need for water quality information on the point sources.</p> <p>The choice of an ICT solution was borne out of the need for real-time, low resource information.</p>

<p>Basic use of ICTs (simple ICT use)</p>	<ul style="list-style-type: none"> • Literacy rates • Level of education • Socio-cultural context • Basic ICT training 	<p>The application has been put to meaningful use, as evidenced by the upgrades to allow for interpretation to the local language; inspection of the water source; increase privacy of the data; enabling access from various platforms such as smartphones and androids and allowing for updating of information that was collected in the absence of an Internet connection. These upgrades were intended to enhance relevance and uptake of the tool.</p> <p>The use of the ICT was however hindered by the technical nature of the information required. While the communities were able to use mobile phones (and therefore the mWater app), they were not able to carry out the water quality tests and to interpret the water quality parameters tested.</p>
<p>Meaningful use of the ICT tool (level of use of the tool)</p>	<ul style="list-style-type: none"> • ICT capacity building • Local and relevant content • Technical local appropriation • Sustainability 	<p>The capacity of the community members to participate in the data collection was low.</p> <p>The technical nature of water quality testing (testing of physio-chemical and biological parameters) meant that the community members were not equipped to perform the field tests. The project participants therefore consisted of staff of the mWater project, of MWAUWASA, MCC, and LVBWO who were then charged with explaining the test results to the communities.</p> <p>The use of the information was impeded by a lack of remedial action on water sources that were found to be contaminated. The communities expected the project or the government to provide an alternative safe source. Some communities however took remedial steps and applied for connection to the piped water network.</p>
<p>Enhanced information capability (multiplier effect)</p>	<ul style="list-style-type: none"> • ICT capabilities • Information literacy • Communication capabilities • Content capabilities • Local technical and social appropriation 	<p>There has been a multiplier effect created by the availability of information collected by mWater:</p> <p>The MCC has increased the level of inspection of water sources.</p> <p>The MCC has used the water quality information collected to design hygiene and public health awareness programs and to implement household treatment/ disinfection of drinking water.</p> <p>Communities that have polluted water sources have requested for connection to the piped water system.</p> <p>There is potential to increase the functions of the application to enhance operational efficiency of MWAUWASA. The project is considering expansion of the functionality of the application to include meter reading and identification of pipe leakages.</p>
<p>Condition</p>	<p>Dimension</p>	<p>mWater (Manobi), Niger</p>
<p>Information needs (Existing information ecologies)</p>	<ul style="list-style-type: none"> • Information needs • Communication needs • Communication channels • Information Gaps 	<p>Prior to the mWater pilot almost no regular documentation was kept on the management of rural water supply systems in Niger.</p> <p>The implementation of mWater was based on the following needs as defined by the Ministry of Water and Sanitation (MHA):</p> <ul style="list-style-type: none"> • Oversee the provision of water services and improve water use management, daily operations and maintenance of the network. • Create a billing system to support the production of clear financial systems and encourage investment • Map community water points. • Collect data on consumption to better evaluate demand.

