



Harnessing ICT for agricultural extension

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SPECIAL SERIES ON AGRICULTURAL ADVISORY SERVICES

Can agricultural extension¹ systems deliver quality services to smallholder producers, often in remote areas? Yes, there is evidence that this is achieved in some developing and emerging economies. But this is by no means a common practice, and many extension systems continue to struggle with weak performance. This series of six papers seeks to understand the patterns behind extension system performance by looking at the different factors that either drive performance or constitute yardsticks to assess performance: governance of extension systems (paper 1), quality of content in extension (paper 2), monitoring and evaluation for accountability and learning (paper 3), ICT in extension (paper 4), assessing performance through cost-benefit analysis (paper 5), and incentives for enhanced performance of extension systems (paper 6). All papers explore emergent practices, showcase promising illustrative examples, and identify potential pitfalls that hinder improved system performance. The objective is to provide state-of-the-art reviews and build the foundation for an informed debate on potential pathways for transformation of agricultural extension systems.

Photo: Geneviève Audet-Bélangier



¹ Extension services are understood as encompassing all intangible services to farmers, including information, knowledge, brokering and advice, on issues such as production, inputs and technology, credit, nutrition, processing, marketing, organisation and business management.

1 ICT in Agricultural Advisory and Extension Systems

In a time of rapidly changing and modernising farming systems, public delivery of extension services in developing countries is sometimes perceived as superseded. Government extension agencies are often bureaucratic and the services they provide may not have the capacity to reach all smallholder farmers nor provide up-to-date and tailored information to meet the needs of the farmers (Bell, 2015). A promising solution for this shortcoming may be found in the increasing prevalence of ICT in developing and emerging economies. Mobile phones have become especially pervasive, as seen below in Table 1, connecting people like never before.

Table 1: Mobile telephone subscriptions per region

Mobile telephone subscriptions per 100 inhabitants	2005	2015	% Increase
Africa	12.4	73.5	492.7
Arab States	26.8	108.2	303.7
Asia & Pacific	22.6	91.6	305.3
Europe	91.7	120.6	31.5
The Americas	52.1	108.1	107.5

Source: ITU World Telecommunication/ICT Indicators database

The agricultural sector has taken advantage of this development and there are hopes that ICT can fill the void that public extension is unable to address, as farms are often resource poor and there are not enough extension workers to reach all smallholder farmers (Bell, 2015). For instance, ICTs such as mobile technology have been harnessed to extend the reach of agricultural extension services by enabling farmers to contact hotlines for technical agricultural advice or to receive market information, such as market locations and prices (Aker and Mbiti, 2010). The growth of ICT in developing countries empowers users to communicate and access vital information, especially for remotely located individuals and communities (Aker, 2011). However, this all depends on the affordability of ICT and whether the information provided is tailored specifically to distinct conditions due to the highly localised nature of agriculture (McNamara et al., 2011; Bell, 2015).

In view of the increasing complexity of farming – think of all the decisions that farmers have to make with regard to land use, the selection of food and commodity crops, the markets they access – the growing diversity of farming systems and the rising request by farmers for knowledge and information, it is essential to understand what role ICT can have in agricultural service provision. Therefore, rigorous impact evaluations of ICT interventions are paramount. Without such evaluations, it is impossible to assess the benefits and challenges of ICT in agricultural advisory and extension systems.

This paper summarises key issues, challenges and lessons derived from literature, case studies and practice concerning the role ICT can play in extension systems. It elaborates on recurring issues and describes innovative experiences and emerging practices that are enhancing the delivery of timely information that fits the needs of farmers. The paper concludes with recommendations on how ICT can contribute to the enhancement of the performance of agricultural extension systems.

2 Background

Agricultural advisory systems have changed over the past decades, especially in regard to public extension, as farmers receive information from a wide range of ICT sources. These changes in ICT during the past two decades have been rapid and far-reaching, from the costly, colossal, energy-consuming equipment once available to the very few towards the booming and continuously changing mobile, wireless, and Internet industries for the many. In the last two decades, public and private actors operating in rural contexts in developing countries have widened their array of methods for disseminating knowledge through radio programmes, videos and other ICT-based methods.

