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Options and Strategies for Information and Communication Technologies within Agricultural Extension and Advisory Services

MEAS Brief # 1 March 2013

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Information and Communications Technology – What is the purpose of ICT?

ICT is different from information technology because it emphasizes the role of communications and the integration of telecommunications networks and computer networks. The communications component is critical when it comes to technology that is intended to deepen understanding, reach communities, and allow more people to provide and access information.

For ICT to effectively support extension and advisory services (EAS, see Box 1), it must be designed with the end user in mind, considering factors such as literacy levels and access to various types of technology. This brief covers key design considerations for effective ICT-supported EAS, highlighting example projects and high-priority issues.

Box 1: Functions of extension and advisory services

EAS have been defined as "the dissemination of expert agriculture knowledge and practices" (Toyama, 2011). EAS communications originate from many sources – government, universities, NGOs, private sector companies. According to Bell, Payne and Bohn (2011), the functions of extension are to:

- link farmers to markets
- raise general awareness of opportunities
- provide technical information, demonstrate or train
- diagnose problems and recommend solutions
- respond to follow-up questions raised by clients
- provide mass advisories
- facilitate access to credit and inputs
- assist with business planning, and
- conduct surveys, monitoring and evaluation, and enumerations.

Assessing recipient needs and customizing the message

Communication involves a sender, a message, a receiver and feedback. But a seemingly simple communications model can in fact be very complex. Every sender has his or her own role, knowledge, biases and credibility, all of which determine how the message is prepared and received. Communication can only be effective if the sender understands the characteristics of the receiver and customizes the message content and delivery mechanism accordingly.

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Well-designed ICT strategies can allow for almost instantaneous adjustments of the message. For example, mobile phones can connect to agricultural information call centers and the information provided can be customized on the basis of information about the caller and changes in agricultural conditions. Similarly, this capability would help an agent with minimal training communicate up-to-date information and customize it in the form of illustrations for illiterate farmers or as technical documents for those who can read. Customizing communications should lead to less noise around the message – this is the challenge.

Using ICT for different forms of communication

Three questions are key to designing an ICT for EAS applications: What is the problem or need? What is the real-world performance that is expected? and What are the long-term objectives? Based on the answers and the assessment of recipient needs and characteristics, planners can select what type of communication to use. Will it be a one-time message, or a series of messages, leading to deeper understanding? EAS communications include these forms, from most simple to most complex:

- data (information, e.g., market prices, weather reports, pest outbreak alerts)
- knowledge (simple skills)
- training (advanced skills and techniques)
- education (where use of information requires critical thinking).

ICT interventions need to be designed for a specific type of extension communication. Particularly with regards to the more complex communications, ICT is often used in programs that combine the use of ICT tools and face-to-face contact. For example, ICT can allow for the unbundling of complex communications, such as dividing up courses into online and face-to-face components. Several universities are already training extension agents online. In India, digital videos that capture good practices are regularly used to train farmers alongside extension agents.

Availability and Selection of Communication Technologies

The number of ICT tools is growing. There is already a wide choice, ranging from simple to sophisticated – and they are constantly changing. Computers, mobile devices and the Internet have powered new ways of training and learning, and emergent approaches to EAS practice. These trends are likely to continue and computers will probably become smaller, cheaper, and more available, especially in the form of smart phones and tablets. These tools may need to be evaluated before funds are invested in them. Given the increasing usage of ICT tools in developing countries, it is likely that funders and governments will continue to expect them to be included as a means of scaling up EAS efforts. It is critical for project planners and practitioners to know their options and select the most effective combination of systems and devices for effective communications appropriate to a range of purposes, contexts and users. Various ICTs are described in the next sections, with some pros and cons noted for each.

1. Broadcast technologies – serving large groups of people

These technologies are very useful for extension strategies although they generally involve less audience participation than mobile or Internet-based ICTs. Coupling broadcast tools with interaction can enhance their impact.

Box 2: Participatory radio campaigns (PRCs)

In 2008 and 2009, Farm Radio International launched PRCs in Ghana, Malawi, Mali, Tanzania and Uganda and conducted a test of their impact on farmer productivity. In the identified 'active listening community', Farm Radio International collaborated with communities to engage listening groups in discussion as well as transmit knowledge. Survey findings showed that 82% were listening, 70% demonstrated knowledge and 39% (in two years) started the practices that were introduced during the PRCs. In the 'passive listening community' and the control group, the rates were much lower (see Figure 1).

