Information and Communication Technologies (ICTs) for monitoring sustainable service delivery

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Introduction

Innovations in Information and Communication Technology (ICT – see Box 1 for a definition of ICT) have produced novel ways of collecting and disseminating data, providing new opportunities to open up monitoring practices and influence wider policy processes and social relations, leading to new avenues to help improve access to basic water, sanitation, and hygiene (WASH) services. Health workers can now use mobile phones to collect data (Hellstroem, 2010), water users can send reports on broken down schemes (Taylor, 2012) and the use of Global Positioning System (GPS) applications, allow the distribution of services and other parameters to be displayed spatially (WaterAid, 2012).

While such ICT innovations hold great potential for improving monitoring practices and opening up new service delivery avenues, there are also important technological and governance challenges to translating these projects into genuine and lasting WASH improvements. Many ICT innovations related to WASH monitoring are currently limited to 'islands of success' implemented by donor- and NGO-funded pilot projects: technological glitches are still prevalent; and updating of ICT-based monitoring WASH data is the exception rather than the rule. Furthermore, evidence on the link between WASH monitoring data provision and WASH-related outcomes remains poor, particularly in the use of ICT-based WASH information to inform planning and implementation.

This keynote paper sets the scene for a three-day exploration of ICTs for monitoring sustainable WASH service delivery as part of a wider symposium on Monitoring Sustainable WASH Service Delivery, organised by IRC International Water and Sanitation Centre (IRC). The keynote situates ICT WASH innovations in the wider context of ICT and development. It explores the current trends and challenges related to monitoring the WASH-related MDGs, and then focuses on the specific role of ICTs in WASH monitoring. It presents current developments in ICT innovations within WASH monitoring and discusses major challenges identified in a recent e-discussion on Water Point Mapping (WPM) held in January-February 2013 (Pearce and Howman, 2013). A summary of lessons from challenges related to ICT innovations in health sector service delivery monitoring leads to the presentation of major topics within the ICT theme at the Monitoring Sustainable WASH Service Delivery Symposium.

ICTs and development

ICTs are now regarded as a key driver for long-term economic transformation (Juma and Yee-Cheong, 2005), serving as an "enabler of development of key sectors of the economy" (Dzidonu, 2010).[1] Rapid reductions in the costs of ICT services alongside increasing efficiency and quality have encouraged wide investment in ICT over the past two decades (Okogun *et al.*, 2012). In the context of global development, ICTs are thought to potentially make important contributions to achieving the Millennium Development Goals (MDGs) (Dzidonu 2010):[2] ICTs help contribute to economic growth and income by raising productivity as they become embedded within public and private information flow networks. Furthermore, through better information flows and communications, the use of ICTs can improve peoples' lives (Juma and Yee-Cheong, 2005). ICTs have been noted to

[1] In 2005, the European Commission estimated that ICTs in Europe accounted for 40% of labour productivity growth in the 1990s, and, further, that ICTs contributed directly and indirectly to improvements in public services, energy efficiency and in addressing social challenges (EC, 2005).

[2] However, according to Juma and Yee-Cheong (2005), the direct impact of ICTs on social and economic development continues to be debated [check UN ICT task force for more recent information].

have positively influenced "the environment, employment, poverty alleviation, attraction of foreign investment, and empowerment for the disabled" (Okogun *et al.*, 2012). The United Nations ICT Task Force on Science, Technology and Innovation (Juma and Yee-Cheong, 2005) emphasises that developmental benefits go far beyond better access to the technologies themselves. Broader gains stem from new opportunities and development solutions that open up with the deployment of ICTs.

Box 1: What is meant by 'ICT'?

According to the World Bank's ICT Glossary, ICT "consists of the hardware, software, networks, and media for the collection, storage, processing, transmission and presentation of information (voice, data, text, images), as well as related services". Established ICTs include: radio, television, video, compact disk while new ICTs relate specifically to cell phones and the internet.

Within the context of WASH monitoring, ICT represents the mobile network, and the mobile tools used for data collection and analysis, and the technology (hardware, software & services) that expedites the data flow. Throughout this paper the term ICT innovation is used to describe any innovation in technology at any scale, including ICT hardware, software, networks and services. ICT tools refer to both hardware and software. ICT e-services are electronic processes and communications that have been developed or adapted to support development practices.

