

ICT for Data Collection and Monitoring and Evaluation

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ICT IN AGRICULTURE

Connecting Smallholders to Knowledge, Networks, and Institutions

The World Bank, in collaboration with the e-Agriculture community and the Food and Agriculture Organization of the United Nations (FAO), is holding a series of two week online forums. These e-forums stem from the launch of the World Bank's *ICT in Agriculture e-Sourcebook* (2011) and the growing demand for knowledge on how to use ICT to improve agricultural productivity and raise smallholder incomes. The following summary captures the discussion during one of these e-forums. *The text is derived strictly from the participants' posts during the forum and does not reflect the views of the World Bank or FAO.*

Data collection and monitoring and evaluation (M&E) efforts take a great deal of time and methodical planning and implementation. In the past, these tasks were performed with paper and pen, which made them prone to error, difficult to conduct on a large scale, and high in transaction costs. Information and communication technology (ICT) tools, including hardware like mobile phones and tablets, applications with the capacity to create digital surveys, and software that allows users to upload data to storage facilities in real-time, have reduced the conventional challenges associated with remote data collection and M&E. This forum explored the digital options for these tasks. The discussion focused largely on applications and experiences using hardware and software components, and the impact of using digital tools for these purposes.

Hardware Components

Choosing the right hardware is a critical step in a project using ICT for data collection. Complex data collection usually requires more capable devices, but for simple collection, leveraging SMS may be appropriate.

Much of the discussion about hardware for data collection focused on the use of Apple products. While many would think that an iPad, iPhone, or Android device would be the best tool, iFormBuilder has found that the iPod touch is most useful, because it is compatible with the dual XGPS150, which captures GPS data alongside other data automatically. Clients of iFormBuilder have had good experience with iPod touch and iPad devices for a number of reasons. The intuitive interface and design is easy for training enumerators who have not used such technologies previously. The devices allow PDF, .mov, or .m4v files to be uploaded and stored, which gives project leaders the opportunity to include

instructions or training materials that can be accessed directly from the device without connectivity. Finally, data plans are not required to use these products.

The most recent iPod touch can be found for about USD170 and the second and third generation devices can be found for less. When iFormBuilder's clients use cheaper devices, they run into trouble with visibility (in sunlight) and limited battery life.

Additional hardware components, like GPS tools, are often required alongside the actual collection device. A combination of software and backend servers, readily available today, is needed for easy data access and data visualization.

In areas where connectivity lacks, devices that allow users to sync data without a connection are required. The ThunderPlug, for example, acts as a local cloud device (like an external hard drive), collecting data from data uploading devices within 200 feet. The data can be viewed and analyzed from the ThunderPlug as well. Upon reaching a location with connectivity, the data from the ThunderPlug can be uploaded onto the cloud.

Off-grid energy components are also important. Solar panels and other alternative energy sources are necessary for charging collection devices and hardware. Radio devices are also key to disseminating information on data collection efforts.



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Best practices/lessons

Though a new field, participants in the discussion shared what they have learned about how best to employ applications and ICT-enabled tools to collect data and perform M&E. One of the primary lessons is that technology itself is not sufficient to meet project objectives. Even a platform for free data collection does not guarantee the right data will be collected effectively. Maintaining a team that can design the collection efforts, implement them accordingly, and evaluate the data are as important as the technology. Training is an important component to collecting data through ICT tools. iFormBuilder works directly with clients to help build their surveys, until the client's capacity is such that they are capable of doing it on their own. Field enumerators and farmers using new technologies need additional training and support. With proper instruction, most organizations have found that even poor, uneducated farmers are capable of picking up the skills.

The most complex technology or platform is not always necessary. Local lead farmers in USAID's Feed the Future Project collect basic data from the community's farmers with paper and pencil. Field advisors from the agricultural associations then check the data and upload it onto an Excel sheet, which is then shared with millers (buyers) in real-time via free accounts on Drop Box.

Another important consideration is utilizing a technology that farmers already use. Introducing a new technology will increase costs and reduce sustainability.