ICT has the potential to respond to a number of challenges that confront public extension systems. Public extension systems face difficulty in reaching all farmers due to the lack of financial capacity and staff to physically meet all farmers and communities. This is exacerbated by the fact that farmers are sparsely populated across large areas and oftentimes isolated. Strong public extension services only manage to directly reach about 10% of the farmer population, and this is even less if operating funds are limited (Bell, 2015). Another key challenge is that farmers increasingly request specified and varied information, as farming is becoming more and more market orientated. Even farming systems in relatively homogenous agricultural areas differ in type of crops cultivated, inputs, ratio/labour machinery and quality standards used. In order to be truly effective, information and knowledge has to be tailored to meet the needs of the individual farmer.

Another limitation of public extension services is the non-recurring character of information and knowledge provision to farmers. In the most optimal case, the information delivered is updated and renewed by means of regular exchanges between extension officers and farmers. However, the disadvantage of this is that it is costly and time consuming. The absence of a local facilitator or expert means that these efforts do not always result in adoption by the farmer (FAO, 2015).

Finally, public extension systems in developing countries are known for being bureaucratic and lacking transparency and

accountability. Underpaid extension officers might use their working time other than visiting isolated farmers. Support effectiveness of extension is often low, as farmers are often resource poor and illiterate, the number of extension staff is limited, extension workers may lack relevant knowledge and skills, and institutional motivation and resources to reach farmers are low (Bell, 2015).

3 Emerging Practices to Improve the Delivery of Information through ICT

Presently, a wide variety of approaches are being tried to use ICT to enhance extension services. Approaches differ in the format and the means by which the information is transferred; for example, by text, voice or picture, and through queries or SMS messages. In some cases, there is direct communication between the sender and the farmer. In others, the messages are disseminated through a farmer extension worker or a local facilitator that has access to the Internet. Some approaches support two-way interaction enabling the farmer to respond to or request from the provider.

ICT-based extension advisory methods are relevant in areas such as preproduction, production, post-harvest and marketing, financial services, and gathering and distributing of data. Different tools are suitable for different applications (Saravanan et al., 2015). In general TV, radio and video are used for awareness creation and transfer of technology. Mobile phones are mainly utilised for collecting and disseminating advisory and market information, such as prices and location. Web portals provide unique opportunities for information sharing and linking with other stakeholders and e-learning is specifically interesting for educational purpose. Social media integrates all functions; from providing advice and sharing knowledge to creating awareness, linking with other actors, and technology transfer. Community radio, telecentres, videos, virtual communities of practice and social media enable farmers and others to ‘gain a voice’ (see Table 2 for a detailed overview). Also, many extension interventions combine ICT channels such as mobile phone services with traditional communication channels, like radio (USAID, 2010).

Table 2: Functions of ICT tools

Functions	Information and Communication Technologies													
	TV		Radio		Mobile Phones		Computer/smartphone without internet			Computer/smartphone with internet				
	TV broadcast	Video with DVD	Radio broadcast	Community Radio	Text	Voice	Decision support systems	Video	Animation	Websites	Video conference	Mobile apps	e-learning	Social Media
Awareness creation	*****	***	*****	*****	*	*	*	*****	*****	***	*	*****		*****
Information dissemination	*****	*****	*****	*****	*****	*****	***	*****	*****	*****	***	*****	***	*****
Promotional	***		***	*	***	***	*	***	***	***		*		***
Advisory	***	***	***	*****	***	*****	*****	***	*****	***	***	*****		*****
Knowledge sharing	*****	*****	***	***	***	***	***	***	***	*****	*	*****		*****
Technology transfer	*****	*****	***	*****			*****	*****	***	*****		***		*****
Training		***						***			*****		*****	
Facilitate market access			*	***	*****	*				***		*****		*****
Credit and banking access					*****					***		*****		*****
Input linking	*		*	***	*****	***				*****		*****		***
Mass advisory	*****	*	*****	*****	***			*	***	***		*****		*****
Business planning												***		
Monitoring and Evaluation										*****		*****		
Linking and partnerships				*****	*					*****		*		*****
Collect and respond to farmers' feedback				*****		*****				*****	***	*****	***	***