Sources: World Bank (2013); Juma and Yee-Cheong (2005)

Concretely, ICTs can contribute to the MDGs "by improving communication and the exchange of knowledge and information", and "by strengthening and creating new social and economic networks" (Juma and Yee-Cheong, 2005) across personal, business and government users. ICTs also contribute to the MDGs by reducing transaction costs through new ways of treating and distributing information thereby leading to efficiency gains in different sectors (ibid). For instance, ICTs have the potential to improve service delivery in the public sector by reducing operational inefficiencies in government administration and by facilitating new communication channels between government and citizens (Dzidonu, 2010).[3] In so doing, ICT-supported public service delivery has the potential to increase transparency of government services and to make them more responsive to citizens' concerns (Deloitte, 2012).

However ICTs are not, in themselves, sufficient to improve the effectiveness of service delivery (ibid). While they can facilitate new ways of engagement through information and feed-back flows, the enabling role of ICTs is subject to other governance factors such as public administration reforms, basic infrastructure, the availability of human resources and skill sets at decentralised levels. Gaps between government policies, ICTs, the economy and service providers need to be bridged in order to harness the expanding potential of ICTs within the field of development, and particularly within the African context (Okogun *et al.*, 2012).

[3] Hirst and Norton 1998 (cited in: Ndou, 2004), differentiate here between different transformation areas of e-Government: 'internal' refers to efficiency gains within government agencies, 'external' refers to opportunities for making data more widely available to citizens and the private sector thereby increasing transparency, and 'relational' refers to the possibility of a fundamental remodelling of citizen-state relationships "with implications for the democratic process and structure of government".

ICT promotion and use in Africa

Many African countries are late-comers in relation to ICT diffusion. The majority of African governments only started actively engaging with ICTs to facilitate socio-economic development at the end of the 1990s. Under the African Information Society Initiative of the UN Economic Commission for Africa, various governments have now put in place ICT for Development (ICT4D) policies and programmes. These programmes aim to develop the ICT sector and infrastructure, and, to further 'enable' development in cross-cutting governance areas such as human resources development, as well as in specific sectors such as education, health, and agriculture (Dzidonu, 2010).

The example of mobile phone services in East Africa illustrates recent trends and levels of ICT penetration. In 2009, East Africa had a total population of 120 million, with the majority living in rural areas with poor infrastructure and low electricity access. Approximately half of the population was under the age of 15 and one third of the adult population illiterate. Yet, in the same year, East Africa counted 50 million mobile phone subscribers, amounting to 40% of the total population.[4] The majority of subscribers used voice, Short Messaging Services (SMS) and beeping applications. Key obstacles to the further spread of mobile phones were costs (of the device, air time and charging), lack of electricity and illiteracy. Most other mobile services such as financial transactions or health related solutions were still limited in the region (Hellstroem, 2010).

So, what opportunities does ICT penetration offer for monitoring WASH related services? The next section explores global trends and challenges related to monitoring MDG Target 7c, related to water and sanitation. This provides the context for exploring the particular trends and challenges related to harnessing ICTs for WASH monitoring.

Trends and issues related to global WASH monitoring under MDG Target 7c

The current international target related to water supply and sanitation is represented in the MDG Target 7c: "to halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation" (UNDESA, 2012). The indicator for measuring water supply and sanitation access is "proportion of the population using an improved drinking water source" and "using an improved sanitation facility" (UNDESA, 2012).

Global progress towards MDG 7c is officially monitored by the Joint Monitoring Programme (JMP) for Water Supply and Sanitation of the WHO and UNICEF. In March 2012, the JMP reported that the MDG on drinking water had been achieved, while progress on the MDG on sanitation was still lagging behind (WHO, 2012).[5] The JMP's 2012 progress report detailed that, at the end of 2010, 89% of the world's population used an improved drinking water source, while only 63% had access to an improved sanitation facility (WHO and UNICEF, 2012a). The report also highlighted important disparities across and within regions: in particular, it reported that more than 40% of the people who

