



CROWDSOURCING APPLICATIONS FOR AGRICULTURAL DEVELOPMENT IN AFRICA

INTRODUCTION

This briefing paper details crowdsourcing applications relevant to smallholder farmers. It is one of a series of briefing papers intended to help USAID missions and their implementing partners in sub-Saharan Africa use information and communication technologies (ICT) to improve the impact of agriculture projects.

Over the last 10 years, sub-Saharan Africa has witnessed strong growth in its ICT infrastructure, including mobile operator services, mobile penetration rates, and mobile network capacity. This growth provides a foundation for new applications that are just beginning to demonstrate their impact in the region. Crowdsourcing is one such application.

Crowdsourcing was first coined in 2006.¹ Worldwide, it commonly refers to outsourcing a function done locally to a large, disconnected group of people. It broadly collectivizes a role otherwise done by an individual or small group by using ICT. A well-known example is the online platform Kickstarter. It facilitates the sourcing of capital for creative projects from the general public. Since 2009, it has fueled \$600 million in funding for more than 100,000 projects.²

This paper details crowdsourcing in an agricultural development context, defined in the textbox. Although still fairly new in practice, it provides a potentially affordable tool for practitioners to conduct field research, gather data from remote areas, exchange information among key stakeholders, and other benefits.

Crowdsourcing: A Definition in Context

Crowdsourcing is when information is sourced from a group of people in response to an open call, a request for specific information, or for an exchange, organized by a central organizer/organizing body.

In the context of this paper, the crowd generally refers to smallholder farmers in sub-Saharan Africa, although it can also apply to other players in the value chain, such as buyers, warehouses, transporters, etc.

It includes sections on the necessary components for using crowdsourcing in agricultural development, profiles of examples from the field, program design tips, implementation challenges, and a peek at what the future might hold.

COMPONENTS OF CROWDSOURCING FOR DEVELOPMENT

ICT-enabled efforts have the potential to leverage the accumulated knowledge of groups of people and expand access to information, funding and markets. Crowdsourcing in development can help with facilitating information gathering that reflects local markets. It allows practitioners to obtain a greater quantity and diversity of data inputs. And in some cases, it can even foster markets.

There are some core differences though that distinguish the use of crowdsourcing in development from their common application in developed economies. The first is platform. Crowdsourcing in

developed economies today is primarily done via websites at computers accessed by internet, while in sub-Saharan Africa, mobile dominates the medium of information exchange. In addition, in sub-Saharan Africa crowdsourced participation to date in the agricultural context has generally been motivated by cash, cash-like payments such as airtime, or valued information with a direct link to securing or increasing income.

When considering if crowdsourcing is applicable for potential new initiatives it is therefore necessary to ask yourself the following questions:

1. What is the fundamental role to be done or replaced by a group?
2. Do target users have access to and literacy in using mobile phones?
3. What is the incentive for people, aka 'the crowd,' to participate?

The examples in the following section aim to place these foundational elements into context.

CROWDSOURCING IN ACTION

The following examples from the field highlight how ICT-enabled crowdsourcing applications can be used within different agricultural development initiatives, particularly those that are working with smallholder farmers. They include increasing farmer access to information, promoting market access and farmer collectivization, tracking pest outbreaks, and sharing weather information. These examples are meant to be illustrative, rather than serve as a comprehensive catalog. While some of these may not succeed, they have been selected to highlight the potential of crowdsourcing in each area.

¹ [Wired Magazine](#) (2006)

² [Kickstarter Stats](#) (2013)

Tracking Pest and Disease Outbreaks

Crop loss from pest and diseases are severe threats to smallholder farmers. Yet, tracking these outbreaks before they have already spread and tracking their movements in a timely manner once there is a known problem can be challenging.

Farmers can greatly benefit from knowing the status of pests and diseases in their region. When they are informed about outbreaks as they unfold, government agencies, NGOs, and farmers can act quickly on the ground to head them off before they spread. Crowdsourcing the reporting of outbreaks therefore, holds significant potential.

