40th WEDC International Conference, Loughborough, UK, 2017

LOCAL ACTION WITH INTERNATIONAL COOPERATION TO IMPROVE AND SUSTAIN WATER, SANITATION AND HYGIENE SERVICES

The role of information and communications technology in teal-time monitoring for quality WASH infrastructure

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PAPER 2610

The risk of inefficiencies in quality of WASH infrastructure construction is higher in places where monitoring is less or absent or when monitoring is only limited to persons directly involved with the business processes and transactions. To address system deficiencies and constraints in the monitoring of latrine construction in WASH in schools' project, CRS Ghana explored innovative technology solutions that allow access to quick, cost-effective quality data on progress of construction activities. The solution involves the use of Tablets, GPS, Iformbuilder Platform and BarTender software to develop a simple system to track and certify construction results in real-time. This approach prevents construction defects, supports cost-effective delivery of quality infrastructure, promotes transparency and allows decision making on payments, contracts and WASH programming.

Introduction

In 2014, Catholic Relief Services (CRS) in Ghana, with funding from the Leona M. and Harry B. Helmsley Charitable Trust, began the implementation of a 3-year project- the Integrated Sanitation and Hygiene for Nutrition and Education (I-SHINE) project in 6 districts across the Northern and Upper East Regions of Ghana. The project aimed to address key issues affecting retention of students in school, specifically relating to the quality of the school environment, nutrition and community sanitation. One main expected outcome of the I-SHINE project was that children regularly attend WASH-friendly schools. To achieve this outcome, CRS Ghana made significant investments in sanitation infrastructure, hygiene promotion and community-led planning and management of WASH in 138 schools, which were essential to meeting project results including behaviour change, improved health and poverty reduction. Despite CRS' rigorous procedures in procurement and management of construction contracts, there was dissatisfaction with outcomes of construction investments and defects that were discovered at a stage that required to break and reconstruct. Latrines were not constructed according to technical specifications and design, and within prescribed timelines, and the quality of construction and sustainability were uncertain. This resulted in excessive time wasting and increased costs on verification of construction stages and repairs to address defects (CRS GHANA, 2016:4).

To address the above system deficiencies, CRS Ghana decided to explore and adapt ICT solutions that allow access to quick but cost effective quality data on latrines construction. A simple system was developed by using tablets, GPS, Iformbuilder and BarTender softwares to track and certify construction results in real-time to support the delivery of quality infrastructure (Cantoni and Danowski, 2015:16). This application promotes transparency and allows decision making on payments, contracts and WASH programming (Yanyi-Akofur, 2016:6).

Project overview

Construction supervision and monitoring can be a very daunting task, especially where several units of sanitation facilities are being constructed at different locations at the same time. Upon the commencement of construction activities, the I-SHINE project implementation was confronted with some challenges which risked the success of the project. The issues identified include the following:

- Operational challenges: - how to ensure value for money
- Implementation challenges: - poor compliance with approved bill of quantities and technical specifications by contractors, and how CRS and the school communities can prevent flaws in construction
- Monitoring challenges: - use of paper based forms, low reliability of data transmission, delays in information flow, poor supervision, late response to defects, etc.

To provide practical solutions to these challenges, CRS Ghana integrated ICT into its infrastructure construction and monitoring program in the I-SHINE Project to ensure the following (CRS, 2015: 24):

- Quality of data collection
- Quality of construction control systems and risk prevention
- Real-time data analysis
- Quality of data accessibility for decision making.

Tools and materials used

To reduce cost of implementation (Yvan, 2013:4), simple ICT4D tools were selected to use, as provided in Table 1. The materials listed in Table 1 formed the toolbox (Figure 1) for the school latrines construction monitoring.

Table 1. Tools and materials used to develop ICT4D solution for the monitoring of school latrines construction

Item name	Unit cost ($)	Quantity purchased	Other remarks
Mini tablet	582	2	1-time cost
BarTender	289	1 (user)	1-time cost for single user licence
IFormBuilder Mobile Platform	15/month	3 (users)	Under CRS licence
ArcGIS online	200/year	-	Under CRS licence

Figure 1. CRS - Components of the ICT4D system

Source: CRS – Ghana

In building the system, forms were developed to cover the various stages of construction as shown in Figure 2. These forms contained questions on the construction processes which would have to be answered by the monitoring officer. Each latrine was also assigned with a specific barcode as an identification number (see example in Figure 3), which upon focussing the Tablet's camera on it will scan and pull up attribute information of the latrine, therefore reducing time spent in searching through the list of latrines to select the one being monitored.

