

Application of innovative ICT tools for linking agricultural research knowledge and extension services to farmers in Kenya

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Abstract

Despite the application and use of mobile and web-based technologies in improving access to information, the agricultural extension services still plays a key role in disseminating knowledge, technologies and agricultural information, and linking farmers with other stakeholders. However, limited access to extension services is the main factor causing decreased agricultural productivity. In Kenya the extension staff: farmer ratio is 1:1,500, a situation that hinders most farmers from accessing technological advances. A critical change agent is therefore required in transforming farming to modern and commercialized agriculture, promote household food security, improve income and reduce poverty. Virtual Agriculture Community (VAC) is a platform that provides access to agriculture information and training for both farmers and agriculture extension officers (AEO) through voice channel and supported by short message service for quizzes and multimedia short message service for graphical information. This paper discusses the application of innovative ICT tools that offer an effective solution that catalyses the information dissemination and knowledge transfer. It proposes Virtual Agricultural Community platform to provide remote access regular live and offline training of agriculture extension officers and farmers through mobile phones.

Keywords: Agricultural Extension; Information Technology; Virtual Agricultural Community

1. Introduction

In Kenya there is a gap between the agricultural researchers, extension officers and the farmers while smallholder famers are faced with numerous productivity and marketing challenges notably lack of access to information on effective farming technologies, farm inputs, marketing and weather advisories. It is also noted that for “each 1% increase in agricultural productivity in Africa poverty is reduced by 0.6%. Thus a smallholder-led growth strategy has potential to make a very significant impact on food security and poverty reduction” (FARA, 2007).The competitive advantage of African agriculture relies on exploiting the agriculture research knowledge asset for transformation, but timely access to relevant and actionable research knowledge from research systems by farmers remains a major challenge.

Conversely, agricultural extension is changing worldwide, with emphasis on innovation (Saravanan, 2008). Currently, there are 500 million small farms in developing countries that support two billion people, a third of humanity (Conway, 2011) hence the need for an efficient extension staff for the diffusion of innovations and adoption of new technologies.

This necessitates the need for a different set of extension, training, and research skills and innovative approaches.

Quick dissemination of technological information from the agricultural research systems to the farmers in the field and reporting of farmers' feedback to the research systems is one of the critical inputs in transfer of agricultural technology. The study further revealed that the information and communication support in the last 55 years has mainly been conventional.

Agricultural extension in Kenya dates back to early 1900s, but its only notable success was in the dissemination of hybrid maize technology in the late 1960s and early 1970s (Gautam, 2000). Over time the government has considerably reduced the dominant role of extension services in the national economy following the implementation of the structural adjustment programs (SAPs), in the 1980s (FAO, 1997). Consequently the effectiveness of the agricultural extension services has been severally questioned and debated on (Gautam and Anderson, 1999).

Conversely, agricultural based institutions obtain funds to develop technological options necessary to improve farm productivity and livelihoods. According to Plucknett (1991), despite these investments there still exists challenges to on-farm productivity that needs innovations and dissemination of technological options. However, access to these improved technologies has been low and slow. Production on small farms would increase if more attention was paid to improving the quality of extension workers. His research findings indicated that there is a need to intensify and increase support from research and extension personnel in the implementation of extension programming, in addition to establish coordination mechanisms at different levels.

The application of ICT innovative tools such as Virtual Agricultural Community (VAC) for agricultural transformation is key. Knowledge management has become the successor of various business trends in the world today. The main function of a VAC platform is to modernize and to make the national extension system demand-driven, participatory, bottom-up, and real time. This could efficiently respond to farmers' extension and training needs emerging as a result of globalization, market liberalization, decentralization and knowledge democratization.

2. Objectives

The objectives include:

1. To create a direct link with agricultural research professionals to respond quickly to farmers problems and queries,
2. To design and develop appropriate learning experiences, courses and required skills to reach and educate both extension officers and farmers by expanding the skill range,
3. To obtain feedback on the effectiveness of research findings and agricultural technological development and,
4. To make required information and knowledge available for stakeholders in a timely and efficient manner.

3. Methodology

The Virtual Agricultural Community platform has potential of transforming Kenya's agriculture from production to markets especially in this dispensation where knowledge is driving development.

The VAC platform provides three main solutions (1) Dial in service where an individual extension officer or farmer can dial-in and speak to an agriculture specialist concerning general agriculture issues on live mode. (2) Voice recorded and telephone-based information delivery services, and Interactive Voice Response (IVR) functionality that provides advice on farming information needs such as methods, climatic information and market access. (3) Live and off-line training of Agriculture Extension Officers (AEO) and farmers which can be scheduled and conducted from a central place where participants either dial-in or calls are triggered to all the class members on their mobile phones on schedule.