To date, crowdsourced pest and disease services have been value added offerings to existing relationships and/or as part of a greater integrated service model. For instance, the Center for Agricultural Bio-Science International (CABI) launched Plantwise, an initiative offering farmers crop and pest diagnostic tools and other resources. Plantwise collects information on soil health and other risk factors.

In exchange for participating by providing data, farmers receive technical assistance via SMS and voice messages on how to remove or avoid pests, thereby reducing crop loss.³ Plantwise has crowdsourced the part of the role of its agricultural technicians, a role previously completed by a few individuals, now done by thousands of farmers in 24 countries, including DR Congo, Ghana, Kenya, Rwanda, Sierra Leone, and Uganda. Instead of sending a technician into the field to diagnose plant disease, farmers are trained by agricultural experts to identify and transmit this data to Plantwise's central database, called the Knowledge Bank.

In addition to its other efforts to reduce crop loss and improve food security, Plantwise has compiled resources into a publicly available Knowledge Bank. It is based on aggregated farmer data with

over 2,500 plant pests, pest identification tools, and pest distribution maps for use at a local level.⁴

In Zambia, the Ministry of Agriculture faced the logistical challenge of getting a limited number of trained plant technicians to assess a wide area in the field. In 2012, it was able to circumvent this challenge by using crowdsourcing to successfully stop an armyworm outbreak.

Farmers providing crop health information received government assistance, if needed, with pest-control. A total of 37 pest reports came in at the start of the season. Armed with this information, the government was able to focus limited resources to treat all of the cases in a month, preventing a larger outbreak, thus helping those farmers and their neighbors.

Although not a direct call for data from the crowd, another example of using crowdsourced data comes from Grameen's Community Knowledge Worker program in Uganda. Working with Palantir Technologies, a data visualization company, they were able to track crop and livestock illness based on trends in queries for information being made by farmers.⁵

Verifying Local Weather Information

Access to accurate weather information is highly valuable to farmers. While predictive models are improving, hyper-localized weather information in much of rural Africa is still often spotty at best. National governments and international organizations are, however, beginning to crowdsource the collection of localized weather information to verify forecast accuracy and to improve their modeling.

In Zambia, for example, the Meteorological Department's RANET project uses crowdsourcing to collect local rainfall and weather information. Weather data is collected by remote sensors distributed to 3,000 community

members in rural areas.⁶ Locals, including farmers, are trained to read and remit data to a central database via mobile phones. This weather information is later disseminated back into the community, broadcast by community radio stations.

While a valuable service for communities, weather information is also desired by planners and policy makers. Since benefits to farmers can often seem to be indirect, RANET incentivizes participation by providing free mobile phones and subsidizing air time. Oxfam in Eastern Ethiopia administers another example. This SMS-based effort monitors water points and provides early drought warnings. Participating farmers enter data into a phone with specially designed survey software. Air time is subsidized, facilitating easy transmission of water availability in the region.⁷ In exchange for providing data, farmers receive local water information, reducing their travel in drought conditions.

Collective Buying and Selling

Smallholder farmers have little purchasing power or control over their value chain. They often lack volume to get good prices for inputs or transport. Crowdsourcing can change that dynamic, by helping farmers collectively increase their buying and selling power, as well as foster access to new markets.

[M-Farm](#) in Kenya offers an SMS service that enables farmers to collectively buy agricultural inputs or sell direct to market. Instead of selling through a middle man, a group of farmers can agree on a price through the M-Farm platform and collectively sell directly to a buyer. This is done by subscribing via SMS to join other farmers in their community. To sell a crop, farmers send an SMS with the product, weight and asking price.⁸ M-Farm matches local sellers and buyers based on the prices they submit to the platform via SMS. It provides a means for the 6,000 farmers currently subscribed to circumvent value

³ [Plantwise Annual Report](#) (2012)

⁴ [Plantwise Knowledge Bank](#) (2013)

⁵ [Grameen Foundation & Palantir: Partners for Food Security](#) (2012)

⁶ [Zambia RANET Project](#) (2013)

⁷ [Oxfam East Africa Blog](#) (2013)

⁸ [M-Farm Services](#) (2013)

chain middle-men and retain higher sales margins.