Access to ICTs (ICT infrastructure)	<ul style="list-style-type: none"> • Access to electricity • Access to ICT infrastructure • Geographic location 	<p>Prerequisites for successful ICT use, namely electricity, telecom coverage and access to ICT tools are limited in Niger, given its vast area of 1,267,000 km².</p> <p>In the pilot region of Tahoua, lack of electricity and purchasing power were key challenges. The equipment used which enabled success of the pilot phase was largely based on subsidies. It would have been difficult for users themselves to purchase the necessary equipment for data collection and analysis</p>
Basic use of ICTs (simple ICT use)	<ul style="list-style-type: none"> • Literacy rates • Level of education • Socio-cultural context • Basic ICT training 	<p>The literacy rate in Niger is very low, even more so in the rural areas where 75 percent of the 17 million rural population is illiterate; this required additional efforts during implementation to ensure the efficient operation of the tool.</p> <p>Once trained users were able to use the application to transmit data when the access conditions were met (such as network connectivity).</p> <p>The poverty level of the municipalities hampers the implementation of the tool.</p> <p>The connection costs in Niger are very high and the spread of mobile phones reaches only 39.3 percent of the population.</p> <p>Despite the simplicity of the application's user interface successful implementation and use were limited by the local conditions.</p>
Meaningful use of the ICT tool (level of use of the tool)	<ul style="list-style-type: none"> • ICT capacity building • Local and relevant content • Technical local appropriation • Sustainability 	<p>12 months after the introduction of mWater, enough key data on the management of rural water systems was collected to allow for accurate performance assessment of private operators managing 62 rural water points. Through the provision of data mWater has also supported the regulatory mission of the MHA.</p> <p>The pilot project was deemed so successful that the ministry is committed to extending the system to the whole country. Successful scale-up of the pilot project will require financial and human resources support, along with a coherent exit strategy for donor organizations to ensure sustainability.</p>
Enhanced information capability (multiplier effect)	<ul style="list-style-type: none"> • ICT capabilities • Information literacy • Communication capabilities • Content capabilities • Local technical and social appropriation 	<p>Given optimal operability conditions, mWater has the potential to be an ideal tool for effective management of rural water supply, especially in the decentralized context of Niger, where water supply management has been transferred to the districts/municipalities.</p> <p>However, successful implementation and use of the tool is hampered by limited infrastructure, illiteracy, lack of financial resources at the district level and in Niamey and current dependency on donor organizations.</p>
Condition	Dimension	mSludge, Senegal
Information needs (Existing information ecologies)	<ul style="list-style-type: none"> • Information needs • Communication needs • Communication channels • Information Gaps 	<p>mSludge was designed with the vision of improving poor households' access to sanitation services - specifically the mechanical emptying of septic tanks. Due to a lack of awareness and income constraints, only 60 percent of low-income households use desludging services.</p> <p>Though the use of mobile phones and a call center, mSludge seeks to improve market effectiveness by facilitating the rapid connection of supply (mechanical emptying operators with vacuum desludging trucks - VDT) and demand (households) at affordable rates.</p>

Access to ICTs (ICT infrastructure)	<ul style="list-style-type: none"> • Access to electricity • Access to ICT infrastructure • Geographic location 	mSludge is currently operational only in urban areas, specifically Dakar, where access to electricity and telecom coverage is adequate.
Basic use of ICTs (simple ICT use)	<ul style="list-style-type: none"> • Literacy rates • Level of education • Socio-cultural context • Basic ICT training 	<p>The numbers of auctions held and requests handled reported by the various partner organizations indicate that the tool is being successfully adopted.</p> <p>The tool is enabling competition amongst the operators through online auctions – pushing down the cost of the service and optimizing the use of the VDT through geolocation.</p> <p>Uptake of the tool by households and operators is simple as it is based on technology already in use (voice and SMS).</p> <p>Households appreciate the ease of finding a desludging service provider via the call center, are satisfied with the customer service and are recommending the service to their neighbors. The operators appreciated the ease of use and implementation, appreciated the ease of connecting with customers and are learning more in terms of customer service (location, timing.).</p>
Meaningful use of the ICT tool (level of use of the tool)	<ul style="list-style-type: none"> • ICT capacity building • Local and relevant content • Technical local appropriation • Sustainability 	<p>The mapping capabilities of mSludge allow for the collection of socio-economic data and the creation of a database on sanitation facilities within the project area.</p> <p>As mSludge breaks with the traditional professional practices of the desludging market, it could be seen as a threat, especially to the employment of operators unfamiliar with ICTs.</p> <p>Despite some reluctance on the part of the operators in regards to the geolocation application (mFleet) - which was largely due to monthly running costs on each truck – the president of the association indicated a good sense of ownership.</p>
Enhanced information capability (multiplier effect)	<ul style="list-style-type: none"> • ICT capabilities • Information literacy • Communication capabilities • Content capabilities • Local technical and social appropriation 	<p>Data on septic tank or latrine pit access is continuously collected to better reflect the needs of the households. For example, household accessibility by the septic trucks is often a constraint so data on length of connection required is collected.</p> <p>The data produced by mSludge is used for more effective management of sanitation services.</p> <p>ONAS has access to the data produced by mSludge and can use it to monitor sector performance indicators, to evaluate mSludge and the impact the tool has on the provision of sanitation services.</p>
Condition	Dimension	mWater (Manobi) - Senegal
Information needs (Existing information ecologies)	<ul style="list-style-type: none"> • Information needs • Communication needs • Communication channels • Information Gaps 	<p>mWater addresses the lack of data on the management of rural water systems and their financial status.</p> <p>mWater allows for real-time information sharing, between users, service providers, consumers and government to ensure better monitoring of operations and infrastructure as well as the supply and demand for drinking water.</p> <p>The ASUFORs who are the main users are responsible for sending daily SMS to the mWater platform for the following indicators: production levels (volume); functionality (functional or not); and the fund account balance (financial profitability).</p>