In implementing a Virtual Agriculture Platform (VAC) to provide remote access to regular live and offline information, data, knowledge and training of AEOs and farmers will allow them to access required information, practical advice and attend real-time new and refresher classes through mobile phones complemented with web-based content material that provides dynamic knowledge for all value chain players.

This provision of information and learning material provides agricultural skills, including video based and e-learning approaches where necessary. Through VAC, the expert schedules classes by registering participants and their phone numbers, initiates calls, mutes or un-mutes participants phones during the class sessions while the participants can “raise hands” by dialing a specified number either #1. The class lesson can then be followed by an interactive quiz on SMS.

3.1 Dial in service

In this service an individual or group of either extension officers or farmers can dial in and speak to agricultural professional specializing in a particular domain area. This service is demand driven, where the individual user dial in and is able to speak to either an agricultural expert or automated voice recorded service. The VAC system through its interactive Voice Response system allows individual users to call a specified number from their mobile phones, the IVR system provide several options. One such option is dial for example #4 to “Speak to an expert”. The call is automatically routed to an expert contact number; the system can have capabilities for “follow me” calls. The system through its dialer can automate the call process in two common ways: (1) dial initiation and (2) outcome detection, the automatic dial outcome relies on the SIT signals.

3.2 Interactive Voice Response System (IVRs)

When a user calls they will first talk to a pre-recorded voice through a menu options, using speech-recognition software to understand the different options, the caller may choose to talk to a live person or follow the instructions to obtain the required information. IVR uses computer-telephone integration (CTI), the most common way for a phone to communicate with a computer is through the tones generated by each key on the telephone keypad, commonly known as dual-tone multi-frequency (DTMF) signals. The IVR allows for pre-recording of information.

At an advanced stage the system can employ speech-to-text (TTS) software to fully automate outgoing messages, instead of recording all the possible responses to the customer query, the computer generates a customized text and read it back to the caller using an automated voice. The voice-based platform interacts with users in different languages. The audio clips populate an Interactive Voice Response (IVR) menu which callers can navigate through for information.

The system allows farmers and other users to interact with pre-recorded content through a given phone number, and in cases where they do not find a solution, a leave a message (LAM) functionality allows them to leave a message requesting for specific content or ask a question. The system registers phone numbers for follow up, each message being tagged to the owner's phone number which can then be used to call them back and provide them with the information or support requested.

3.3 Live and offline training of agricultural extension officers and farmers

This enables learners to access, or fully conducts training, from anywhere, anytime on virtually any device. The agricultural expert schedules a class to registered farmers and extension officers; the expert then conducts the class and members can join the live session from their phones. The class members can interact via text chat; raise hands by pressing a specified number such as #1, record the class offline and access class recording whenever it is convenient for the learner. Learners with smart phones can extend learning beyond the live event, use emotions, view content stream or download recording, join the sessions from the email link or calendar invite and then communicate in a two way chat.

3.4 Short Messages Service (SMS) and Multimedia Messages Service (MMS)

The SMS and MMS allows subscribed users to receive SMS content via their mobile phones, the module allows the class participants to receive questions from the class content to test their understanding of the training and in addition receive feedback from the participants. Both SMS and MMS are data driven services protocols used for sending messages over wireless networks, they fundamentally work on voice network and is based on Global System for Mobile (GSM) communication, Code division multiple access (CDMA) and time division multiple access (TDMA) network technologies making it universal.