Source: Saravanan et al. (2015)

Photo: Geneviève Audet-Bélanger



Although positive experiences are numerous, few of the ICT-based extension services have managed to scale up to a large number of farmers and it is not clear yet, due to the lack of research and the relatively short time periods of implementation, to what extent and which ICT initiatives have the most widespread impact. Also because in many cases a combination of approaches (or the complementarity of approaches) is used (Saravanan et al., 2015). In the following sections, case studies that demonstrate innovative use of ICT are presented.

Farm Radio International²

As a response to the fact that information shared by farmer radios was often not adopted in the field, the Canadian NGO Farm Radio International created a new model of radio broadcasting: participatory radio campaigns, theme-based radio programmes running four to six months, broadcasted on a consistent schedule. Farm Radio International has directly worked with more than 80 radio stations in 10 countries across Sub-Saharan Africa in the past 5 years with more than 5 million farm families as beneficiaries (Bell, 2015). Regular broadcaster services provide content on a weekly basis to 600 broadcast partners with themes including livestock husbandry, farmer innovation, soil erosion, and specific diseases such as banana bacterial wilt (Bell, 2015).

Initial evidence of impact is available. In the context of the African Farm Radio Research Initiative, 4,000 farmers in 100 communities across five countries were surveyed, revealing that 40% of actively listening communities adopted improved farming practices, and 20% of passively listening communities adopted (Ward, 2011). These adoption rates are higher than those from many other radio programmes, demonstrating that participatory radio is more effective than programmes that do not engage farmers directly. Farm Radio International also utilises a unique approach by making media more participatory by enabling farmers to help develop the scripts, and communities

are invited to participate during implementation and evaluation (Francis and Addom, 2014). Moreover, participatory radio campaigns feature voice response systems and call-in options.

Farm Radio International does not only help farmers to enhance their livelihoods, it also provides useful information to extension staff and local NGOs; for instance to identify the challenges in the communities they work in and to gain knowledge on and understand the different perspectives of their beneficiaries. Moreover, the regular inclusion of women farmers in broadcasts and field implementation makes their importance in the local agricultural supply chain more visible.

Grameen Foundation Community Knowledge Worker³

The Grameen Foundation Community Knowledge Worker (CKW) initiative in Uganda was launched in 2009, in order to reach farmers in remote communities through a network of peer advisors. The initiative combines ICT, such as mobile technology, and farmer networks to aid smallholder farmers by improving their access to accurate, timely information which can improve their agricultural activities, businesses and livelihoods (Grameen Foundation, 2016). The services provided by CKW reach the most isolated rural villages by utilising a network of local advisors, who are also farmers and who are chosen by their peers. Through the use of smart-phone applications, the CKWs give other farmers information on weather and marketing prices and advice on treating pests and diseases (Grameen Foundation, 2016).

However, there are some challenges, such as the integration of women into the CKW initiative. According to USAID (2012), it proved difficult to identify women who met the minimum educational, language, and literacy requirements, since their higher labour demands on the farm and household left them with less time for education and training. Moreover, female CKWs incurred additional financial costs because of the need to hire labour for household or farm activities in their absence due to their CKW duties. Finally, there was the case that some female CKWs had less control of the mobile phones provided than their male counterparts as many were required to also share project airtime with their husbands, which demonstrates the influence of cultural and social norms (USAID, 2012).