Access to ICTs (ICT infrastructure)	<ul style="list-style-type: none"> • Access to electricity • Access to ICT infrastructure • Geographic location 	<p>Data collection is dependent on availability of electricity to ensure that phones are charged - charging points are accessible even in rural areas.</p> <p>Similarly, 2G and 3G networks are accessible in most of the country.</p>
Basic use of ICTs (simple ICT use)	<ul style="list-style-type: none"> • Literacy rates • Level of education • Socio-cultural context • Basic ICT training 	<p>Data collectors need to be trained in the operation of the tool and users of the tool need to be trained in the different methods of data use and analysis.</p> <p>Users of the tool (ASUFORs and PEPAM) have the capability to use the tool once trained especially as the application makes use of technologies already in use (mobile phones, SMS, internet).</p> <p>The application can be used on available technologies including GSM mobile phones (“feature phones”) for the recording of data by SMS or data storage, and/or smartphones with GPS for geotagging and the internet and online tools for submission, analysis and visualization of the data with tools such as a dashboard. Users with smart phones can also access the internet for analysis on the job.</p>
Meaningful use of the ICT tool (level of use of the tool)	<ul style="list-style-type: none"> • ICT capacity building • Local and relevant content • Technical local appropriation • Sustainability 	<p>mWater supports the collection of a large amount of data at the local level with which PEPAM can improve the governance of rural water.</p>
Enhanced information capability (multiplier effect)	<ul style="list-style-type: none"> • ICT capabilities • Information literacy • Communication capabilities • Content capabilities • Local technical and social appropriation 	<p>PEPAM has sufficient resources to use mWater in its current form, but any changes and updates to the application requires significant inputs from Manobi.</p> <p>For the ASUFORs, training and awareness sessions are conducted to further improve ownership of the tool.</p> <p>The data collected can improve the management and monitoring of water supply systems. In total, nearly 30,000 water points across the country have been referenced using the mWater system and over 1,000 of these points have mWater+ advanced service.</p> <p>PEPAM is using data collected by the tool to assess and monitor the achievement of its goals in the rural sector. The WASH sector in Senegal would benefit from setting up an integrated platform between PEPAM, Sénégalaise de l’Eau (SDE), Office National de l’Assainissement (ONAS), DGPRES, NGOs and other sector stakeholders to maximize use of the data.</p>
Condition	Dimension	mWater (Manobi) - Benin
Information needs (Existing information ecologies)	<ul style="list-style-type: none"> • Information needs • Communication needs • Communication channels • Information Gaps 	<p>mWater supports increased understanding and improved management practices, which will be essential as part of the upcoming transfer of close to 500 rural water supply systems to private operators.</p> <p>mWater allows stakeholders and operators of rural water supply systems to be in direct and continuous communication in order to share the necessary information on the operation and management of the rural water supply systems (RWSS).</p>

Access to ICTs (ICT infrastructure)	<ul style="list-style-type: none"> • Access to electricity • Access to ICT infrastructure • Geographic location 	The ICT infrastructure is generally developed enough to support the operation of the tool. Although some rural operators did face connectivity issues and had to resort to specialized solutions, such as USB modems, to access the web platform.
Basic use of ICTs (simple ICT use)	<ul style="list-style-type: none"> • Literacy rates • Level of education • Socio-cultural context • Basic ICT training 	<p>Use of mWater requires a basic level of literacy. Data collection is done using widely used feature phones while smartphones are required to perform more advanced operations such as geo-referencing of systems.</p> <p>The impact of connection costs are limited as Internet is only required for specific tasks such as viewing back data or generating reports.</p>
Meaningful use of the ICT tool (level of use of the tool)	<ul style="list-style-type: none"> • ICT capacity building • Local and relevant content • Technical local appropriation • Sustainability 	<p>The implementation of mWater strengthens user capabilities, as the application acts as a support system for operators in the field.</p> <p>The mapping and inventory of assets create a knowledge base that can be employed by WASH stakeholders.</p>
Enhanced information capability (multiplier effect)	<ul style="list-style-type: none"> • ICT capabilities • Information literacy • Communication capabilities • Content capabilities • Local technical and social appropriation 	Data analysis facilitates the monitoring and development of the water sector, while dashboards available via the online platform facilitate the visualization and interpretation of the data by all actors.
Condition	Dimension	AkvoFLOW - Liberia
Information needs (Existing information ecologies)	<ul style="list-style-type: none"> • Information needs • Communication needs • Communication channels • Information Gaps 	<p>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.</p> <p>Communication channels are restricted, given the limited penetration and high cost of mobile telephony services and electricity.</p> <p>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</p>
Access to ICTs (ICT infrastructure)	<ul style="list-style-type: none"> • Access to electricity • Access to ICT infrastructure • Geographic location 	<p>Access to electricity is not an issue in Government of Liberia county offices, but it is an issue at the local and community level.</p> <p>Neither electricity nor internet connectivity is essential 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.</p>