[4] This compares with a worldwide penetration of mobile phone use of 75% in 2012 (World Bank, 2012).
[5] However, this achievement needs to be treated with caution. Compared to the first international water decade from 1980-1990, MDG 7c is much less ambitious: rather than aiming to achieve water supply and sanitation for all, it aims to halve the proportion of people without access. Furthermore, although agreed upon in the year 2000, the baseline for monitoring the MDGs is the year 1990 (UNDESA, 2012).

still lacked access to safe drinking water, lived in Africa in 2010, and that some African countries had, in fact, fallen behind the 1990 levels of coverage. The report also emphasised differences between urban and rural coverage of drinking water with 96% of the urban population using improved drinking water sources compared to only 81% of the global rural population (WHO and UNICEF, 2012a); and drew attention to high rates of inequality between the highest and lowest population quintiles within a country (WHO and UNICEF, 2012a).[6]

Since global monitoring started in the 1980s, the quality and comparability of monitoring has increased considerably (WHO and UNICEF, 2012a). This is mainly due to a change in data sources from provider to user-based data. Since the mid-1990s, the JMP has relied on existing national representative household surveys such as USAID funded Demographic and Health Surveys or other relevant surveys from the individual countries' statistical services, instead of data provided by national line ministries and utilities (WHO and UNICEF, 2012a). However, this has led to discrepancies between international and national monitoring. Many national line ministries continue to use data sources based on sanitation facility and scheme inventories for their estimates of water and sanitation access, resulting in divergent figures reported for a specific country at the national and global level.[7]

There are further gaps and limitations in national and global water and sanitation monitoring. Currently, both global and national monitoring of water and sanitation focus primarily on technical parameters related to an improved source or facility (Welle, forthcoming). Important dimensions that have remained neglected in JMP (global) and national sector monitoring include water quality and equity dimensions, particularly related to gender relations (Mehta, 2006), and a recognition that people use a combination of improved and unimproved sources to cover domestic and productive water needs (Van Koppen *et al.*, 2012). In addition, national water supply scheme inventories are not updated regularly and sector routine monitoring data is not considered very reliable. A review of data from 20 sub-Saharan African countries by the Rural Water Supply Network (2009) found an average non-functionality rate of rural water schemes of 36%. The high non-functionality rates make obtaining up-to-date information on scheme sustainability a particularly urgent challenge in the rural water supply sub-sector.

In the context of reviewing the MDGs for the post-2015 era, the JMP hosted a global consultation on future WASH related targets and indicators (see Box 2 for more details).

[6] The vast disparities in water and sanitation service distribution are greatly illustrated in Sierra Leone, where data disaggregation of urban and rural areas by wealth quintiles highlights the richest quintile of Sierra Leone's urban population having almost universal access, in contrast to a mere 10% of the poorest quintile of rural areas. Distinguishing access among different wealth categories within a country is possible because the household surveys that the JMP uses allow for the classification of households by wealth, based on an asset index (WHO and UNICEF, 2012a).

[7] While the JMP's target and indicator both refer to water access as an outcome (people using an improved source), national line ministries' scheme inventories refer to water supply access in terms of an output (infrastructure provided). The difference in reporting can result in stark differences in access figures and lead to contestations over figures in concrete policy settings (Butterworth *et al.*, in press).

Box 2: Post-2015 consultations on WASH monitoring

From May 2011 until December 2012, the JMP hosted a global consultation on post-2015 monitoring of water supply, sanitation and hygiene. A cross-cutting working group made suggestions on how to include aspects related to the human right to water, in particular, equity, equality, non-discrimination and long-term sustainability of services. The work-in-progress document resulting from the consultations proposes more comprehensive definitions, targets and related indicators to measure water supply, sanitation and hygiene. While it is not yet clear how exactly water and sanitation targets will feature in the Sustainable Development Goals that will define the post-2015 monitoring agenda, the consultation document points to much more nuanced monitoring targets and indicators in the future. Potential additional monitoring aspects include:

- measuring inequalities including intra-household,
- distinguishing more nuanced levels of service (via a service ladder),
- monitoring settings beyond the household such as school and health care facilities, and
- sustainability (WHO and UNICEF, 2012b).

Furthermore, the availability of rapid, low-cost water quality testing kits opens up the possibility of including water quality monitoring into future global monitoring procedures (WHO and UNICEF, 2012a).

