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The role of human-centred design in implementing ICT solutions in WASH projects

David Schaub-Jones & Jessica Kaliski (South Africa)

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Over the past decade in many parts of Sub-Saharan Africa, there has been a continual rise in the advancement of telecommunications, as well as a continual rise in urbanisation. Within this context, a number of sector professionals have acknowledged the potential for the rapid growth in information and communication technologies (ICT) to offer new opportunities to water providers to address some of their enduring challenges. Desille and Faggianelli (2013) emphasise the importance of those both collecting and analysing information to ensure data collected is relevant and regularly updated. Unfortunately, little attention is initially given to catering these systems towards those collecting data. This paper uses lessons learned regarding appropriate and inappropriate design approaches in ICT projects in the WASH sector to showcase two case studies implemented by the social enterprise, SeeSaw. Despite SeeSaw's attempt to incorporate the personalities, incentivise, and motivations of the reporters at the onset of the project, some challenges still remain. These results suggest both the challenges avoided when design considerations incorporate those collecting information, but also the challenges that still remain – and that future research can help clarify.

Introduction

Over the past decade in many parts of Sub-Saharan Africa, there has been a continual rise in the advancement of telecommunications, as well as a continual rise in urbanisation. The latter has subsequently led to a rise in the lack of expansion and maintenance of basic infrastructure. This is particularly apparent in the delivery of water infrastructure, where 37% of the world's population without improved water sources resides.[1]

Nevertheless, within this context, a number of sector professionals have acknowledged the potential for the rapid growth in information and communication technologies (ICT) to offer new opportunities to water providers to address some of their enduring challenges. Information is needed by those in managing water infrastructure in all that they do: when it comes to water services, reliable and up-to-date information is crucial in being able to oversee the quality of services provided to customers and to assess the level of compliance of operators with sector rules and strategies.[2]

To obtain the benefits of ICT,[3] information must be collected. In respect to information and the regularity of monitoring, Desille and Faggianelli (2013) find that the "regulation of water supply services requires information that is both relevant (i.e. clear and useful to the person for whom it is intended) and regularly updated. In small towns, the challenge lies in ensuring sufficient capacity is in place to collect and analyse relevant and reliable data on the management of water services so that this is then forwarded to the different regulatory actors involved." [4]

Desille and Faggianelli (2013) emphasise the importance of those both collecting and analysing information to ensure data collected is relevant and regularly updated. Unfortunately, little attention is *initially* given to catering these systems towards those collecting data. It is usually, and only in hindsight, when recognition of those reporting and their incentives and motivations to both collect information and provide reliable information is uncovered.

This paper is divided into three sections. The first section discusses 'lessons learned' regarding appropriate and inappropriate design approaches in ICT projects in the WASH sector. The paper frames this discussion around Two Key Questions that should be taken into consideration to better understand the characteristics, motivations, and incentives of reporters. The second section discusses two case studies involving the Cape-Town based social enterprise, SeeSaw, and how the enterprise sought to incorporate the answers to these 'Two Key Questions' in designing a solution. This section also highlights the challenges SeeSaw faced, which bring to light the difficulty in executing a 'flawless' design approach. Finally, the paper concludes with suggestions for future research.

Overview: design approaches in ICT projects in the WASH sector

As any reporting system is only as good as the data being fed into it, it is necessary to understand the personalities, motivations, and incentives of those responsible for reporting. Reporters who are unable to report (he / she might be lacking the necessary technology), do not understand how to report (he / she might not understand the technology), or unwilling to report (he / she might not have motivation to report) will prevent reliable and timely data from being collected, and ultimately prevent action to maintain and expand infrastructure from occurring.

Two broad questions should be considering when developing a design framework for introducing an ICT tool within a WASH sector project (See Box 1):

Box 1. Two key questions:
determining the personalities, motivations, and incentives of those reporting

1. How easy is it to report?
- What technology do the reporters use?
- How difficult is it to report?
- What are the financial or time costs to reporting?

2. How willing are users to report?
- What does the reporter 'gain' by reporting?
  - How does a reporter know that his / her report was heard and processed?
  - Does the reporter see action taken after he / she made a report?