<p>Basic use of ICTs (simple ICT use)</p>	<ul style="list-style-type: none"> • Literacy rates • Level of education • Socio-cultural context • Basic ICT training 	<p>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.</p> <p>These could present challenges when and if AkvoFLOW is used at the local and community level.</p> <p>Connectivity costs are high, but offline data collection mitigates this problem. In more remote locations, smartphone batteries and SD cards are essential.</p> <p>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 program design.</p>
<p>Meaningful use of the ICT tool (level of use of the tool)</p>	<ul style="list-style-type: none"> • ICT capacity building • Local and relevant content • Technical local appropriation • Sustainability 	<p>AkvoFLOW has been assimilated and integrated into the operations of the organizations and agencies that have adopted it.</p> <p>Water point mapping provided a baseline in 2011, but data is outdated and needs to be reviewed Other WASH indicators need to be included beyond water point data, such as sanitation indicators</p> <p>The Government of Liberia and stakeholders using the application have taken ownership of the data collected and analyzed.</p> <p>The cost of using AkvoFLOW is significant.</p> <p>The long-term sustainability of using AkvoFLOW depends on Government of Liberia support, which has not been forthcoming. Sustainability still has a long way 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's and among NGOs.</p>
<p>Enhanced information capability (multiplier effect)</p>	<ul style="list-style-type: none"> • ICT capabilities • Information literacy • Communication capabilities • Content capabilities • Local technical and social appropriation 	<p>The National Water Sanitation and Hygiene Promotion Committee Secretariat manages the AkvoFLOW dashboard and uses it extensively. However, more technical issues require the intervention of Akvo specialists in the Netherlands.</p> <p>Capacitation on use of AkvoFLOW is now provided by the secretariat, which has acquired the skills to train and equip Government of Liberia employees with AkvoFLOW and smartphones configured for its use.</p> <p>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.</p>

