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**Real time monitoring of rural sanitation at scale in Zambia
using Mobile-to-Web technologies**

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UNICEF, in collaboration with Zambia's Ministry of Local Government and Housing (MLGH), developed an innovative real-time monitoring and evaluation system using a Mobile-to-Web (M2W) platform using low-cost mobile phones, trained Community Volunteers, and simple protocols for the monitoring and analysis of improved access to sanitation. The M2W system uses DHIS 2, an open source software, which analyses Volunteers data in real-time, and provides flexible options for data representation as to be user-friendly and appropriate for various audiences. M2W was piloted in 2013, starting with 15 districts and scaling up to 29 rural districts by 2014, covering a population of 2,153,788. The framework has resulted in greater accountability, better data quality, and high cost efficiency per village targeted. Given its cost-effectiveness, the Government of Zambia has the potential to expand M2W into not only a national WASH management information system but also to incorporate indicators from other sectors, as well.

Introduction

By 2016 the Government of Zambia aims to ensure that 60% of the population has access to improved sanitation and that Zambia will be open defecation free (ODF) by 2020. In order to achieve those targets, with the support of DFID, the government and UNICEF's '3 Million People Sanitation' Programme is contributing through the promotion of community-wide sanitation improvements including: handwashing with soap and ash; safe water handling and use through treatment and safe storage; sanitation marketing to create the demand for the building of sustainable toilets; and encouraging households to upgrade their sanitation facilities. The programme is a component of the government's National Rural Water Supply and Sanitation Programme (NRWSSP) and covers almost all of the nation's 92 rural districts. While the programme incorporates the latest evidence-based models of community mobilization and behavior change, one of its most innovative aspects is the Mobile-to-Web (M2W) real-time monitoring system.

Accurate targeting of sanitation and hygiene interventions requires precise and timely data at the village-level. Prior to M2W, the programme used a paper-based system in all of its target districts to transfer aggregated information from the community level to the district, provincial, and, lastly, the central-level where it was aggregated into a central spreadsheet. This system was associated with heavy workloads in processing the data, transcription errors, and long delays in data transfer to the central level. The task was made all the more difficult since Zambia's population (15 million people) is scattered in a territory three times bigger than the United Kingdom.

M2W

Over the years, mobile-to-web monitoring has quickly garnered the interest of many implementation agencies, researchers, and national governments, especially within the context of increasing access to safe drinking water, improved sanitation and hygiene services (Lama, 2014; Osman, 2014; Schaub-Jones, 2013; Scott, 2011; Taylor, 2011). Interventions under this category span a variety of applications, including the use

of smartphone technology to map point data and area-based data, in order to store data (often in Microsoft Excel) and generate and visualise maps based on web-based platforms (Google Earth) (MacDonald et al, 2009; Welle, 2010; WSUP, 2011). While great enthusiasm supports using these digitized methods for rural sanitation interventions, the fundamental process of monitoring rural sanitation is still in its pilot-phase in many countries and there exists relatively little evidence to inform national scale-up. To address this gap in information, this paper reports an efficient and effective sector-wide monitoring framework that is working at-scale. To this end, the effective roll-out of M2W in rural Zambia has demonstrated how a mobile system combined with simple ground-based protocols for reporting and analysis has potential for nation-wide monitoring of ODF.

The M2W system was developed in 2013 for monitoring rural sanitation and hygiene by UNICEF and its technical partner Akros under the lead of the Ministry of Local Government and Housing of Zambia. The system utilizes the Short Message Service (SMS) text delivery system found on most basic mobile phones and is coded using the open source District Health Information Software 2 (DHIS 2).

District Health Information Software 2 (DHIS 2)

DHIS 2 is a free, open-source software originally designed for health applications, but is currently being used in 40 countries at a national scale for a number of sectors requiring routine data reporting (including water, sanitation, agriculture, and forestry). In Zambia, DHIS2 is already a cross-government database, making it relatively simple to 'bolt-on' additional sectors for monitoring; many government officials have been trained and are already familiar with it. DHIS2 is a comprehensive 'surveillance' system addressing data collection, transmission, aggregation, analysis and feedback loops. Advantages include:

- Availability as an open source software, which minimizes costs;
- Spatial mapping options that provide user-friendly visualization of data e.g. charts, maps, reports and customized dashboards;
- Real-time mobile-to-web monitoring that eliminates time lost between points of data transference;
- Minimizing the use of paper-based surveillance in order to reduce data errors together with the need to manually aggregate and digitally convert data; and
- Simple data analysis that improves the managerial capacity of partners for at-scale programmes

The system uses a standard reporting and reviewing mechanism at the district level, which includes carefully defined key performance indicators (Table 1) together with clear reporting protocols together with tools and templates.