Oftentimes, the answers to these questions are determined at the end of an introduced pilot or project, rather than at the beginning. A review of eight initiatives[5] using ICTs to monitor water supply services examined the various elements that are likely to hinder or promote sustainable water supply systems. The comprehensive study, using Qualitative Comparative Analysis, defined success in terms of (1) successful ICT-based reporting; (2) successful processing of ICT reports by government or service provider, and (3) successful water service improvements. Many of the successes and failures described within the study showcase inadequate, incomplete, or non-existent answers to the 'Two Key Questions.' Tables 1 and 2 below highlight the studies' key findings in regards to the 'Two Key Questions.'

Table 1. Question 1: How easy is it to report?	
What technology do the reporters use?	- Women and children, the individuals primarily responsible as 'water-fetchers,' are least likely to have mobile phones (and hence be able to report). - Reporters preferred to directly call the mechanic to report a problem rather than send an SMS. - Poor GSM reception prevented reporting. - Inability to charge mobile phones can prevent reporting (and the opposite can promote it).

How difficult is it to report?	• Inability to read the location he / she is at due to poor labels can decrease reporting. • Sending text messages was often difficult for users, as they were unable to read or input the correct numbers. This decreased usability or reliability of reports. • Knowledge of how to report via advertisement campaigns (radio, posters, flyers) increased success of ICT tools.
What are the financial or time costs to reporting?	• Some methods of reporting, such as SMS, cost the user money.

Table 2. Question 2: How willing are users to report?	
How does a reporter know that his / her report was heard and processed?	• No confirmation that report sent in via ICT tools decreased confidence that a report was heard. • Poor or good communication between reporters and those receiving and acting upon the information can hamper or promote, respectively, acceptance of ICT tools.
Does the reporter see action taken after he / she made a report?	• Lack of trust between reporter and service provider decreased probability of reporting. • Low government body / service provider human resource and knowledge to process ICT reports decreased likelihood problems would be given attention (and vice versa can result in positive change). • The ability of government body / service provider / outside organisation to fund operational costs can positively or negatively impact functionality and hence the reporter's ability to see that action was taken after reporting. • In some situations, the reporter is a hired employee by the service provider. As such, it is in his / her best interest to report (either because the use of the ICT tools or the income generated from the waterpoint are directly related to his / her pay).

As examined above, the failure of many ICT projects within the WASH sector can be attributed to a poor understanding – or a misunderstanding – of those responsible for reporting information. Oftentimes, a clearer grasp of those reporting is comprehended after the rollout of the project.

Below are two examples of current projects SeeSaw is implemeneting to try to incorporate the personalities, motivations, and incentives of those reporting at the beginning of the project, rather than as an after thought.

Case study example 1: VerAgua monitoring system

In 2013, Development Workshop Angola (DWA) contracted SeeSaw with a grant from GSMA, to implement the VerAgua Monitoring System in Huambo. Following the success of the VerAgua system in Huambo, DWA approached SeeSaw in 2014 to extend the system to cover 200 urban standposts in Luanda. DWA works with Water User Associations (WUAs) across Huambo and Luanda, who, in turn, manage the delivery of water from standposts. Bulk supply of water can be extremely variable, significantly impacting the level of service.

The expansion of the system in Luanda – with its introduction nearly two years after that of Huambo's – provided an ideal opportunity to use lessons learned from Huambo to design a system that adequately addressed the 'Two Key Questions' described earlier. First, we will describe one ICT component of the system and how it was crafted to address Question 1 (how easy is it to report?). Then, using lessons learned from Huambo, we will showcase how the design of the VerAgua Monitoring System in Luanda more adequately addressed Question 2 (how willing are users to report?).
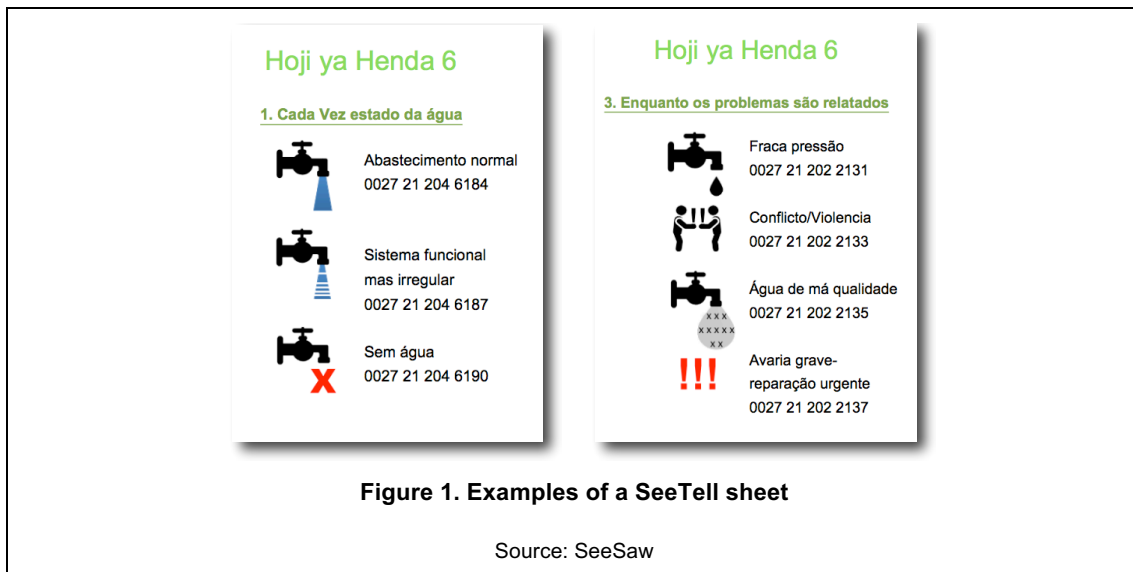
Figure 1. Examples of a SeeTell sheet