Annex 3: Additional Resources

Impact of ICTs on Economic Development

- ACET, 2014. *Growth with Depth*, Accra, Washington,DC. Available at: <http://africantransformation.org/wp-content/uploads/2014/02/2014-african-transformation-report.pdf>
- AfDB, 2013. *Connecting Africa: An Assessment of Progress Towards the Connect Africa Summit Goals*, Tunis. Available at: www.afdb.org.
- AfDB, 2014. *Tracking Africa's Growth in Figures*, Tunis.
- APF, 2008. *ICT in Africa : Boosting Economic Growth and Poverty Reduction ICT in Africa : Boosting Economic Growth and Poverty Redution*.
- Deloitte, 2012. *eTransform Africa : Modernising Government through ICTs. Transformation-Ready: The strategic application of ICTs in Africa*, Available at: http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1346223280837/ModernizingGovernment_Fullreport.pdf.
- Devarajan, S. & Fengler, W., 2013. Africa's Economic Boom: Why the Pessimists and the Optimists are Both Right. *Council on Foreign Relations*, 92(3), pp.68–81. Available at: <http://www.heinonline.org/HOL/Page?handle=hein.journals/fora92&id=656&collection=journals#656>.
- Dzidonu, C., 2010. *The Role of ICTs to Achieving the MDGs in Education: An Analysis of the Case of African Countries by Technology in Government in Africa*.
- Fleshman, M., Essoungou, A. & Gillespie, J., 2011. Investing in Africa: Digging deep for new opportunities. *Africa Renewal*, (April). Available at: <http://www.un.org/africarenewal/sites/dr7.un.org.africarenewal/files/Africa-Renewal-April-2011-en.pdf>.
- Heeks, R., 2011. ICT and Economic Growth: Evidence from Kenya. *ICT4D*. Available at: <http://ict4dblog.wordpress.com/2011/06/26/ict-and-economic-growth-evidence-from-kenya/> [Accessed August 16, 2014].
- IDC 2014: *Breaking barriers with technology: A special report on the Kenyan ICT market. An examination of Kenya's ongoing technology-powered transformation and push to transition to a Knowledge Society and regional ICT powerhouse*.
- McKinsey, 2013. *Lions go digital : The Internet 's transformative potential in Africa*, Available at: http://www.mckinsey.com/insights/high_tech_telecoms_internet/lions_go_digital_the_internets_transformative_potential_in_africa.
- Omwansa, T., 2009. *M-PESA : Progress and Prospects*, Available at: <http://www.strathmore.edu/pdf/innov-gsma-omwansa.pdf>.
- RSA, 2013. *Millennium Development Goals: Country Report 2013*, Johannesburg.
- Safaricom, 2013. H1 FY14 Presentation. , (November), p.35. Available at: http://www.safaricom.co.ke/images/Downloads/Resources_Downloads/Half_Year_2013-2014_Results_Presentation.pdf.
- World Bank, 2011. *ICT in Agriculture: Connecting Smallholders to Knowledge, Nwtwokrs, and Institutions*. Available at: <http://www.ictinagriculture.org/content/ict-agriculture-sourcebook>
- Yonazi, E. et al., 2014. *The transformational use of information and communication technologies in Africa*, Washington DC.

Yonazi, E. et al., 2012. *The Transformational Use of Information and Communication Technologies in Africa.*, Washington DC. Available at: <http://documents.worldbank.org/curated/en/2012/05/17120711/transformational-use-information-communication-technologies-africa>.

Growth of Mobile Technology in Africa

- GSMA Intelligence, 2013. *Sub-Saharan Africa Mobile Economy*, Available at: www.gsmainelligence.com.
- Hope, R., Foster, T., Krolkowski, A., & Cohen, I. (2011). *Mobile water payments in urban Africa: Adoption, implications, and opportunities* (p. 35). UK.
- Hutchings, M. T., Dev, A., Palaniappan, M., Srinivasan, V., Ramanathan, N., & Taylor, J. (2012). *mWASH: mobile phone applications for the water, sanitation, and hygiene sector. Report for Nexleaf...* (p. 114). Retrieved from http://www.indiasanitationportal.org/sites/default/files/Full_Report_MWASH.pdf
- Rashid, A. T., & Elder, L. (2009). Mobile Phones and Development:, 1–16. Retrieved from <http://www.ejsdc.org/ojs2/index.php/ejsdc/article/viewFile/529/265>
- World Bank, 2012a. ICTs Delivering Home - Grown Development Solutions in Africa. Available at: <http://www.worldbank.org/en/news/feature/2012/12/10/ict-home-grown-development-solutions-in-africa>.

ICT Regulatory Policies

- AfDB, 2013. *Connecting Africa: An Assessment of Progress Towards the Connect Africa Summit Goals*, Tunis. Available at: www.afdb.org.
- CAK (Kenya) 2014: Quarterly sector statistics report - fourth quarter of the financial year 2013/14 (Apr-Jun 2014)
- ECA, 2007b. *The African Information Society Initiative (AISII): A decade's perspective*, Addis Ababa: United Nations Economic Commission for Africa (UNECA). Available at: www.uneca.org.
- Eberhard R & Kapika J (2013) Peer Review of the Urban Water Sector Regulatory System in Tanzania. ESAWAS
- Kimura, K., Omole, D.W. & Williams, M., 2011. *Yes Africa Can* P. Chuhan-Pole & M. Angwafo, eds., Washington, DC: World Bank.
- Ministry Of Information And Communications, Kenya: National Information & Communications Technology (ICT) Policy 2006
- Ministry of Water and Environment, "Water and Environment Sector Performance Report 2014," *Government of Uganda Report*, pp. 17–18, Oct., 2014.
- Ministry of Water and Environment website [Online]. Available: <http://www.mwe.go.ug/> . [Accessed: 11-Nov-2014].
- Ministry of Water and Irrigation & WSP (2014) Technical Workshop on Water Point Mapping in Tanzania: Report on Workshop Proceedings. Dar es Salaam, Tanzania
- MWAUWASA (2011) Mwanza Urban Water and Sewerage Authority Business Plan July 2011 – June 2014. Mwanza, Tanzania
- MOWI (2006) National Water Sector Development Strategy 2006 to 2015 Ministry of Water and Irrigation, Government of Tanzania. Dar es Salaam, Tanzania
- MOWI (2014) Water Sector Development Program: Roadmap for the Institutionalization and Enhancement of the Water Point Mapping System. United National University, Water Development and Management Institute and Ministry of Water and Irrigation, Government of Tanzania. Dar es Salaam, Tanzania.