Table 1. Mobile-to-Web Monitoring Indicators, application to rural sanitation

↑	Status	Indicator*
	Going Beyond Quality check +, sustainability	# HHs the CC has done a quality check on # of HHs passed the quality check
	Sanitation Ladder Step 2+ Adequate sanitation, Meeting the criteria of the 'adequate latrine' / Open Defecation Free Status	# latrines in use with platform # latrines with smooth cleanable floor # latrines with lid on top of hole # latrines with superstructure providing privacy # latrines with hand washer with soap/ash
	Sanitation Ladder Step 1 Improved sanitation	# improved sanitation facilities built after sanitation interventions # latrines in use with platform
	Sanitation ladder Step 0 (baseline) Unimproved sanitation / Open Defecation	Village population # households per village # latrines built before sanitation interventions # improved built after sanitation interventions
	* HH = Household; CC = Community Champion	

These quantitative measurements act as effective direct proxy indicators for improved sanitation in each of the target villages under each district. DHIS2's flexibility allows for the data to be organized by **type** (e.g., # of latrines) **time** (e.g., daily, weekly, monthly) and **location** (e.g., village or ward). Step 0 is the baseline situation, which is entered in the system once, and the other indicators corresponding to the Step 1 of the sanitation ladder (improved sanitation JMP), Step 2 + of the ladder (with adequate latrine corresponding to ODF status) and other important indicators related to quality checks (like the ODF verification) and factors contributing to sustainability (i.e. to see if ODF status is maintained through population growth and the rainy seasons).

Data collection

At the village level, Sanitation Action Groups (SAGs) play a key role in driving the M2W process. SAGs were established with the purpose to encourage every household to build a toilet and a tippy tap (a makeshift handwashing station using jerry cans and other locally sourced items), as well as to wash hands with soap or ash. SAGs act as the front line of data collection by recording information on key sanitation and hygiene indicators using paper forms that are handed to Community Volunteers¹ who in turn enter the data into a low-cost, simple Nokia feature phones. As soon as the data are entered, the real-time updating feature displays the information on the online java-based DHIS2 platform.

An integral component of M2W is its ability to conduct timely quality assurance, as disseminated in Figure 1. Community Volunteers are incentivised to send their reports by the 10th of the month following data collection. On the 11th of the month, Environmental Health Technicians (extension workers of the Health Sector working at sub-district level, EHTs) receive an automated SMS with a summary of the data from the Community Volunteers in their wards with a request to follow-up on poor performances. On the last day of the month the Community Volunteers who reported as per standard receive talk time (3 USD) for each report submitted before the deadline. The data is available on a near real-time basis, with total reporting time from village-to-national focal points taking 24 hours.

This village-level data is then compiled across districts and provinces, for which management meetings amongst the multiple data inputters and assurers Volunteers are an important part of the approach. Meetings occur regularly between the Community Volunteers and Environmental Health Technicians to review the data submitted and provide support as necessary; Community Volunteers and Sanitation Action Groups to review feedback on coordination; and Community Volunteers and Environmental Health Technicians as well as District Water and Sanitation Health Education (DWASHE). By logging this information into system, as well, the accountability for each actor to play his role is strengthened. It also allows for each level of the data collection to be cleaned and assured for through the feedback loop.

Outcomes of M2W

Over the past year, the system has been put in place in 29 out of 92 rural districts which are now submitting monthly reports through 1,564 Community Volunteers and Environmental Health Technicians. This covers a total population of 2,383,704 from 13,805 villages; in these villages, this system contributed to reaching 1,520,661 new users of improved sanitation and to raise the practice of hand washing with soap or ash from 8.6% to 47%.