The targets and indicators put forward in these consultations suggest that WASH monitoring will become more nuanced and multi-faceted in the future, which, in turn, will require more distributed and sophisticated monitoring approaches. By opening up novel ways in collecting and disseminating data, ICTs provide ample opportunities to support new monitoring pathways. The next section explores current trends in the use of ICT innovations for WASH monitoring and identifies key challenges.

Trends and challenges in harnessing ICT-innovations for monitoring WASH services

WASH related ICT-based monitoring innovations in the South have grown steadily since the early 2000s. For instance, a recent study of m-WASH monitoring mapped 40 initiatives in the sector (Hutchings *et al.*, 2012). A prominent application of ICTs for m-WASH monitoring is WPM (Water Point Mapping).[8] Mapping techniques help visualise the spatial dimension of key development issues. By presenting complex information on a particular geographic locality in an accessible way, WPM has the potential to inform WASH service related decisions (Welle, 2007).

In conjunction with WPM, mobile phone applications are increasingly used to improve data flow, i.e. during data collection and for updating related information (Pearce and Howman, 2012). Two ICT innovations that are popular among sector professionals are the mobile application called FLOW (Field Level Operation Watch) and for analysis the Water Point Mapper. FLOW combines Android cell phone technology with Google Earth software, and is used by a growing number of organisations to facilitate data collection. The Water Point Mapper, which combines excel-spread sheets with Google Earth to produce maps, facilitates data cleaning and analysis, and has the advantage that it can be

[8] The popularity of WPM among ICT-related monitoring innovations in the WASH sector is indicated in the existence of a dedicated e-platform hosted by the Rural Water Supply Network.

used also in situations where there is no internet connectivity. Alongside these innovations, many organisations still rely on expensive and skill-intensive mapping applications, such as Arc-GIS, as their choice for the spatial presentation of data (Pearce and Howman, 2013).

A recently held e-discussion on WPM yielded that its potential is mainly seen in the support it provides for more transparent, equitable, and efficient allocation of water schemes across administrative scales, and the sustainability of services (assessing the sustainability of technologies and management styles, and to reduce system downtime); and as an advocacy tool, especially at district and sub-district levels, in accordance with decentralisation processes across sub-Saharan Africa (Pearce and Howman, 2013).

The e-discussion brought to light a number of trends in WPM spread and use: WPM was more prominent in rural than in urban areas, overall more used in Africa than in Asia or Latin America and more for water supply than for sanitation and hygiene. Mapping initiatives were predominantly initiated by external support organisations and applied for internal, project-based monitoring, as well as with the intention to support local government planning and implementation, and entire sector-wide monitoring systems (e.g. in Ghana, Uganda, Liberia).

In the same e-discussion, several challenges arose in relation with WPM data collection, analysis and presentation and with its use, scalability and sustainability. Data collection was generally perceived as time-consuming and expensive, and, depending on the software used and on the local skill base, computer facilities and electricity, data inputting and analysis at the district level can often be beyond the capacity of local government staff. This is not only an issue for the initial data analysis but also a crucial obstacle towards keeping water point data up-to-date. Participants of the e-discussion also reported technical problems with printing maps. Making mapping data openly and easily accessible was seen as vital to encourage its use. This happened in Liberia, where WPM data is inputted into a central data base and available online. However, in many cases, WPM analysis and data was still kept in isolation, partly due to the patchwork nature and limited geographic scope of external support for WPM activities.

E-discussants gave examples from national, regional and local government levels on how WPM had triggered discussions around sustainable service delivery (Mozambique) and specific cases where political leaders took an interest in WPM data to inform themselves about the equitable distribution of water schemes (Tanzania). Examples from Latin America highlighted the importance of involving local government stakeholders from the early stage in the mapping process to gauge their interest in the data for local planning purposes. A glaring absence in terms of potential data users in the e-discussion was the stake that citizens and water user committees might have in WPM data.