Issues like access to electricity need to be considered before investment. Where electricity is lacking in rural communities, local entrepreneurs have formed businesses that offer electric generators for re-charging mobile phones.

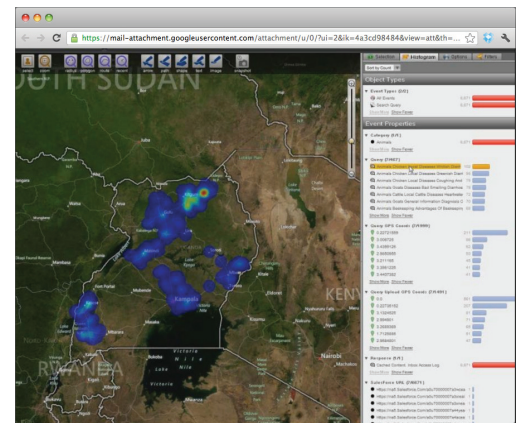
Another consideration is program costs. Messages, staff, and other critical resources invested in the provision of a communications service or data collection effort all cost money. Varying designs can help project leaders or agencies manage these costs. For example, if taking an effort to a large scale, it might be useful to break down a central communication hub into smaller regional hubs (which may reduce/avoid international roaming fees for SMS or phone calls).

When using ICT to collect data from farmers or disseminate information, project leaders should remember that "context is king", and that policy, the enabling environment, and marketing efforts are still critical to maintaining farmer participation. Since most farmers have limited disposable funds, incentives to participate (such as free airtime) or subsidizing the costs of the messages that they are asked to send may be necessary.

Concern was expressed that big data collection efforts are strictly aimed at informing the well-educated and not smallholder farmers who cannot interpret the data. This concern highlights the importance of disseminating easily usable, relevant results to farmers in a timely manner. Some applications, like FrontlineSMS, attempt to enable anyone (including smallholders) to "have a say". Radio programs that invite farmers to send questions, answers, or information are a form of data collection that better connects with local communities. For radio to be a truly useful tool, critical issues (not specifically related to data collection and M&E) were identified, including that locally relevant and regularly revised programming is key to retaining listenership. Concern was also raised about small, local broadcasters being displaced by international companies, and in the process losing the needed connection with farming communities.

On the national policy-level, large scale data collection efforts can have a massive impact. The Grameen Foundation, through their Community Knowledge Worker program, partnered with a NASA data miner and Palantir (on separate occasions) to explore and analyze data. They found rich data about behavior patterns of farmers. Using heatmaps, they also explored using agriculture information queries to identify crop and animal disease outbreaks. Visual representations of the CKW data set can be seen in a video at <http://youtu.be/4FCq-EidkKc>.

Data integrity and security are also important factors for success. Leveraging location data and other metadata with individual records helps to maintain integrity. Using robust skip logic, where relevant follow-up questions are shown based on a specific response to the previous question (essentially omitting aspects of manual data entry/choice), results in better data quality. Encrypting the local database on the device being used to collect data, not storing keyboard caching (strokes of the keyboard), and allowing users/enumerators to create passwords are ways to protect information. If sending messages to farmers, organizers should make sure their users are not receiving spam or other misinformation that could compromise the validity of the project/data collection effort. Engaging farmers and enumerators in survey design (especially if transferring/using surveys from country to country) is also critical to successful collection and data validity.



CKW query data is visualized to identify crop and animal disease outbreaks.

Impact

Many applications and agencies have seen positive impacts from using ICT enabled tools in their data collection and M&E work. In Central African Republic, Catholic Relief Services used barcoded ID cards to track beneficiaries, vouchers, and vendors' sales at seed fairs. They saw a number of benefits, including a reduction in the time it took to run a seed fair (time reduced from 6 to 3.5 hours) as well as the staff required to manage the fair.