Summary of key outcomes

- M2W is operating in 29 out of 92 rural districts and scaling-up is ongoing in more than 20 additional districts
- 13,805 villages are monitored on a near real-time basis
- 1,564 Community Volunteers have been trained
- Around 210 Environmental Health Technicians have been trained
- 32 Chiefdoms have been trained
- Over 1,500 phones and tablets are operational

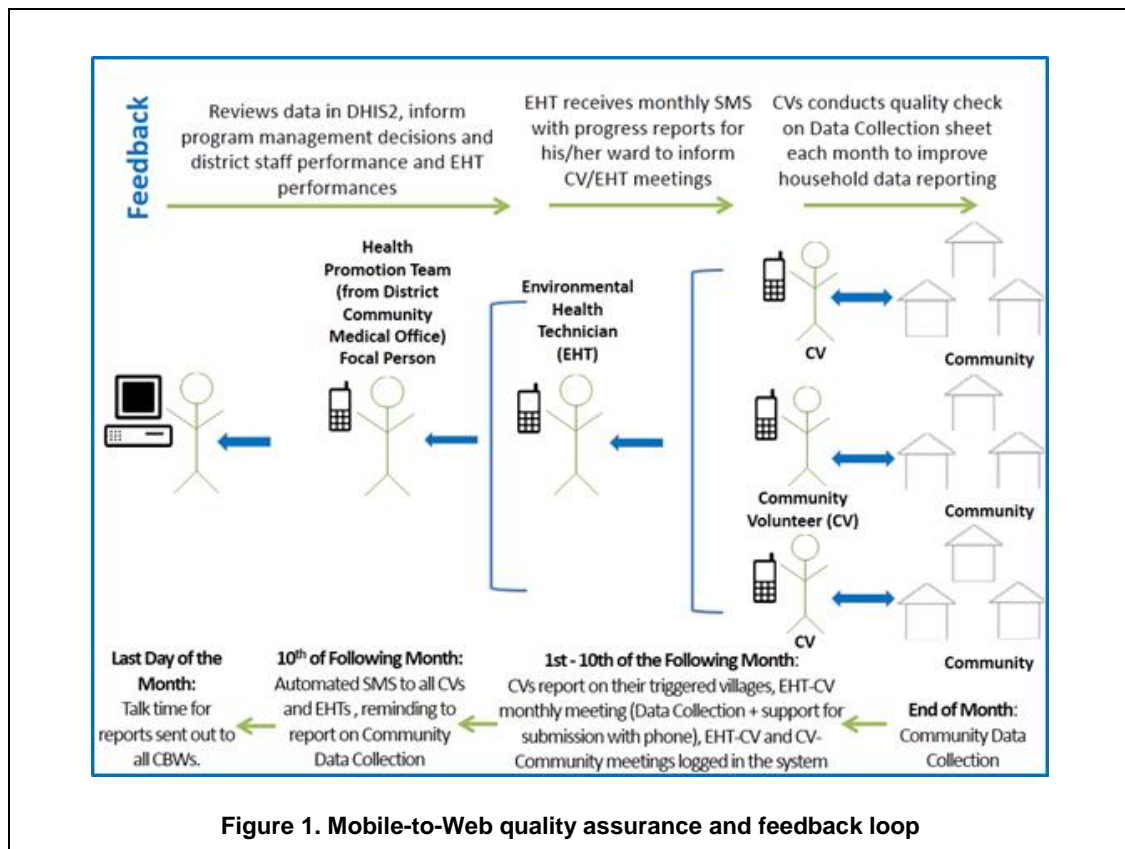


Figure 1. Mobile-to-Web quality assurance and feedback loop

Factors for success at-scale

Critical success factors for going to scale include:

Community level actors: M2W is supported by a vast surveillance network from the village-level up: including the SAG; village headmen and headwomen; Community Volunteers; Environmental Health Technicians and Chiefs. The Government and UNICEF were instrumental in ensuring that appropriate participatory practices were applied and that community members were involved at every stage of the planning and implementation process. One concern is the existing gender dynamic, as the majority of Volunteers (who receive incentives) selected to date are male, whilst the majority of active SAG members (who don't receive incentives) appear to be women.