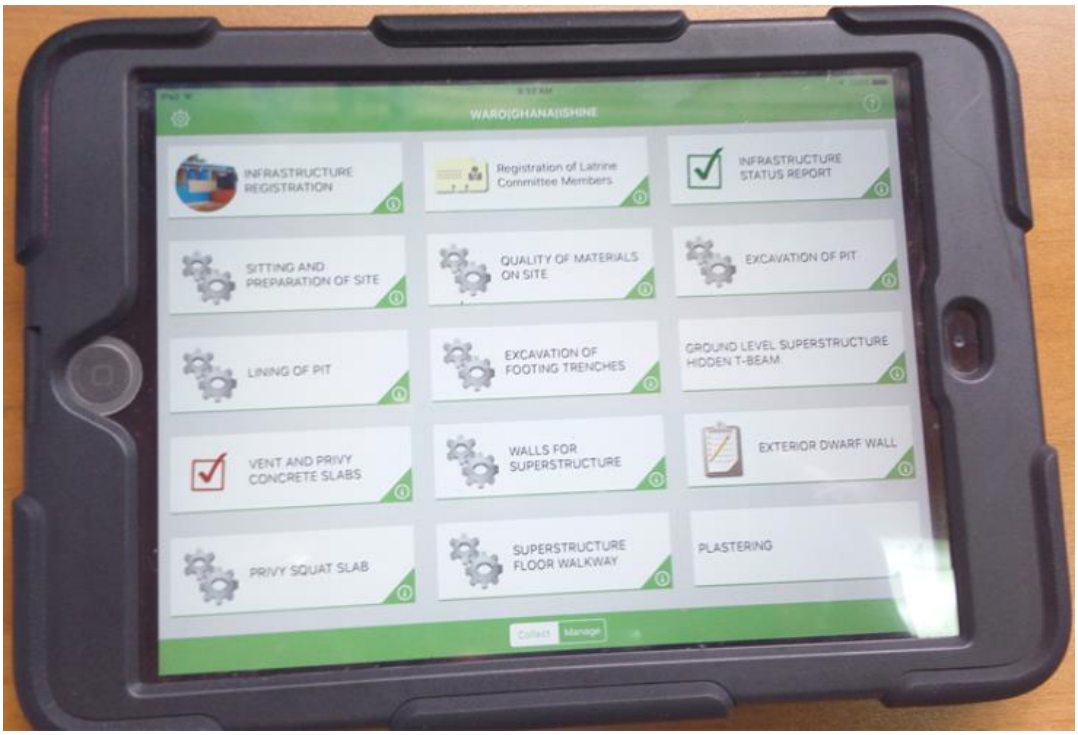

Figure 2. CRS - Interface on the Iformbuilder on mini-IPad showing construction stages

Source: CRS – Ghana

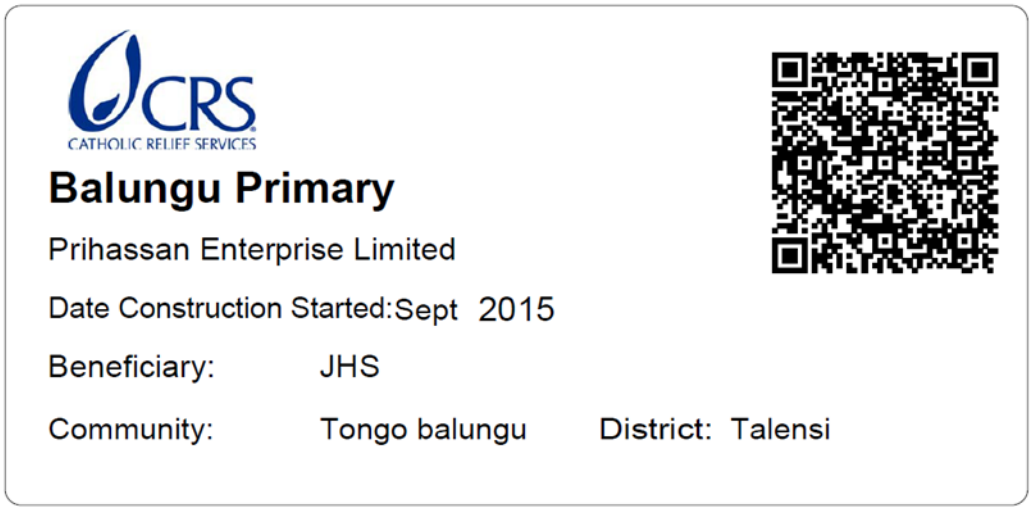

Figure 3. CRS - Sample latrine ID card

Source: CRS – Ghana

Training and field monitoring of construction works

Two construction quality field officers were trained on the use of the ICT4D tools and system. Each officer was then deployed to the construction sites in one region (i.e. one in the Upper East Region and the other in the Northern region) to supervise and monitor the day-to-day construction activities of the contractors. Data collected during monitoring was relayed almost immediately to the base office for storage, retrieval, analysis and decision making, as depicted in Photographs 1 and 2. Figure 4 shows a location map of WASH infrastructure with metadata interface prepared from the data using GIS software, and photograph 3 presents a completed school latrine.