Another example is [iCow](#), a mobile application from the Kenyan app-development Green Dream Tech Ltd., that helps 42,000 dairy farmers daily to track livestock.⁹ iCow aggregates and maps its crowdsourced data, helping dairy farmers and others find one another by accessing a publicly-available map online or sending an SMS to iCow with a location request. It also increases bargaining power by facilitating collective buying of inputs from suppliers in bulk and enabling larger sales volumes in aggregate.¹⁰

Leveraging Broad-based Crowdsourcing Tools for Agriculture

Crowdsourcing tools are becoming more common in a development context. The examples showcased so far are specific to smallholder farmers, but are not the only tools available. Two broad-based tools that are applicable and provide ready-to-use platforms to crowdsource information: Jana and Ushahidi.

Jana is a Boston-based for-profit company that gathers market research in emerging markets through mobile phones and sells corporations direct access to consumers. Jana gets data from, and engages with, difficult to reach populations. Through Jana, a program could reach any farmer that subscribes to one of Jana's partner networks, like Safaricom in Kenya.

Development organizations that want to collect data or provide technical assistance to remote farmers could use Jana's existing platform, instead of building their own. In Indonesia, Danone used their services to launch a trial of new products, increasing the sales of one product by 27%.¹¹ While in Vietnam, Unilever created online focus groups, engaging 20,000 consumers in 24 hours.¹²

⁹ Discussion with iCow Founder (2013)

¹⁰ [iCow Crowdmap](#) (2013)

¹¹ [Jana Case Study: Danone Indonesia](#) (2013)

¹² [Jana Case Study: Unilever Vietnam](#) (2013)

Jana participants earn small cash payments or airtime minutes by completing a short survey by phone. A cash or airtime incentive is valuable for low-income individuals living on \$2-3 per day in rural areas with few alternative income opportunities. Jana is, by no means, the only provider in this space though. Newer entrants like GeoPoll also provide access to anyone with a mobile phone who has registered with them for polling.

The other example is Ushahidi, a non-profit Kenyan software company that grew out of the 2008 post-election violence. It offers a free, open-source platform available to anyone with an internet connection. For short-term projects, Ushahidi's Crowdmap allows someone to collect and map data from multiple sources, including SMS, Twitter feeds, and web-forms. Efforts around a common cause—like pest infestation or inclement weather—can use Ushahidi to quickly aggregate simple, non-secure data.

Users can also customize the platform for a fee. This is more affordable than building a platform from scratch, especially for programs that plan to use crowdsourcing for more robust undertakings that require an ongoing exchange of complex data. As part of this paid service, Ushahidi will also manage the crowdsourcing initiatives for you.¹³

While these two platforms have been highlighted as examples, they are not the only examples currently available. In addition, broad-based crowdsourcing tools continue to come onto the market.

PROGRAM DESIGN TIPS FROM CROWDSOURCING SUCCESS STORIES

Although still nascent and evolving, successful crowdsourcing initiatives demonstrate consistent factors. Practitioners planning similar efforts can view the following as emerging best practices.

¹³ [Ushahidi Services](#) (2013)

Match End-User Demand

Crowdsourcing works well when fulfilling a marketplace role. Tools should be structured based on the needs and behaviors of the users, not on the technology or development goal.

Participants respond when they directly understand how their involvement may increase income and/or the security of income. The program must appeal to, and attract, the right population. For example:

- iCow created its own platform and offers products and services specific to the needs of its 42,000 participating dairy farmers.
- Farmers reported army worm information because they could get pest control services in exchange.
- Broad-based platforms like Jana are interested in a wider base of consumers and offer cash, the only incentive that can encourage participation of a diverse global consumer-base.

Create Desirable Participation Incentives

Motivation for participation must be specifically desirable and appropriate to appeal to the target demographic.