Digital Green⁴

Digital Green trains rural communities to produce videos by farmers, of farmers, and for farmers to exchange the best agricultural practices to boost agricultural productivity and improve the nutritional intake of farmers (Francis and Addom, 2014). Community leaders are very much involved in rolling-out the approach. Three to four people get trained in video production. The screenings are shown to producers in the community and selected persons are trained to facilitate

² for more information see <http://www.farmradio.org/>

³ for more information see <http://www.grameenfoundation.org/what-we-do/agriculture/community-knowledge-worker>

⁴ for more information see <https://www.digitalgreen.org/>

the screenings and discussion in nearby villages. Moreover, these community facilitators assist farmers to adopt the practices. With regard to the content of the videos, the topics are selected by the government, civil society organisations or private partners. Farmers are requested to bring in their specific requests regarding the practices they would like to learn about. The videos are produced in the regional language.

By now, Digital Green has produced nearly 3,000 videos in more than 20 languages, and has reached more than 300,000 farmers in more than 3,900 villages across India, Ethiopia and Ghana. These videos have been collectively screened more than 200,000 times and have resulted in more than 370,000 adoptions (FAO, 2015). Nightly viewings are set up on a rotating basis around different areas of the village for small groups of 10 to 20 farmers (USAID, 2010).

In an evaluation, the approach was found to be 10 times more cost-effective and uptake of new practices has been seven times higher compared to traditional extension services (Bell, 2015). Digital Green implements projects in collaboration with over 20 partner organisations across eight states in India and parts of Ethiopia, Afghanistan, Ghana, Niger and Tanzania (Bell, 2015).

4 Principles and Process to Strengthen the Delivery of Information through ICT

To successfully improve extension systems with ICT, a number of context conditions have to be met. First of all, success of ICT is dependent on the knowledge of people on how to use devices and navigate the Internet. For example, hosting web portals and e-learning platforms requires advanced technical knowledge and computer skills. The same applies for app-development.

Second, ICT only achieves impact when the mode used corresponds to the interest and capacity of the user group. Web portals, e-learning and text-based SMS messages are only useful for literate farmers, whereas video, voice-based advisory services and community radio are more suitable for illiterate people. The tools selected have to match the purpose, content and clientele. Moreover, integrating traditional media and new ICTs can expand the reach of extension, but a high adoption rate requires farmers to be engaged in determining relevance and developing content and allowed to interact with information/service providers (Francis and Addom, 2014).

Third, it is important to realise that ICT does not generate content but acts as a vehicle to disseminate it. People make use of the services provided only when the content is of interest to them. This is more probable when services are timely, specific, contextualised and targeted. Moreover, ICT based services alone are not enough. They create greater synergy when combined with other extension methods like farmer field schools and demonstrations. To achieve widespread impact, institutionalising ICTs is therefore necessary (Christoplos, 2010). There has been an assumption that with the 'right' technological investment, extension agencies will achieve new objectives and become more sustainable. However, innovations within ICT must be adapted to prevalent constraints, such as institutional structures, human and financial capital constraints, in order to be scaled up and successfully implemented (Christoplos, 2010).

For ICTs to successfully enhance extension, Saravanan et al. (2015) suggest the following steps for implementation, which can be seen in Box 1. Note that each step depends on the situation and judgement of the extension organisation:

Box 1: Successful Implementation of ICT

- 1 The first action of the organisation/ministry/agency that is going to use ICT-based extension should be an assessment of the needs of the target community.
- 2 To adapt, monitor and evaluate ICT enabled services it is important to conduct benchmark surveys before introduction. Benchmark surveys also help to get a good overview of the actual situation.
- 3 Based on the needs assessment and benchmark surveys, localised and customised content needs to be developed.
- 4 ICT tools need to be selected and developed, in such a way that they correspond to the desires and needs of the target group.
- 5 The target audience should be sensitised on the presence of the services and how to access them.
- 6 The newly developed ICT-based services are introduced and used in extension.
- 7 To ensure sustainability of the services, it is recommended to search for partnerships with stakeholders present in the target area or seek for integration of the services in the public agricultural extension system.
- 8 Monitoring and adaptation is important, especially in the beginning of the project. Modifications should be made when the project does not correspond to the needs of the audience.
- 9 Finally, an impact assessment should be realised to determine the degree of success of the project.