In terms of using data for decision making, Catarina de Albuquerque highlighted that “decisions about resources are political, and so, to be influential, data must be communicated in a way that persuades, motivates and mobilises people to take action” (Pearce and Howman, 2013). E-discussants provided a number of examples from local-government levels and above, where WPM was used to inform decisions about financial allocations for scheme rehabilitation (Ghana), to increase the equitable distribution of schemes and to draw attention to functionality issues (Burkina Faso); WPM was also said to have led to the establishment and training of water and sanitation committees in various places. However, several voices highlighted that we cannot yet speak of sustained use of WPM data for decision making, partly due to difficulties in making mapping data

available and doing so in a user-friendly format. These voices are supported by evidence from WPM reviews, which indicated that mapping results have not been used consistently to inform planning processes (Taylor, 2009, Welle, 2010)

A key obstacle for sustained use of data to inform service delivery decisions highlighted in the e-discussion was the lack of updating. WPM tended to remain a one-off exercise that often stopped when the external agency withdrew its support. Discussants agreed that the WPM potential can only be realised if mechanisms are in place to regularly update as part of a continuous, sector-wide, data management process. Particular challenges to updating, illustrated in the example of Liberia, included: lack of financial resources, technical support, and standard methodology or agreed procedures, absence of a national consolidated geo-referenced data system for monitoring water, and insufficient coordination among organisations that are in a position to support WPM updating. A fundamental challenge underlying all updating efforts was the lack of dedicated staffs in the water sector who are generally only represented down to the district level and therefore unable to regularly update mapping data themselves. Various mechanisms were discussed on how to overcome this challenge. Among them were suggestions to team up with extension staff from the health or agricultural sectors, ways of communicating with water and sanitation committees or options to encourage citizens to report broken down schemes. While discussants reported various pilots involving citizens in updating (e.g. Daraja in Tanzania[9]) as well as hand pump mechanics (M4W in Uganda), these initial experiences suggest that these trials have not yet been proven to work. Discussants highlighted that ICT innovations need to be directed more towards encouraging water users to provide information on the functionality of their water supply. Important here was the point to focus on fitting the technology with the patterns in which users deploy them rather than the other way round.

Learning outside of the water sector: trends and challenges of ICT-innovations in health sector monitoring

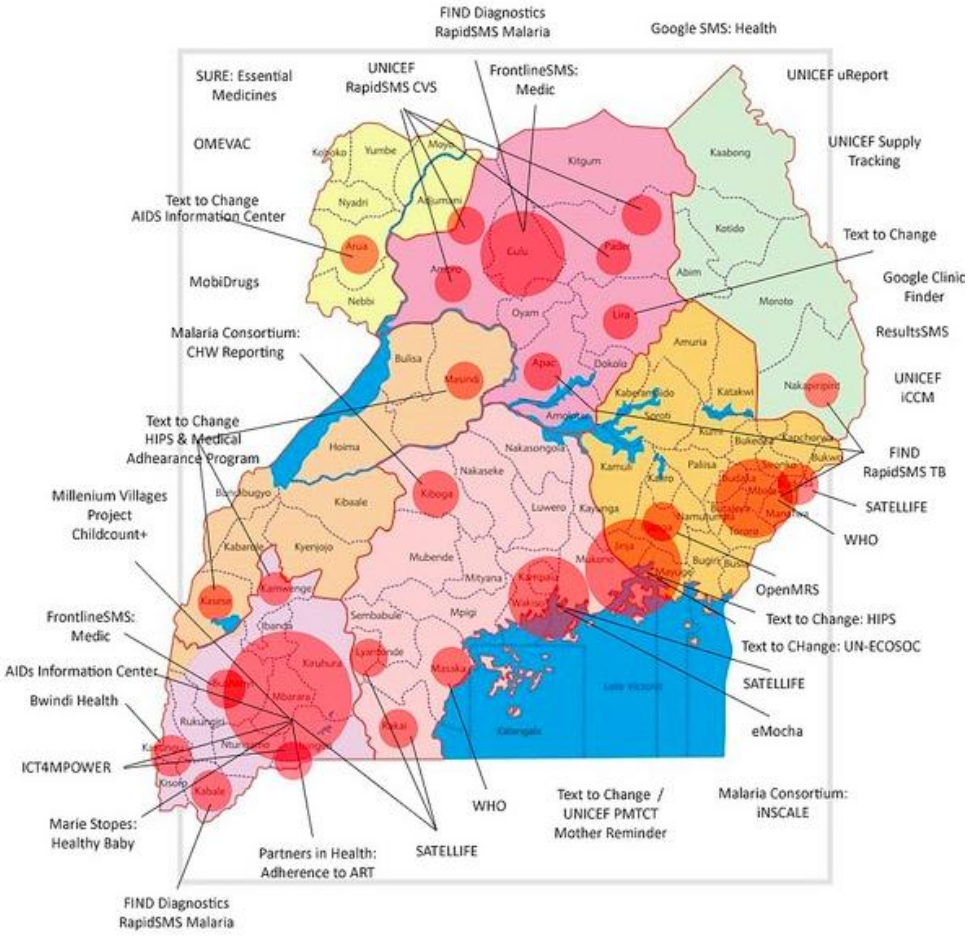
The health sector has seen a substantive growth in the use of real-time digital information for monitoring purposes (Greeley *et al.*, in print), which dwarf the initiatives currently underway in WASH. A recent WHO survey registered 835 health services that used mobile-phone technology (Lucas *et al.*, in print-b). Henry Lucas (in print-b) defines Real-Time Monitoring (RTM) as "higher frequency data collection or reporting, often using ICTs to strengthen current programme performance or to inform policy and the practice (design, scale and scope) of future service delivery". Data sources for health services RTM are community-based participatory monitoring, sentinel sites, routine data systems and rapid surveys (Lucas *et al.*, in print-b). A typical example of RTM in health refers to such services as using mobile phones to enable community health workers to feed-back information on the health status of infants and young children, and to receive immediate advice from qualified health personnel (ibid). Over the last years different RTM methods have been trialled in various countries to improve routine data collection systems (Lucas, 2011, cited in: Greeley *et al.*, in print).