Incentives have to be easily understood, immediate, and offered over the duration of the program. The closer to direct financial value the incentive, the easier it is for participants to 'get it'. Cash or airtime have a specific dollar value. Farmers may also see an indirect dollar value in the form of potentially higher profits or reduced costs through collective buying and selling programs.

Services like iCow and M-Farm charge farmers 10 Kenyan shillings per message for technical assistance plus the cost of the SMS.¹⁴ Farmers pay because they can make more money from their sales or lower costs with collective buying.

¹⁴ Collective efforts by farmers have reported an increase in incomes. [Maendeleo Agricultural Technology Fund](#) (2009), [Collectif Stratégies Alimentaires asbl](#) (2011), [Network of Farmers' and Agricultural Producers' Organisations of West Africa](#) (2009)

For pest tracking, the farmers' incentive is preventing crop loss, which is a clearly understood risk and threat. This motivates farmers to attend, for example, Plant Clinics, which spread Plantwise's services.

Programs that do not readily show direct income value must be creative with their marketing efforts. For the weather reporting effort, free phones and airtime was not motivation enough to send information. To encourage rural Zambian farmers, RANET also invites farmers to view seasonal rainfall forecasts.¹⁵

Ensure Quick Sign-up & Usability

The online user interface should be simple and the sign-up process fast. In the context of smallholder farmers, mobile phone registration through SMS or voice is highly favored over e-mail or websites. Participant self-registration by sending an SMS can also reduce the practitioner's logistical burden of registration.

For example, to register with iCow, farmers simply send "iCow" to "5024" via SMS. To find the nearest vet, farmers need only send one SMS with hashtag "#Vet" and their location, "#location".¹⁶

Quick sign-up is especially important for time-sensitive efforts, such as the armyworm infestation, natural disasters or storms. To locate infested areas, farmers submitted a pest report by sending an SMS or by calling a special toll-free number.

Build Local Partnerships

It is valuable to coordinate crowdsourcing initiatives with local entities and governments. This is particularly important for anything that could be deemed a public good, such as weather, pest and disease outbreaks, and market prices. Sharing this information with the government, can empower them to make decisions and form policy on data and proof what is really going on. It can also empower civil society to

encourage the government to take action. Although their support and collaboration does not guarantee program outcomes, it generally improves prospects.

Local entities should also help in the design phase to ensure local fit. Their partnership and support foster marketing and promotion, and help international partners anticipate obstacles in the field.

Jana, when implementing a market research campaign, partners with at least one local mobile operator in each region, sometimes more. In countries with a consolidated telecom market, one operator is enough to reach users. This is the case with Safaricom, with 78% Kenyan market share.¹⁷ This allows Jana to access sufficient numbers of almost any segment of the population.

Plantwise cultivates multiple local partnerships with donors, governments and the private sector to expand its plant clinics and Knowledge Bank. It establishes local government relations by offering trainings and Plant Clinics, sharing credit and responsibility with partners. The ability to attract farmers to Plant Clinics and to make partnerships with local governments helps Plantwise gauge interest when deciding to expand into new countries. For example, Plantwise coordinated its 2013 Ghana launch with the Ministry of Food and Agriculture as the lead.¹⁸

Establish Local Physical Presence

A physical presence encourages adoption and ongoing participation in crowdsourcing efforts. Programs that offer technical assistance as an incentive, however, do face higher costs and require on-the-ground infrastructure.

Local training is a cost, but also an opportunity, as a means to reach remote people from whom data is often difficult to collect.

This presence augments the crowdsourcing effort in a number of

ways. It serves as additional marketing for the effort. It builds buy-in from participants. It can train farmers to properly collect and remit complex information. And, it encourages participation of those less accustomed to technology— including older and younger farmers alike.

Plantwise offers physical programs in DR Congo and Ghana. It trains older, well-respected farmers as 'Plant Doctors' to support local networks. In doing so, Plantwise empowers a segment of farmers that it might otherwise struggle to incentivize to participate, and it increases membership by involving existing farmer networks.

M-Farm maintains a physical presence in its markets in Kenya. Since it offers a fee-based service, it is able to pay for a sales and marketing component to its services. And, since some data collection is complex, they want to ensure client understanding and satisfaction.