The role of traditional leaders is also critical, through the involvement of both local chiefs and the overall Ministry of Chiefs and Traditional Affairs (MoCTA) at national level. Empowering chiefs with data has been a powerful catalyst for accelerated progress. Chiefs in Zambia have proven to be critical CLTS Volunteers themselves by taking the necessary actions to achieve ODF communities. Chiefs have now taken on a critical role in monitoring; with computer tablets they can view reports, charts and maps generated from the data collected and customized to reflect the progress in their chiefdoms. The data has helped create a system of benchmarking and competition between chiefs and is used to inform the Chiefdom-level Total Sanitation plans.

Appropriate technology: Community Volunteers were initially provided with smart phones (using a specially designed application and open-source DHIS2 software). However, as handsets were difficult to use with limited technical capacity, they were replaced with more affordable and widely available simple phones. However, internet connectivity remained a major barrier to reducing lags between transfers.

A simple verification and certification process: UNICEF and Akros supported the Government of Zambia to establish a system of spot checks and ODF verification field visits with their Government counterparts to check the reliability of results being reported. The field results are also monitored through Sustainability

Checks and joint reviews to provide guidance to improve performances when necessary. Together these provide an important learning mechanism.

Training of programme staff: Training of provincial, district and ward-level staff, as well as Community Volunteers and Environmental Health Technicians has been provided on usage of reporting tools, analyzing data in DHIS2, troubleshooting reporting incompleteness, and ensuring data quality. Continuous hands-on support at the district-, ward- and village-levels has been provided by the technical partner, Akros, until routine implementation, monitoring and reporting are autonomously carried out by government and community stakeholders, thereby ensuring sustainability. A staggered exit strategy has been planned by the technical partner, to allow the partner to gauge district and provincial-level governments' and community stakeholder's ability and commitment to maintain the system.

Government leadership: In many settings, external development partners and NGOs play a primary role in mobile to web monitoring. For technical innovation in monitoring to be scalable and sustainable, it must be driven by national government and supported at provincial, district and community level. In Zambia, the Ministry of Local Government and Housing took ownership in developing the M2W system: the district and provinces support the data collection and verification and national government leads data analysis and dissemination. This has also ensured a harmonized sector-wider national approach.

Programme management: The Government of Zambia found that having limited data created challenges in designing and implementing rural sanitation and hygiene interventions. The M2W system has been used as a management tool for programming: feedback loops and course correction mechanisms have led to increasing numbers of people now using improved sanitation and practicing handwashing with soap or ash. M2W also led to efficiencies that reduced the average cost of implementation: in areas covered by the mobile-to-web system the cost per new user of improved sanitation is 1.65 USD, compared to an average of 2 – 2.5 USD in areas relying solely on paper documentation at every stage.

A low-cost strategy for scaling-up: The costs include funds necessary to maintain the server, maintain mobile phones and district laptops/computers, SMS messaging, costs of talk-time top-ups given to Community Volunteers for timely reporting, spot-checks to validate data and support visits, in wards, villages and to ensure that management meetings are occurring as planned. The system requires 18 to 24 months capacity building to ensure that it is being rolled-out without support from UNICEF or Akros and this cost represents up to 88% of the total WASH budget. The remaining 12% of the running costs are being supported with the national budget, which will be altered as Akros hands off the monitoring system to the government to ensure sustainability.

Conclusion and next steps – going beyond sanitation

The key attributes of M2W are that it is an appropriate, accessible and affordable monitoring tool. The system addresses sector performance monitoring as well as coverage and functionality and highlighting organisational accountability.

The Ministry of Local Government and Housing has pledged to establish a national WASH Management Information System (MIS) by 2016, for 65% of all districts, or approximately 67 of 103, in Zambia. Having witnessed its success, the government seeks to make the M2W system the backbone of the National WASH MIS. Presently the data are accessible online for focal points at district, provincial and central level but there is intention to make the data more widely accessible to other ministries as well as development partners.

UNICEF's partner is currently adapting the platform for monitoring school-led total sanitation as well as water point monitoring; for water point monitoring this will be a GIS-integrated database, with Community Volunteers providing monthly updates on key indicators to measure sustainable access to safe drinking water. It will be the first time in Zambia's history where districts, provinces and central personnel are provided with data on the status of all water points in a large cross-section of rural districts in order to improve the targeting of resources for installation and repair of water points.

Note

¹ Community Champions are selected through a consultative process and trained to trigger CLTS activities; they receive around 10 USD per verified ODF village.

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