With regard to funding, almost all of the participating survey respondents indicated that programs are started with external funds. New and current ICT projects should be required to establish a business plan for sustainability once the initial external funds are spent.

- **Radio** – low cost, high coverage, can be powered by batteries or by wind-up and thus reliable as a broadcast medium, can reach men and women

with low literacy, permits some audience participation (call in, texting/SMS responses, multiple speakers); a cost-effective EAS tool (see Box 2).

- **Television** – higher cost, slower penetration in recent years, lack of dependable electricity in rural areas, and lack of audience participation; an EAS tool with less impact.
- **Video** – hand-held devices of fair quality are now widely available, involving local people in production brings more active learning and exchange; videos can be shown on site for training, but online dissemination can be expensive (see Box 3).

Radio and television are affected by government policies and political trends. If a country limits the number of radio and television stations, or permits only government-sponsored media, then a lack of available channels for extension-related communication can limit the potential impact.

Box 3: Digital Green

Digital Green "combines technology and social organization to improve the cost-effectiveness and broaden the community participation of existing agricultural extension systems" (www.digitalgreen.org). It has projects in 900 villages in India. According to their website, Digital Green has produced more than 2,500 videos (25% by women) that have been screened more than 150,000 times, with a viewing audience that is 75% women. Acknowledging that innovation can originate in rural communities, Digital Green uses participatory video production methods that allow farmers to be actively involved in telling their own stories and learning from one another. Many of the videos are designed to share farmers' best practices and are shown in the context of training sessions facilitated by an instructor. If further guidance is needed, extension agents help with new solutions and techniques.

These videos are also openly available on Digital Green's website and on YouTube. Digital Green's technology platform facilitates exchange of data in areas with limited Internet and electrical grid connectivity. Digital Green has systematized, integrated and computerized its video storage and sharing processes to ensure reuse. Its success lies with the involvement of local people, including extension agents. Digital Green conducts ongoing evaluation in order to continually improve its services for the community.

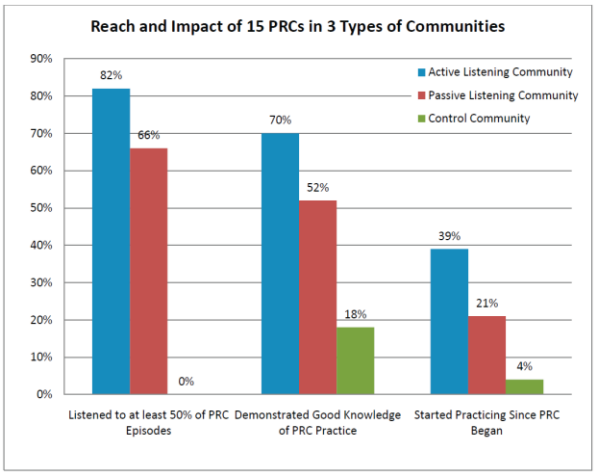

Figure 1. Effectiveness of participatory radio campaigns (Yordy, 2008)

2. Mobile devices – connecting people and information

The era of mobile telecommunications is here. Before mobile technologies, connecting to rural farms and providing information was time-consuming and involved hours of travel. According to the World Bank, there are almost 6 billion cell phone subscriptions, with 118 subscriptions per 100 people in developed countries and 79 per 100 people in developing countries (World Bank, 2011). In many regions, mobile technology has the highest penetration of all ICTs. In Africa, and in many of the world's poorest nations on other continents, the impact is growing, though it lags in the rural and farming communities. The Middle East and Africa are expected to have the strongest mobile data traffic growth.

- **Cell phones** – low cost, allow exchange of information by SMS technology and direct communication with extension agents and other experts; women, however, are much less likely than men to own a cell phone.
- **Devices with Internet capability (computers, smart phones, tablets)** – higher cost, more complex information, more audience interactivity, becoming increasingly prevalent.