Catholic Relief Services



The Grameen Foundation's Community Knowledge Worker Program (made up of 800 CKWs, who function as "information intermediaries") has collected more than 38,000 surveys. These surveys are validated and checked for errors by experts. A recent study showed that, in Eastern Uganda, farmers who have access to CKWs receive 17% higher maize prices than those that do not. It was also found that CKWs who set-up offgrid charging enterprises (where farmers can pay a small fee to charge their mobile device) earn approximately 40USD per month.

FAO's Farmer Field School (FFS) monitoring system in Kenya allows for immediate feedback from FFS participants, and for the analysis of remotely located trainers' performance from a central location. As a result, project coordinators have been able to adjust the FFS and where necessary, replace non-performing trainers.

Thanks goes to everyone who participated in this forum and made it a success. Special recognition goes to the Subject Matter Experts who volunteered their time, shared their knowledge on these important issues, and guided the discussion that lead to the output you are now reading: Or Dashevsky, Catholic Relief Services; Takayuki Hagiwara, FAO; Sean Krepp, Grameen Foundation; Chris Reichart, Zerion Software Inc.; and, Laura Walker Hudson, FrontlineSMS.

Applications

There are many applications and ICT-enabled tools for data collection purposes. The following paragraphs provide a synopsis of the applications discussed and presented during the discussion.

Applications	Where	Description
Applied Data Logix and Octagon Data Systems Ltd	India and Kenya	These two partners have developed applications that use digital scales to collect data on farmers yields at tea and dairy community aggregation centers in Kenya. Agricultural product is weighed on a digital scale, and then data uploaded to a central repository. The data is aggregated each month and the farmers are paid according to the records. http://www.adl.co.in/ - http://www.octagon.co.ke
Cropster	Latin America	This application provides online tools for sustainable supply chains - including producers, traders and processors of agricultural products. It also has an M&E tool, enabling efficient data collection and exchange within producer groups and between producer groups and NGOs or commercial partners. This tool is not a classical M&E platform, where data is only available to the questionnaire managers, but also to the people who are providing their answers and valuable insights. The tool also combines data generated through commercial processes (production, quality, price) with questionnaire data. http://www.cropster.org

Applications	Where	Description
Digital Purjee Information Service	Bangladesh	The Digital Purjee Information Service via SMS ensures timely harvest, enhanced income for farmers, and ready supply of raw materials for sugar mills. This project is a joint initiative between the UNDP-supported Access to Information Programme, organized by the Prime Minister's Office and the Bangladesh Sugar and Food Industries Corporation of the Ministry of Industries. http://www.epurjii.info/en_index.php
Frontline SMS	global	Two versions of the software exist now. Version 2 has a more intuitive interface, smoother operability, and increased stability. However, because it was just launched, it is still lacking some of the more complex data analytical features of Version 1. FrontlineSMS is used in a variety of ways. In one instance, the application was used to organize messages on disease outbreaks, which lead to proper diagnosis. http://www.frontlinesms.com/
iFormBuilder	global	The software allows the user to filter the data, and is compatible with XLS, XML, JSON, ATOM and RSS. Real-time data visualization through live data feeds are possible through tools like Klipfolio, Gekoboard, RoamBI, and Google. Custom databases and dashboards can be created for entire organizations and/or companies (allowing multiple users to access the same central data hub and maintain agency/company standards). Integration with Google allows for custom analysis reporting and GIS representation. http://www.iformbuilder.com/
mPower Social Enterprises Limited	Bangladesh India and the Middle East	mPower Social Enterprises Limited are working in Bangladesh, India and in the Middle East using mobile technology to get real-time information from the field. The application will be used to track the agricultural information, agri-markets, and monitor the growth of the seeds. It will also be used to implement a mobile-based public health module and track health of livestock animals. Frontline workers, using a Android mobile handset to ask the farmer questions on the health of their animals. The collected data is sent using EDGE/GPRS and a dashboard is created in the web for each individual beneficiary. The veterinarian can suggest or give instruction to the staff, who can then instruct the beneficiaries on a real-time basis. http://www.mpower-social.com/
Smartagro	Chile	SmartAgro is a smartphone application that allows farmers or agronomic experts to collect in real time data about the field (type of products, operations carried out on the field, use of inputs, quality of soil, inventory of tools and machines, pictures of diseases on the crop, etc) onto a smartphone. The application is fairly easy to use for new technology users. Once collected, the data is uploaded onto a computer (which can be shared or personal). A web application allows NGOs, and public and private organizations to interact and advise the farmers based on the information collected. http://www.smartagro.net
Text to Change	Africa	This application creates simple surveys in the form of a quiz, keeping length under 160 characters. The end-users send and receive the text messages for free, and the Telecom provider bills the partner for messages sent and received. The data is collected continuously and can be accessed by a stakeholder in real-time through our platform that runs online. http://www.texttochange.org/