Source: SeeSaw

One component of the VerAgua Monitoring System is SeeTell. This system enables vendors and members of the WUAs to use basic cell phones to make 'missed calls' to signal the status of water (no, intermittent, or normal water), the number of hours of water at kiosks and rural water points, and various problems (emergency, conflict, low pressure, etc.) (See Figure 1). Reporters received such a system positively, as it provided an 'easy' way to report (See Box 2):

Box 2: SeeTell – How easy is it to report?

1. **What technology do the reporters use?**
   - Reporters relayed information by making a 'missed call.' Missed calls require a basic phone, rather than a smartphone and do not require a reporter to download an external application.

2. **How difficult is it to report?**
   - SeeSaw and DWA chose the SeeTell system, as many of the reporters were familiar with how to make a missed call. As a result, users were accustomed and comfortable with the system, decreasing, if not eliminating, any learning curve (and lowering the possibility of entering incorrect information).
   - Reporters are given laminated cards with unique phone numbers that correspond to their specific water point (See Figure 1). In addition to all information translated into the local language (Portuguese), each number corresponded to both text and an image. This addition helped those less literate to still be able to report.

3. **What are the financial or time costs to reporting?**
   - As the platform relied on 'missed' calls, no cost was incurred by reporting.
   - As many individuals are accustomed to 'missed calls', the system reduced the time required to report (in comparison to sending an SMS or actually making a phone call).

However, the second Key Question was not adequately addressed in Huambo. Much of this was a result of poor communication between the DWA staff in Huambo and the reporters. For instance, there was poor communication and engagement regarding the creation of the project and those responsible for fixing reported issues: government financing and an interim solution for repairs were not present at the outset to sustain reporter engagement and demonstrate the impact of monitoring. Moreover, DWA staff did not have strong relationships or communication with caretakers. As a result, DWA was unable to relay to SeeSaw (1) why reporters were not reporting and (2) issues reporters might have had that DWA and SeeSaw could have helped to ameliorate (such as broken or stolen phones or lack of airtime, as well as when caretaker's responsibilities shift and substitute reporters are introduced without informing DWA).

Compared to Huambo, in Luanda, the DWA staff act as strong middlemen between SeeSaw and DWA's reporters. This has created a strong communication loop. The initiation, development, and continuation of this relationship have been influential in both the reliability and frequency of reports and the sustainability of

the system. DWA staff has strong relationships with each reporter, and is more immediately aware of situations that hinder reporting in Luanda. These include when mobile phones are no longer working, lack airtime, lose credit, or are expired; when reporters change phone numbers; and when a reporter's responsibility shifts and a new reporter takes his / her space. DWA promptly alerts SeeSaw, allowing SeeSaw to adjust the system properly. Moreover, with such strong communication and relationships between DWA and reporters, DWA is able to 'replace' reporters who are no longer actively reporting and to more easily understand the issues he / she might have with reporting (financial or time constraints; a lack of incentive to report) and relay this information to SeeSaw who can make modifications.