The ICT framework needs to be carefully considered when planning for use of cell phones. Cell phones work well for providing certain types of information

to farmers and allowing farmers and extension workers to extend their communications with each other. Providing market information and linking farmers to markets are the most common functions, often including an extension component. On the other hand, for projects aiming to change behavior, such as farming practices, simple mobile technologies might be too limited. Internet-enabled devices offer greater flexibility, enhancing the communication supported by other technologies.

It is important to keep in mind potential barriers, such as infrastructure, electricity, levels of poverty and literacy, and sustainability. These technologies may not be as reliable in farming areas and the cost for rural families is often very high.

Mobile applications will likely be the fastest growing ICT tool. Most mobile application projects have been funded by outside grants and public–private partnerships (see Boxes 4 and 5).

Box 4: Sustainable mobile applications for agriculture in Kenya

Two examples of highly sustainable mobile application approaches are Kilimo Salama and M-farm, both located in Kenya, where the telecommunications policies and the business environment are favorable. Both programs link farmers to markets and for-profit companies, while lowering the overall costs through economies of scale (World Bank, 2011). In Kilimo Salama, the Internet service intermediary is paid using a 5% increase that farmers pay on inputs such as seeds and fertilizers. This payment provides insurance for the farmers, which compensates them for crop failures due to bad weather (based on input from weather stations). M-farm connects farmers to insurance for seeds, fertilizers and pesticides, and allows for bulk purchasing.

Setting up pilot projects using innovative technology requires flexibility and a willingness to partner with experts who may be viewed as 'outsiders'. Providing information to farmers, creating opportunities for public–private partnerships, and making technical and advisory services available through SMS and texting could all be supported by EAS.

3. The Internet – the cornerstone of ICT for EAS

The growth of the Internet lies at the heart of the ICT revolution in development. As shown in Table 1, Internet usage penetration (% of population) by the end of 2012 ranged from 15.6 in Africa up to 78.6% in North America. Growing Internet coverage in Africa and Asia is limited by costs and the scarcity of electrical power.

Box 5: The mFarmer Initiative

The mFarmer Initiative is a complex endeavor. Its vision was to spur members of GSMA (an association of 800 mobile operators serving over 95% of the market in developing countries) to adopt new approaches to providing value-added agricultural information to farmers. In 2009, the Bill & Melinda Gates Foundation made a grant to GSMA to catalyze mobile operators' investment in innovative mobile services, evaluate their impact and facilitate experimentation with sustainable and scalable delivery models. USAID also provided expertise and funding for pilot projects by mobile operators proposing innovative approaches. Serving India and 10 countries in Africa, mFarmer includes the development of a global, shared database of digital agricultural information, a challenge fund to promote innovative partnerships between operators and public or private agriculture extension service providers, technical assistance, sharing of best practices, and impact evaluation. The integration of mobile devices and databases allows for a sophisticated response system. Queries from mobile device users are connected to a call center and fed into a database, and an employee or extension agent might be called in to provide an expert response. Mobile operators now understand that launching products for agriculture should provide enough economic gains for farmers to more than pay for using the mobile service. But the mFarmer model is expensive. Such projects will only be sustainable if the models of funding can be shifted so the investment in ICT is either a government expense or, as in Kilimo Salama (see Box 4), the higher pricing buys services and insurance.

Table 1. Internet users as a percentage of the population, and recent growth

Region	% of population 2012	% growth 2000–2012
Africa	15.6%	3606.7%
Asia	27.5%	841.9%
Europe	63.2%	393.4%
Middle East	40.2%	2639.9%
North America	78.6%	153.3%
Latin America/Caribbean	42.9%	1310.8%
Oceania/Australia	67.6%	218.7%
World Total	34.3%	566.4%

Source: www.internetworldstats.com/stats.htm.

Internet-based tools and projects range from single websites to those that include databases and repositories. These sites can support EAS functions such as raising awareness and providing technical information and free training opportunities.

- ***Simple websites*** provide links and valuable information.
- ***Websites with a database*** running in the background allow users to search for agricultural resources. Raw data can be very useful to EAS. The databases are likely to be built by large organizations and governments. An example is the Africa Crop Calendar (www.fao.org/agriculture/seed/cropcalendar/welcome.do by the Food and Agriculture Organization.
- ***Web-based and asynchronous tools*** allow learners to access materials when convenient to them. 'E-learning' uses web-based software, learning management systems, video and simulations; the least expensive courses may allow self-paced studying of mainly text-based material.
- ***Synchronous tools*** include web conferencing, from simple Skype to the more sophisticated systems. Agrilinks (http://agrilinks.org), for example, hosts webinars to engage stakeholders in learning about agricultural development.
- ***Repositories*** are connected, making it possible to send project information to internal and external databases and to pull in information from other open databases (rather than recreate it).