Government of Tanzania, (2002). National Water Policy. URT

WASREB 2014: Impact 2014 - A Performance Review of Kenya's Water Services Sector 2012 - 2013

Recommendations for ICTs in WASH

Champanis, M. et al., 2013. *ICTs in the water sector – where do we stand ?*

Champanis, M., & Rivett, U. (2012). Reporting water quality: a case study of a mobile phone application for collecting data in developing countries. *Technologies and Development*, 105–114. Retrieved from <http://dl.acm.org/citation.cfm?id=2160688>

Densmore, M., 2012. Claim Mobile: When to Fail a Technology. , pp.1840 – 1842

Dimagi, 2013. CommCare. , (MA 02129), pp.1–6. Available at: <http://indigotruster.files.wordpress.com/2013/08/commcare-overview-august-2012.pdf>.

Heeks, R. (2002). Information Systems and Developing Countries: Failure, Success, and Local Improvisations. *The Information Society*, 18(2), 101–112. doi:10.1080/01972240290075039

Hellström, J. & Jacobson, M., 2014. “ You Can't Cheat the Community Anymore ’ – Using Mobiles to Improve Water Governance. In I. Niang & C. Scharff, eds. *Proceedings of 4th International Conference on M4D Mobile Communication for Development*. Dakar, Senegal, pp. 48–59.

Hicks, N., 2013. 10 Tips for Successful ICT4D Interventions: An Interview with ICT4D Pioneer Ken Banks. 2013. Available at: <http://bestict4d.wordpress.com/2013/06/02/10-tips-for-successful-ict4d-interventions-an-interview-with-ict4d-pioneer-ken-banks/> [Accessed September 1, 2014].

Rogers, P. & Hall, A.W., 2003. Effective Water Governance. , (7), pp.1–42. Available at: <http://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/4995/TEC%25207.pdf?sequence=1>

Seebregts, C.J. et al., 2008. The OpenMRS Implementers Network. *international journal of medical informatics (2 0 0 9)*, (IJB-2516), p.10.

Souza, P. F. De, Mackintosh, G. S., Suites, C., Town, C., Management, E., & Africa, S. (2014). Lessons Learnt from the Implementation of ICT Applications to Support the Water Sector, 1–16. Retrieved from <http://greenseesaw.files.wordpress.com/2014/05/wisa2014-081-schaub-jones-et-al-b.pdf>

Watson, R.T., Kunene, K.N. & Islam, M.S., 2012. Frugal information systems (IS). , pp.1–12. Available at: <http://dx.doi.org/10.1080/02681102.2012.714349>.

Waugaman, A., 2014. *Using Technology for Social Good: An Exploration of Best Practice in the Use of Information and Communication Technologies (ICTs) for Development*. Available at: http://solutionscenter.nethope.org/assets/collaterals/Using_Technology_for_Social_Good_v2.pdf.

World Bank, 2012b. The Transformational Use of Information and Communication Technologies in Africa. , p.17. Available at: <http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1346223280837/Summary.pdf>.

Methodologies and Frameworks

B-S.,Gigler, “Informational Capabilities’ – The Missing Link for the Impact of ICT on development,” Working Paper Series No.1; E-Transform Knowledge Platform, The World Bank, March, 2011.

Champanis, M., Gool, S., Rivett, U., & Chigona, W. (2013). *ICTs in the water sector – where do we stand ?* Water Research Commission (South Africa).

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