[9] the NGO *Daraja* stalled its Tanzanian mobile phone initiative *Maji Matone* because it only received a fraction – 53 out of 3,000 – anticipated SMS water scheme breakdown reports from citizens during its pilot phase. *Maji Matone* faced technical issues such as problems of mobile phone reception but also socio-cultural problems such as low expectations from citizens that government actors would respond to their failure reports (Taylor, 2012).

However, Greeley and colleagues caution that there is still a lack of understanding of which approaches work, and, in which settings (Greeley et al., in print). This is confirmed by the Editors of the PLOS Medicine journal (2013) who highlight that a review of m-health evaluations found that a rigorous evidence base on the impacts of m-health initiatives is still lacking – a point that resonates with the challenges of data use discussed for WPM above. According to the journal's editors, the lack of evidence on the impact of m-health initiatives is partly due to the poor quality of existing studies. Furthermore, they point out that very few studies have so far found "clinically significant benefits of the interventions" (ibid). Lucas *et al*. (in print-b: 16) highlight the dimension of data analysis in relation with its use. They hold that data analysis needs to be tailored to specific policy programmes or problems in order to foster the use of results. They also suggest that, where traditional mechanisms for communicating information (paper, phone) are effective, "they should not be discarded until there is a clearly better and *sustainable* alternative (in print-a).

A further concern related to e-services (electronic processes and communications to support health care) in the health sector, which resonates with the e-discussion on WPM, is the "technical complexity of systems and standards and language differences" (The PLOS Medicine Editors, 2013). In e-health services, experts identified a need to improve ICT 'interoperability', in other words, to enable "the exchange of data among systems in common formats, the use of common protocols, and, ultimately, the ability to work together" (ibid). Related to 'interoperability' is a current concern about the use of open standards, i.e. making information about the use and application of a particular system publicly available (ibid).

Figure 1. The multitude of m-health pilots in Uganda, 2011.



According to Tomlinson and colleagues (2013), the sustainability and scalability challenges are prominent among mobile initiatives in the health sector. The authors cite Uganda to illustrate their point: 23 out of 36 m-health initiatives implemented between 2008 and 2009 did not move beyond the pilot phase (2013). Figure 1 highlights the multitude of disconnected m-health pilots in Uganda (Lemaire, 2011).

A key challenge in the health sector, which is quite different from experiences in WASH, is the interest from industry in m-health initiatives, which may be different and at the detriment of public interests in safe-guarding health.