Source: Saravanan et al. (2015)

5 Implications for Gender

The development of ICT interventions within agricultural development has been heralded as a way to improve opportunities for male and female farmers. However, it cannot be assumed that ICTs inherently reduce gender inequalities (Manfre, 2011). The potential for ICTs to be effective in facilitating women's entry into and performance in agricultural development depends on whether they are designed to accommodate men's and women's different capabilities and opportunities (Manfre, 2011; USAID, 2012).

Women experience a lack of access to resources globally, in the form of agricultural production inputs, labour, credit, training, and information (USAID, 2012). This is especially the case when accessing ICTs as there are a number of constraints, such as higher levels of technological and language illiteracy among women and girls, cultural norms that discourage women and girls from using technology, and lack of control and ownership of the technology (Manfre, 2011). For example, in terms of high illiteracy rates, it would be more appropriate if the ICT intervention focused on audio and video based technologies. There are also two specific challenges which reduce the potential for ICT applications to contribute to gender equality within agricultural development. One of them is that smallholder farmers are often considered a homogenous group of beneficiaries, with the same challenges and needs, which can be resolved with a solution for all. The other challenge is that ICTs are automatically assumed to be gender neutral, that men and women have the same ability to access, use, and control ICTs (Manfre, 2011).

Although these challenges can be inhibiting, when these barriers for women's effective use of ICTs are addressed, the potential for impact is large. ICTs can support access to agricultural productive resources and empower women with knowledge. Also, they can improve access to markets, pricing, and crop information, and increase contact with value and supply chains. The FAO estimates that when women have equal access to productive resources their farm output can increase by 20-30%, potentially raising agricultural output by 2.5-4% in developing countries and reducing global hunger by 12-17% (or 100-150 million individuals) (FAO, 2011; USAID, 2012). Access to ICTs is therefore a critical component for reducing inequality between women and men.

6 Challenges for Promoting ICT in Extension

Despite the promise and potential of ICT in extension services, there are numerous challenges facing ICT as an extension strategy, which can be seen in the list below:

- 1 One key challenge is the scaling up of ICT in extension services. Many ICT interventions fail to scale up and achieve widespread adoption due to market fragmentation and the

lack of financially sustainable business models that will attract private sector investments in innovative solutions for small-scale agriculture (World Bank, 2016). Rather than assuming that an ICT approach will always be cost-effective and yield a better outcome, there is a need for a more nuanced understanding of the underlying institutional environment and constraints (World Bank, 2016).

- 2 Complex and dense information, such as nuanced information on agricultural practices and inputs, have to be converted into ICT-based messages (Aker, 2011). To transform these into SMS messages or videos requires the capacity to summarise complex information into concise key points, which can be easily understood and utilised.
- 3 Whereas the expansion of mobile phone access has been rapid and commercially self-sustaining, even among many of the poor, the same does not hold for the Internet. In the long run, however, the Internet can have an even greater impact on rural growth. Much depends on finding sustainable business models that encourage its spread in the poorest parts of the world (World Bank, 2016).
- 4 Even with the information provided from the ICT intervention, it is not guaranteed that the farmer will act upon this information because of the inaccessibility of alternative markets and the complex interlinked relationships between buyers and sellers in low-income developing economies (World Bank, 2016).
- 5 Communicating information in the national language might lead to misunderstanding or low adoption rates, as in many rural areas farmers only speak local languages. In regard to adoption rates, integrating traditional media and new ICTs can expand the reach of extension. However, to achieve high rates of adoption, farmers need to be engaged in determining the relevance and content that will be shared and distributed to other farmers (Francis and Addom, 2014). This also relates to the capacity of the farmer to search information. Even if the information is simple and the message is fast and timely, reception depends on farmers' understanding of the phone, computer or any other medium used. This holds also for the extension worker or call centre agent sending the information; in case farmers respond with questions he or she must be able to search the answers and respond in an understandable way (USAID, 2010).
- 6 Another challenge is the diversity of farmers. Having the potential to tailor and personalise messages, ICT initiatives can reach a diverse and large number of farmers. However, this requires good knowledge of the user group. To make sure that not only the entrepreneurial young farmers receive the information it is important to differentiate between the farmers in a community. For example, women and elderly often have lower literacy and schooling rates than young men. This requires the development and use of adapted information and training materials. In this respect, audio-visual tools are more likely to offer opportunities to reach women farmers (Quisumbing and Pandolfelli, 2009).