Although the development of ICTs in support of EAS also makes use of older dependable technologies, like radio and cell phones, the Internet is becoming the cornerstone of ICT because it can globally connect the more educated participants in EAS, supporting their work with farmers.

Knowledge management

'Knowledge management' websites collect multiple types of information, including resources from other websites, and sort it in a way that makes it searchable. The newer knowledge management websites also pull information from other websites through Real Simple Syndication (RSS) feeds, or harvest data through the use of 'crawlers' designed to look for certain materials. When a knowledge management system is built, it should have the capacity to evolve and serve additional audiences in the future. For example, a system built to serve extension workers with Internet access should include a plan that will allow farmers to access the same information in the future when they obtain access to the Internet. Farmers can provide firsthand information to knowledge management systems (e.g., websites). However, it is often difficult to move from a hierarchical system where only experts contribute EAS content to one where practitioners can also use the same set of tools. Since anyone with Internet access can post information in a myriad of ways – blogs, websites, wikis, etc. – the issue is control of the information to ensure accuracy.

Social media evolution — The power of networking

Extension agents – themselves a 'human broadcast medium' – have always networked with farmers, cooperatives, communities, NGOs and government agencies. Social media are Internet-based tools that enhance the ability of a group of people to network, allowing many voices to engage in the discussion. This kind of networking can move through a community very fast and the challenge is to ensure that the messages are accurate and useful to the community. For that reason, EAS strategies that use this tool should include a social media plan. Highly successful social media campaigns have the potential to enhance communities by creating and strengthening links between people and information sources; but this has yet to be tested in the EAS environment.

ICT for extension – matching tools and messages

Extension remains a valued service throughout the world, but like many other training and education programs, extension is increasingly being asked to do more with less. ICT can assist with this. Table 2 summarizes the extension functions, types of information and tools in the current environment. The capabilities of ICT tools and their availability to clients will continue to mature and expand as the industry continues to evolve and improve. The future growth of ICT applications in extension must allow for the sharing of resources and best practices integrated within the flow of other information.

Table 2. Aligning extension functions to ICT

Extension functions	Type of information	Frequency	Cost of repetition	Best ICT tools	Databases and software considerations
Linking farmers to markets	Information and knowledge	Constant	Low	Radio, texting, smart devices	Should be tied to an official commodities exchange or other pricing mechanism
Raise general awareness of opportunities	Knowledge, training and education	Consistent	High	Radio, smart devices, computers, Internet	Databases should pull from useful websites
Provide technical information, demonstrate or train	Knowledge, training and education	Consistent	High	Radio, TV, video, computers, Internet	Simulation and training software should be explored
Diagnose problems and recommend a solution	Education	Consistent	Medium	Mobile, smart devices, computers, Internet, social media	Databases should pull from similar problems
Respond to follow-up questions raised by clients	Knowledge, training and education	On demand	High	Mobile, computers, Internet, social media	Call center database needed
Provide mass advisories	Information	On demand	Medium	Radio, broadcast media, texting	Emergency response software
Facilitate access to credit and inputs	Knowledge, training and education	On demand	High	Radio, video, computers, Internet, social media	Databases connecting buyers and sellers
Assist with business planning	Knowledge, training and education	Constant	High	Radio, video, computers, Internet, social media	Database connecting information business planning
Conduct surveys, M&E, enumerations	Education	Infrequent	High	Mobile, computers	Survey tools

The longer version of this brief, the MEAS Discussion Paper 1, is available at www.meas-extension.org/meas-offers/best-practice .

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For further information on the importance of integrated ICT approaches: USAID 'ICT for Ag' website and the World Bank 'Agriculture in Rural Development' website.