Nevertheless, despite adjustments to the VerAgua Monitoring System in Luanda, difficulties are still experienced. In Luanda, reporters receive confirmation SMSs that their reports have been received and processed, as well as morning and evening SMSs reminding them to report if they have not already done so. Unfortunately, due to problems with the mobile network and SMS provider, it was common for particular phone numbers to not receive these SMSs. By using this situation as a randomised trial of sorts, it provided an opportunity to evaluate the 'effectiveness' of morning and evening SMS reminders. However, after preliminary analysis, the reporters who continually report tend to receive SMS reminders 100% of the time; while the reporters who continually do not report, are the ones who frequently have a large percentage of 'undelivered' SMS reminders. This, in fact, suggests that the phones of these reporters are no longer working. As such, it might suggest that the communication among the reporters, DWA, and SeeSaw in Luanda is not as strong as believed or as required for 100% participation.

Case study example 2: genius of space

More recently, in November 2016, SeeSaw partnered with Greenhouse Systems Development (GSD) in its Genius of Space (GoS) project located in the informal settlement of Langrug (in Franschhoek, Cape Town). The introduced system, a stormwater, greywater and solid waste management and treatment system based upon the principles of biomimicry, is designed to help eliminate water pollution in the Berg River.

Greenhouse Systems Development has employed a number of 'flow agents' in Langrug to make sure the prototype systems are functioning, clean, and being used by residents properly. Before the introduction of SeeSaw's ICT tools, flow agents used Google form surveys and paper checklists to report information on infrastructure maintenance and status. However, this reporting mechanism was not very efficient, and often caused delays in fixing broken parts. It also meant that GSD did not have a clear understanding of the functionality of the systems.

After meeting with SeeSaw, GSD decided to pilot the SeeTell (missed call system) and Snapture (Android application whereby users take pictures of QR codes), both of which are simple reporting systems that allow reporters to signal issues (SeeTell) or answer a series of Yes / No questions (Snapture) through the use of mobile phones. Both systems are intended to lower the barriers to communication between flow agents and other GSD staff, ultimately leading to better service delivery.

Similar to the strong communications found between SeeSaw and DWA in Luanda, a similar relationship exists within the GoS project. This has allowed SeeSaw to adequately answer Question 1 (how easy is it to report?) and Question 2 (how willing are users to report?). SeeSaw has been able to frequently discuss and visit (due to the close proximity of the project to SeeSaw's office) the project to better understand the difficulties encountered by flow agents and craft a system around the reporters from the onset, rather than after various iterations. A key to the project's initial success was the positive reception and engagement of flow agents. GoS selected one individual to be responsible for the ICT tool of Snapture, and two agents for SeeTell. This allowed for intensive engagement with these individuals to determine their working habits and preferences, and ensure they master how to use the technology and also become excited about using it (compared to filling out a Google survey).

As this project is in its initial phases, the further continuation of the project will showcase the success of crafting an ICT platform around the reporters, as well as surprises and challenges we might not have predicted or expected.

Conclusions and next steps

Much attention in the use of ICT tools in the WASH sector has been centred on collecting information and processing it, with little mindfulness given to crafting an ICT tool that caters explicitly towards the ones reporting. This paper describes some of the shortcomings in past ICT projects, specifically as they failed to adequately address the Two Key Questions: (1) How easy is it to report? And (2) How willing are users to

report? The discussion of the VerAgua Monitoring System in Angola and the Genius of Space project in Langrug highlighted the different mechanisms SeeSaw and its respective partners used to answer these two questions in order to craft an ICT solution.

Nevertheless, there are still lessons to be learned and questions that need to be further investigated and answered. A move in the right direction would be to further understand the role of confirmation and reminder mechanisms in incentivising reporting; to discover ways to determine whether partnering organisations will be influential and active; and to design other creative ways to encourage users to report timely and with reliable information. Unfortunately, this will be no easy feat, as every project will bring with it new challenges – whether culturally, socially, or financially, among others – and surprises.

Acknowledgements

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Notes

[1] Banerjee, S.G. and Morella, E., 2011.

[2] Faggianelli, D.; Desille, D., 2013.

[3] For more information on the benefits of ICT in the WASH sector, see: Schaub-Jones, D. 2013 Considerations for the successful design & implementation of ICT systems in the WASH sector. *33rd WEDC International Conference, Briefing Paper 2243.*

[4] Faggianelli, D.; Desille, D., 2013.

[5] Well, K., Williams, J., and Pearce, J., 2015.

Contact details

Schaub-Jones, David & Kaliski, Jessica
SeeSaw
210 Long Street
Cape Town, South Africa
Tel: +27 82 400 6068
Email: david@greenseesaw.com
Email: Jessica@greenseesaw.org
www: www.greenseesaw.com