7 Finally, like with any other extension service the financial aspect is a key issue. Who pays for the services? ICT-based extension services often involve private sector parties, like mobile phone service providers. An example is the Vodafone Farmer's club, a mobile price plan that offers special rates and a range of information services to farmers. Private sector actors will step out in case payment is not guaranteed (Aker, 2011). Profit oriented service are relatively more client oriented, as they depend on clients for income, and therefore more up-to-date and targeted. Customisation is a key requirement for sustainability.

In an ideal situation, ICT is recognised as a tool for rural development by key ministries. This would lead to the introduction of policies to support the use of ICTs for sharing knowledge, enhancing rural access, and building capacity for information management among government agencies responsible for agriculture. A good example portraying the openness of government institutions to ICT tools is Bolivia. With the support of the International Institute for Communication and Development (IICD), the Bolivian Ministry of Agriculture implemented an ICT strategy for the agriculture sector in 2002. This included strengthening the internal ICT capacities of all staff in the Ministry. The result was that ICT and information are not only part of daily practice in the Ministry but also take a central position in agriculture policy (IICD, 2006).

7 Key Lessons and Recommendations

The sheer multitude of ICT initiatives in agricultural extension plays an important role in revitalising the interaction between extension services and farmers by making services more demand-driven, up-to-date and inclusive. However, ICT are but one element in the wider transformation towards pluralistic extension services. Francis and Addom (2014) argue that extension alone cannot lift people out of poverty unless there is the right combination of policies, technologies, and market opportunities.

Context-specificity is critical. To be effective, it is essential to choose the ICT tool that is the most appropriate in a specific situation and context, such as in terms of affordability

(McNamara et al., 2011). This depends both on the type of information to be transferred as well as on the characteristics of the target group.

ICTs should not be seen as the sole solution to solving the challenges associated with agriculture, as broad access to more sophisticated and integrated ICTs requires organisational capacity. Public sector agricultural extension systems at present lack this capacity. The private sector could play a key role in changing current communication concepts in agricultural extension. However, this requires a supportive policy and enabling environment in order to facilitate the development of strong institutions and private sector actors who can drive innovations in ICT based extension.

Moreover, ICTs constitute supporting tools that can never fully substitute 'conventional' extension approaches like real-time advice from extension officers. In fact, without an organised extension system, ICT will be less likely to achieve widespread impact. In addition, ICT can neither do without nor replace face-to-face interaction between farmers and extension agents. Support to enhance extension systems in developing countries should therefore be broader than the introduction of ICTs.

Finally, empirical evidence on the impact of ICT remains limited. In order to measure the impact of such services on farmers' knowledge, adoption and welfare, as well as their cost-effectiveness, comprehensive impact evaluations are needed (Aker, 2011). In relation to impact evaluation, it is important to be aware of differential impacts and the factors that cause these differences, such as gender and social differences in access and use of ICTs (McNamara et al., 2011).

As mobile phones and other ICTs continue to gain popularity and offer unique opportunities to share information among large numbers of farmers and other stakeholders, there is little doubt that ICT has a key role to play in agricultural extension systems. While not a panacea for all of the problems facing extension, the integration of ICTs as a communication channel potentially reaching millions of farmers and as an enabler of change is considered a critical part of future reform and investment agendas.

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