Photograph 1. CRS Ghana – monitoring of construction progress using ICT4D

Source: CRS – Ghana

Photograph 2. CRS Ghana – pit of school latrine under construction

Source: CRS – Ghana

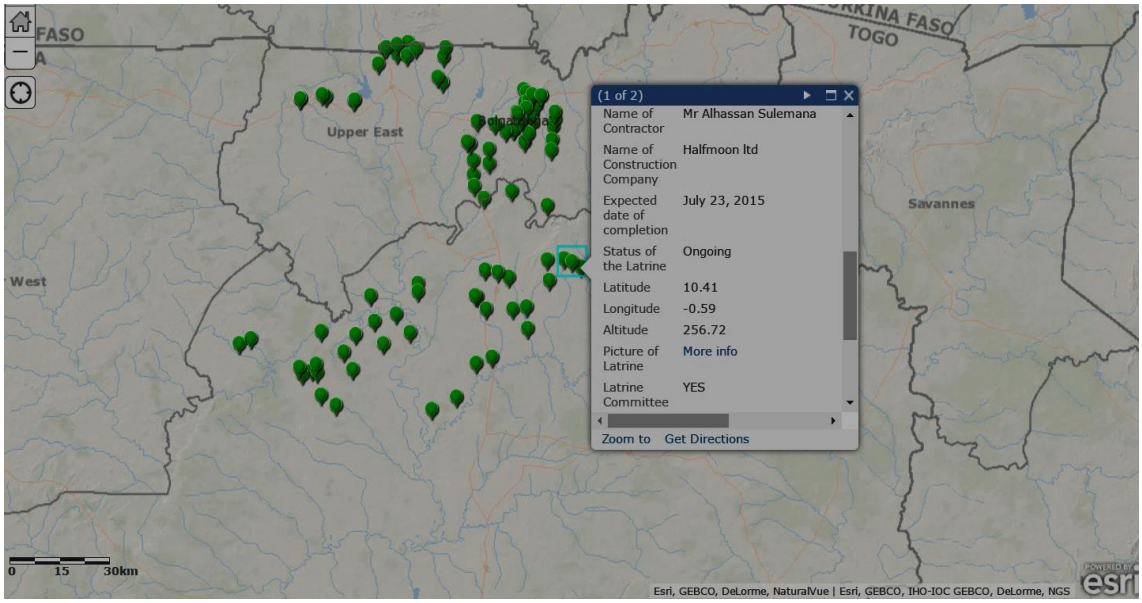

Figure 4. CRS – Map showing locations of WASH infrastructure with data interface

Source: CRS – Ghana

Key achievements

The use of the ICT4D system to monitor school latrines construction has been very cost effective and efficient in providing real-time, accurate data on construction stages to aid project management in decision making. The successes achieved include:

- Completion and submission of forms in real-time (data transfer improved from 2-3 months' delays to a few minutes or hours (depending on internet connectivity)
- Error reduction and elimination of incomplete forms submissions through the input of control checks in the fields of the forms design
- Rapid data treatment/aggregation and reporting
- Improved trust and transparency throughout the construction periods
- Eliminated or reduced the risk of poor construction works by the contractor; defects are immediately identified for correction
- Data accessibility at all levels (data centralized into one system)
- It also ensured value for money for works done
- Production of location maps of WASH infrastructure with metadata interface.

Initial paper data collection covered 30 latrines between July-December 2014. From analysis done in January 2016 that compares the experience between the paper data collection and electronic system on 78 new latrines, accuracy of data transmitted from the field has improved from 85% to 98% due to control checks embedded in the fields of the forms design. Completeness of forms submitted from the field has also improved from 75% to 100%. The electronic system was used to assess data on the 78 latrines bi-weekly. This enhanced decision making as data transmission improved and the system allowed real-time monitoring and reporting. Timeliness of data transfer improved from 2-3 months' delays to a few minutes'/hours transmission time. Data is automatically transferred as soon as users move to a location with connectivity.

Photograph 3. CRS – a completed school latrine with WASH murals

Source: CRS – Ghana

Key challenges encountered

The main challenge encountered in the course of implementing the ICT4D in monitoring latrine construction works was user related, rather than on the platform used or its design. There was an initial low capacity of field-based staff to use the ICT devices. However, this challenge was addressed with adequate training and increased usage of the devices.

Lessons learnt

- Monitoring officers need training and hands-on coaching to become confident with the use of the ICT devices
- ICT is a powerful tool that can be used for WASH infrastructure monitoring as it enables real-time transmission of accurate data and information on progress of construction, reduces time and cost of data submission from field to office, and eliminates the submission of incomplete forms
- It has proven to be an effective means of checking on construction quality in real-time, thus enabling any corrective measures to be taken on time to ensure construction quality and sustainability of infrastructure
- It enhances decision making and timely reporting
- The ICT solution could be applied to other sectors of WASH monitoring and programming

Conclusion

The use of ICT in monitoring of WASH infrastructure construction provides a cost effective solution in tracking and certifying construction progress, as it promotes transparency and allows real-time corrective measures to be adopted. These go a long way to ensure quality of infrastructure construction and their long-term sustainability. The ICT as a monitoring tool is applicable to other areas of WASH programming.

Acknowledgements

The authors would like to acknowledge the Helmsley Charitable Trust which provided the funding for the I-SHINE Project. The contribution of the WASH team at CRS Ghana (especially Elliot Abra and Moses Korbli) to the preparation of this paper is also greatly acknowledged.

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