Resources

Review of data collection tools available.

<http://dev.mobileactive.org/comparing-mobile-data-collection-tools-followup>

Overview of how to use mobile phones for data collection.

<http://www.mobileactive.org/howtos/mobile-phones-data-collection>

The Central African Republic Seed Fair and the KAP Malaria presentations from Day 2 of the Catholic Relief Services' ICT4D Conference show detailed architecture used for the projects.

<http://www.crsprogramquality.org/ict4d-2012/>

The Cambodian Ministry of Agriculture Forestry and Fisheries is using data collected through FrontlineSMS to track and contain animal diseases. Village chiefs and animal health workers report livestock deaths weekly via SMS to monitor mortality offering timely and accurate reports.

<http://www.frontlinesms.com/2012/04/23/data-collected-via-frontlinesms-is-used-by-cambodian-ministry-of-agriculture/>

A more advanced data collection project, where Technoserve used Frontline Forms to follow-up after training sessions to monitor impact.

<http://www.frontlinesms.com/2011/08/31/tanzanian-farmers-report-improved-yields-via-sms/>

Using radio and FrontlineSMS in Tanzania.

<http://www.frontlinesms.com/2011/06/16/reaching-communities-through-the-airwaves/>

Blogs and discussions on radio by Farm Radio International and CTA.

<http://www.barzaradio.com/>

National Geographic article on FrontlineSMS.

<http://newswatch.nationalgeographic.com/2011/04/26/%E2%80%9Cfarming-out%E2%80%9D-agricultural-advice-through-radio-and-sms/>

Articles on radio technology and community participation:

<http://www.hamuniverse.com/setuphamstation.html>

<http://www.hamlife.co.uk/categoryRender.asp?categoryID=3654>

<http://voices.yahoo.com/how-set-own-fm-radio-station-licensing-274533.html>

<http://www.clydebroadcast.com/img/bank/SettingStation.pdf>

New version of Frontline SMS.

<http://www.frontlinesms.com/2012/06/12/frontlinesms-same-vision-new-user-driven-design/>

Technology that transfers paper data to digital form.

<http://captricity.com/>

This project has set up a livestock information system in Eastern Africa, including data collection and surveying. It relies on basic mobiles already in the hands of beneficiaries, who are able to take part via SMS.

http://www.cahnet africa.net/assets/mag_cahnet_news_jul_sep_2010.pdf

<http://www.frontlinesms.com/2011/05/20/6763/>

<http://www.frontlinesms.com/2009/03/31/farmer-to-farmer-phone-to-phone/>

<http://www.frontlinesms.com/2009/07/07/on-a-mission-to-aid-farmers-in-latin-america/>

<http://www.frontlinesms.com/2009/12/15/fishing-meets-texting-in-banda-aceh/>

<http://vimeo.com/43577313>

Video on the SmartAgro application.

<http://vimeo.com/33390640>

Video on Grameen's community knowledge workers.

<http://grameenfoundation.force.com/ckw/apex/Dashboard?sfdc.tabName=01r70000000HaJA>

The cloud for Africa.

<http://www.grameenfoundation.applab.org/blog/the-cloud-for-africa.html>

The Data Integrity Guide from FrontlineSMS: This guide aims to show the path and potential vulnerabilities of sending text messages to help assess risk and adopt best practice when storing and sharing information.

<http://www.frontlinesms.com/user-resources/user-guide-data-integrity/>