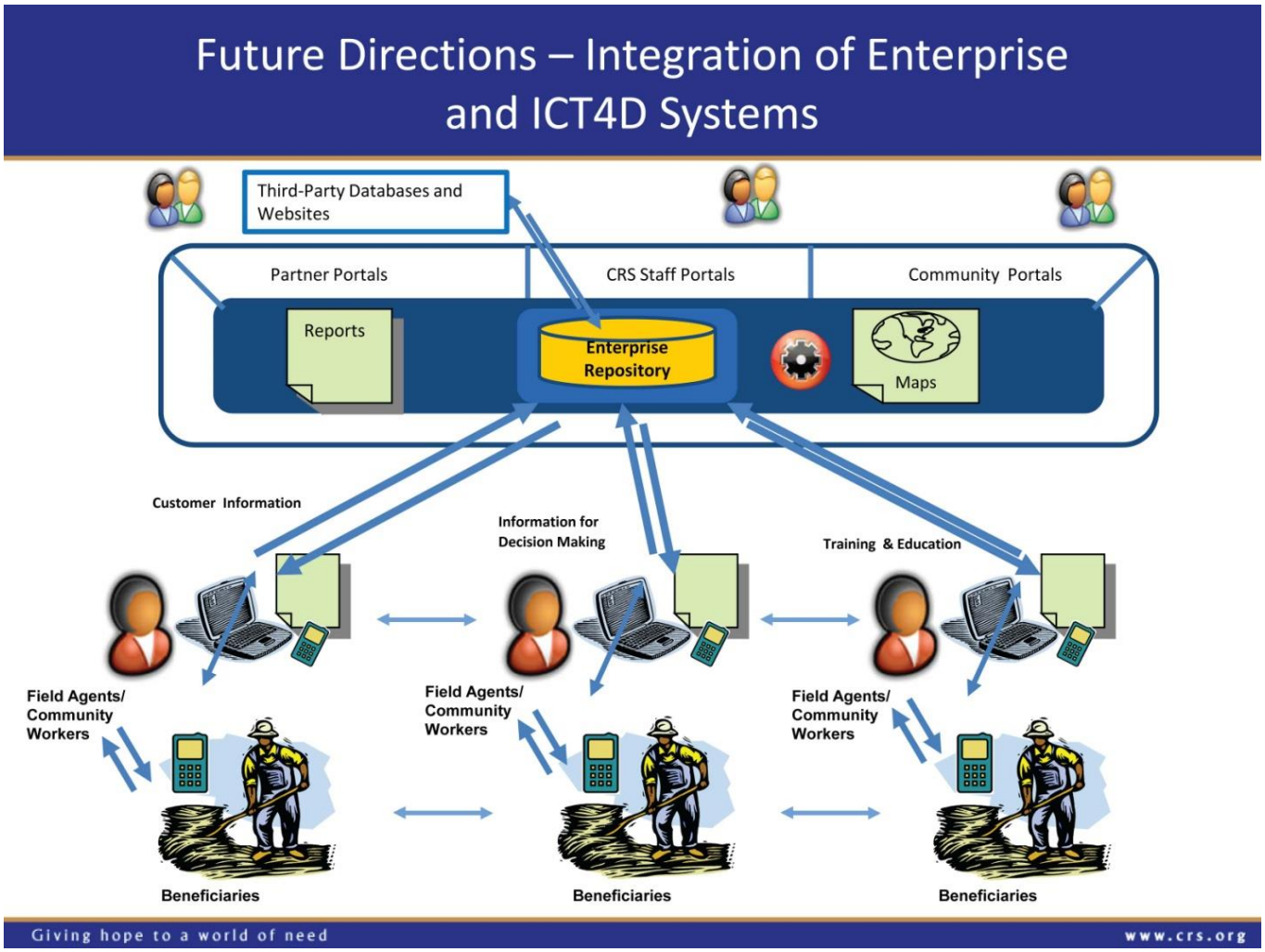

Figure 2. Knowledge management portal serving extension service providers and farmers (Ferris, 2011)

Adapted manuscript prepared by Jane Patten, Green Ink, and Brent M. Simpson, Michigan State University, MEAS Series Editor. The full document is available at http://www.meas-extension.org/meas-offers/best-practice.

The brief was made possible by the generous support of the American people through USAID. The contents are the responsibility of the authors and do not necessarily reflect the views of USAID or the United States government.

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March 2013