Interestingly, the two key challenges related to using ICTs in WASH and health monitoring – scalability and sustainability – apply more widely. For instance, Dzidonu (2010), who reviewed the use of ICTs in the context of MDG achievement across different sectors, reports that "the majority of the ICT projects and initiatives in most African countries are typically of small- scale pilot nature" and that "[a] number of these projects in most African countries are donor-driven or funded and in some cases not sustainable beyond the pilot phase". He also highlights that, often ICTs are deployed to facilitate the delivery of specific, community-based services in areas like health, education and public information provision and the provision of communication services. Furthermore, according to Dzidonu, ICT projects are often not scalable and resulting in only limited impacts on a country's socio-economic development process (2010).

The widespread use of ICT-innovations in m-health highlight the potential for integration between m-health and m-WASH initiatives. This could apply to making common use of hand sets, for instance, and also points to the importance of interoperability of systems not only within but also between different sectors.

The important issues raised in the health sector regarding interoperability could act as a warning for WASH stakeholders and an encouragement to focus efforts on making ICT applications and related datasets publicly available, and capable of communicating to each other.

Conclusion and suggestions for the ICT-theme at the IRC Symposium

Potentially, the use of ICT through WPM and related mobile-services has the capacity to open up new monitoring pathways, increasing the responsiveness of services to citizens, and with this, their sustainability. However, with regard to WASH services, many monitoring-related ICT innovations are still in a pilot phase and face substantial barriers. These challenges illustrate the need for a targeted social learning process to strengthen and improve the technological, social and organisational dimensions of systems of innovation related to mobile monitoring of basic services. Such a learning process cannot stop at the technological aspects of innovations themselves but needs to address the wider institutional and governance settings, which shape, and are shaped by innovations. Two sets of issues emerge: on the one hand, operational research is required to foster moving from isolated innovation ideas and trials towards sustained use. On the other hand, normative concerns could be put forward to critically question existing ICT innovations and to help identifying such ICT innovations that are more likely to support equity and sustainability of basic services. Normative questions could explore the directions of change fostered by ICT-innovations (What are they for?), questions related to distribution (do ICT innovations in monitoring address concerns of the poor and vulnerable? Do they lead to a greater equity in services?), and of diversity of ICT-innovations (Which

innovation pathways fit together? Where limits and trade-offs?), put forward in more detail in Table 1.[10]

Table 1: suggested questions derived from the STEPS Centre's '3D' agenda

	Water, Sanitation and Hygiene
Direction	What are innovations for? What are goals? What innovations are favoured by which interests? How is power exercised to favour particular innovation pathways?
Distribution	Who are innovations for? Who are the providers and recipients of information? Who gains who loses? Which innovations foster social equity and sustainability? Which innovation designs favour the perspectives of the poor and vulnerable?
Diversity	What are the trade-offs between different innovation pathways? How can alternative innovations be fostered that include different actors as providers and recipients of monitoring information?

Source: based on STEPS Centre, 2010

ICT has been represented in this paper not simply as a tool for improving information flows and communications, but as an enabler of economic and social development. A substantial link between the use of ICT and the achievement of the MDGs has been established and evidence has been presented around the potential of ICT for increasing the transparency and responsiveness of government services. Such approaches should help to create a governance structure that is more reactive to, and accountable for, the concerns of citizens. As we examine the various stages of the WASH monitoring data flow process through the lenses of project and national level approaches, a number of key questions emerge for consideration during the symposium. These include:

- How do we move from data to decision-making?
- How can we keep inventories updated?
- How do we design and apply ICTs in a manner that realistically facilitates long-term sustainable uptake?
- How can we make the cost of ICT sustainable for local government?
- How do we move past the pilot phase?
- What are the questions we should be posing for the Post 2015 debate?
- Are we moving from broken-down handpumps to broken-down mobile phones?

We've identified a need for transitioning from ICT system designers to people-system designers, and from this standpoint we must look to address the relationships and incentives that will sustain and continue to drive the demand for information, and translate that information into real equitable development.

[10] The three normative concerns of direction, distribution, and diversity are based on the STEPS Centre's (2010) New Manifesto on Innovation, Sustainability and Development.

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