IMPLEMENTATION CHALLENGES

Human Resources

One of the greatest challenges for crowdsourcing initiatives targeting smallholder farmers is ensuring skilled expertise. Using existing platforms, like Ushahidi's open source solution, is one solution to quickly set up a basic shared map with minimal resources. Although remember that just because something is open source, it does not mean that it will be easy to use or free to operate. You will still need someone on staff to set up and manage the platform for you.

Programs that want to offer more robust or tailored services at this time likely still need technical experts to build the software for them. For example, iCow's platform was developed by an app development company, and Plantwise is facilitated by CABI, which has a 13 person ICT team.

¹⁵ [World Resources Report](#) (2013)

¹⁶ [iCow](#) (2013)

¹⁷ [Communications Commission](#) (2012)

¹⁸ [Plantwise Clinic Partners](#) (2013)

The right technical expertise with local knowledge is helpful to craft a good online platform. Equally important is expertise required to interface with partners and service providers including mobile operator networks.

Data Quality

Crowdsourcing in development can provide access to a breadth and depth of the population rarely available for the same cost with other mechanisms.

Using technology to motivate communication with large groups of people can have repercussions. The crowdsourcing tool might be used for unintended purposes or be subject to misreporting, resulting in skewed data.

The risk of skewed data is greatest when information is sourced through open calls to a large public group. One way programs have reduced data noise is by pre-selecting participants. Pre-selection often occurs at the beginning of a program, by training and subsidizing the costs of mobile phone usage for a specific user group, and later collecting data only from this group.¹⁹

Selling Data to 3rd Parties

Some programs cover costs by sharing crowdsourced data with third parties. This practice of selling to private entities raises potential conflicts of interest. M-Farm sells data to government agencies and NGOs that may benefit from the data, but (in theory) will only use it to further benefit farmers. Jana's business model is based on selling crowdsourced data of voluntary and compensated participants.

Clear internal intentions, a written code of conduct and transparency policies are suggested if you plan to sell the data you collect to third parties. In response to the widespread sale of U.S. consumer data to 3rd parties, the Federal Trade Commission published one of the most comprehensive references on best practices for consumer-privacy protection. Although not specific to crowdsourcing in Africa, these

recommendations may be helpful when designing your own privacy policies.²⁰

Encourage Farmer Participation

Programs interested in farmer participation grapple with a common challenge: older farmers are often more reticent to participate than younger farmers in ICT-based efforts.

Lack of older farmer participation can be problematic, as they have specific knowledge and experience that could be overlooked. Failing to record their input can adversely affect the quality of information, and thereby also adoption rates. To address this issue, iCow introduced a free customer service phone line that responds to questions in real time, a service they found encourages participation by more farmers than SMS services alone.

Mobile Operator Behavior

From a program planning perspective, it helps to consider how profit margins shape different applications. Mobile usage costs should be taken into consideration during program design. This includes geography and number of users, as well as anticipated data frequency and complexity.

If users are in multiple remote geographic areas without strong mobile network coverage, it can be difficult to convince a mobile operator to invest in expanding the network without the upside of large groups of potential customers. Programs that do not have ongoing SMS usage throughout the year may also not be profitable enough for mobile operators to extend service to remote areas.

If the data is complex and expensive to send by SMS, farmers may only participate if they receive free airtime. This requires collaboration with the mobile operator. In countries where SMS costs are high and voice time is cheaper, people do not regularly use SMS, so voice-based options may need to be considered.

Monitoring and Evaluation

It is difficult for crowdsourcing programs to measure and evaluate impact because the cost for mobile airtime leaves farmers little incentive to provide feedback. To gather feedback via mobile, programs will generally need to reimburse this cost. Beyond the cost of airtime, other barriers exist to using mobile phones alone for robust M&E efforts, though applications do exist to facilitate with this process.²¹

M&E is especially difficult to measure for preventative efforts, for which success is a non-event. For the Zambian armyworm effort, they documented 37 cases that were controlled. It is difficult, but possible to measure the 'cost avoided' of a pest outbreak. One way to do this would be to crowdsourcing feedback from the farmers in exchange for free airtime. Ask each farmer to SMS the cost of lost crops in past years compared to the profit they made with a full crop.

Programs with a local physical presence can mitigate some of these challenges through direct contact with participants. iCow conducted a baseline study of participating farmers and consistently asks for feedback. Plantwise measures results through its local Plant Clinics.

LOOKING FORWARD

Crowdsourcing is young, and additional implementation and research are needed to document greater results. Existing crowdsourcing applications offer the potential to gather data and provide information to farmers quickly and consistently over a long period of time.

Future Applications

Crowdsourcing makes affordable efforts and client engagement that have been too costly or logistically difficult to accomplish. The technology suggests a number of potential applications for programs in the fields of remote sensing systems and participatory farming. The nature of the logistical obstacles and

¹⁹ [Voix des Kivus](#) (2011)

²⁰ FTC, [Protecting Consumer Privacy in an Era of Rapid Change](#). (March 2012)

²¹ For more information read USAID's briefing paper on [Mobile Applications for Monitoring and Evaluation in Agriculture](#) 5

technical assistance provided in these fields makes them conducive to crowdsourcing.

Remote sensing systems face logistical challenges of accessing remote information from multiple locations over long periods of time, data that can be transmitted via SMS. A program based on remote sensing systems could reference the training and incentives used by weather verification programs like RANET in Zambia.

Participatory farming efforts incorporate indigenous farming knowledge with scientific agricultural expertise. They require constant data exchange from large groups of farmers, and often need to encourage ongoing farmer participation. 8villages is one such initiative that is attempting to crowdsource local and expert knowledge via mobile phone-based social networks in Southeast Asia. This effort, and others like it, could apply the system of Plant Clinics and Plant Doctors used by Plantwise to foster participation by young and old farmers.

Future Usage

Looking forward, crowdsourcing will be increasingly used in both short and long-term data collection efforts.

For programs that anticipate the use of only one researcher to collect data from a small group of farmers, the infrastructure and funding necessary to sustain crowdsourcing long term may not be worth the replacement cost.

Programs planning short-term data collection in the next year can either partner with a respected local organization that has established credibility, or with a crowdsourcing effort that has an existing platform.

Creating unique, stand-alone ‘apps’ requires extensive expertise, funding and time.

For organizations thinking of starting a future program that requires an ongoing multi-year exchange of information between researchers and farmers, crowdsourcing presents a viable alternative.

CONCLUSION

Unlike traditional data collection and communication tools, crowdsourcing enables projects access to remote farmers and their inputs. It is a tool that facilitates two-way communication between practitioner and farmer, creating a feedback loop for previously one-way data collection efforts. Built on widely available mobile networks, transferred via mobile phone, and highly customizable to specific data inputs, it has the potential to be both scalable and hyperlocal.

Crowdsourcing tools can be the core means of communication with stakeholders or can be integrated into existing programs as a supplement to meetings, trainings, and workers on the ground.

While still at the margins of ICT-usage in the development context, the act of outsourcing the role of an individual to a crowd will only increase as it becomes easier for non-technical teams to implement the technical components of crowdsourcing.

Broad-based ready-to-use platforms like Jana and Ushahidi are easily customizable and represent the start of this trend towards platform solutions. In the future, the usability of these tools will increase for both projects and the crowd itself.

The cost of identifying partners, building local partnerships and incentivizing ongoing participation will continue to make complex crowdsourcing efforts expensive to launch. With economies of scale, long term usage by a large crowd makes it relatively cheap over time. Furthermore, the information becomes more valuable over time, as trends can be drawn. The ability to engage large groups of stakeholders cost-effectively will also likely lead to unseen opportunities.

New examples of crowdsourcing appear on a seemingly daily basis, many with interesting potential for smallholder farmers in sub-Saharan Africa. The prospect of positive advances for development at the village and national level, as they relate to crowdsourcing, are exciting, multiple and only just beginning.

RESOURCES

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