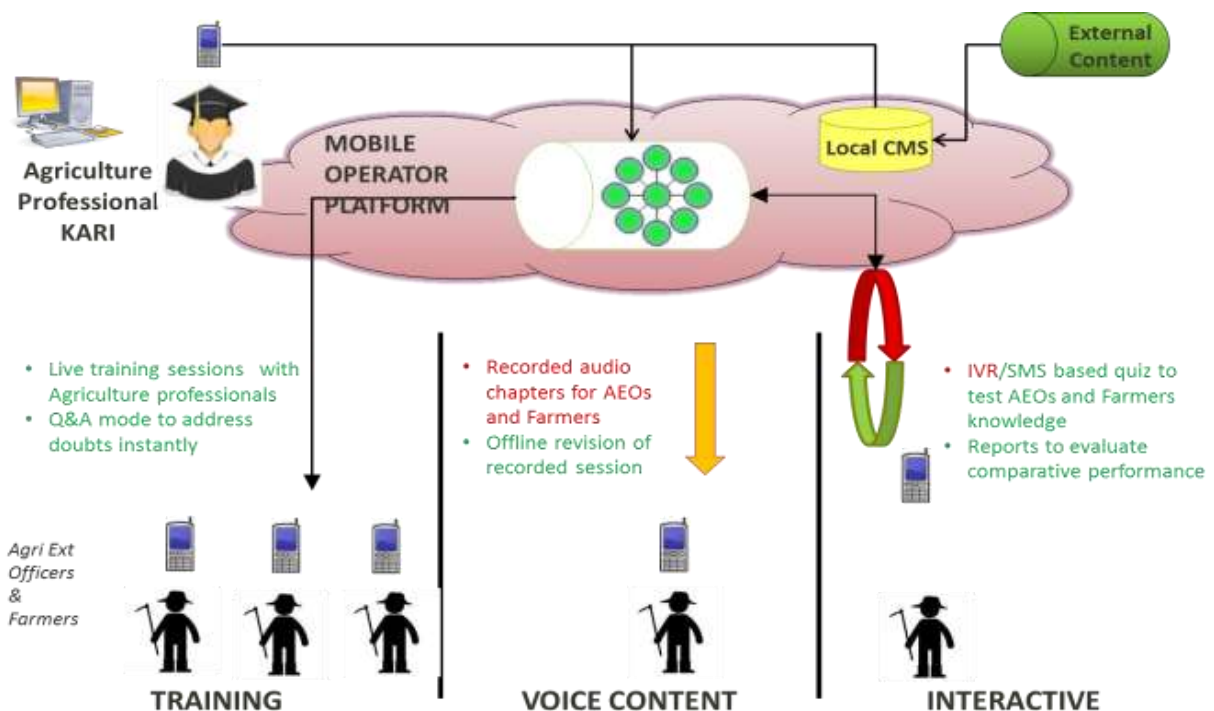


Diagram 1. The Proposed Virtual Agriculture Community (VAC) architecture

4. Results and discussions

4.1 Extension-research-farmer friendly model linkage

Knowledge gaps contribute to yield gaps, the VAC platform is essentially a productivity enhancing tool. The majority of small holder farmers are resource poor on one hand and on the other there has been the inadequate and uncoordinated link between research, extension and farmers thus widening the knowledge gap. The VAC platform provides a direct link to the extension officers and farmers in a friendly approach reducing the gap and increasing knowledge which in return increase yields since knowledge gaps is directly proportional to yield gaps. In addition the VAC platform provides an opportunity for optimum use of research knowledge and extension services.

4.2 Effective transfer of research generated knowledge

The weaknesses in the links between research, extension and farmer linkages has created isolation in technology development and knowledge transfer. The VAC platform provides a strong linkage with the resultant effect seen in influencing formulation of the research agenda based on problem identification and the need to evolve technologies suitable for the prevailing socio-economic environment. Extension requires a constant flow of information on new and improved technologies and practices creating a dual communication.

4.3 Research priority definition

The disconnection between research, extension and farmer linkage has led to the research problems being investigated not being in accordance with the priority needs of agricultural stakeholders. The introduction of value chain approach is an effort to align the priorities of research activities with technology demands. The VAC platform catalyzes the dissemination effort, in addition to addressing historical differences that have existed preventing effective collaboration between research and extension, neither research nor extension can fulfil their mandates effectively without the other. Both strategic and adaptive research require closer link with both extension staff and the farming community.

4.4 Appropriate skills and learning experience development

The VAC platform provides a two way communication which is essential to understanding the practical environment and aid in developing appropriate skills. In addition, it enables the development of required courses and skills, through the feedback mechanism.

4.5 Improved ICT based agricultural knowledge management to increase productivity of smallholder farmer in Kenya

Knowledge consists of attitudes, cumulative experiences, and developed skills that enable a person to consistently, systematically and effectively perform a function (William and Michael, 2005). It is considered as the fourth production factor after labor, land and capital (AFAAS, 2011) and in particular critical in the agricultural sector.

Proper knowledge management is pivotal to enhancing agricultural productivity and addressing the challenges of food security facing the smallholder farmers. The VAC platform

enables appropriate knowledge and information to reach knowledge intermediaries and smallholder farmers in a timely manner. Timely delivery of information and knowledge minimizes the risks of smallholder farmers. To engage in effective agricultural knowledge management appropriate mechanisms must be put place for generating, capturing, and disseminating knowledge and information. The VAC platform is such a system that provides rapid, effective and cost effective knowledge management that supports users through innovative processes.

5. Conclusion and Recommendation

The application therefore of such an innovative platform such as VAC has an immense impact in unleashing the true potential and innovation in agriculture. Information access is key to increasing agricultural production which subsequently reduces poverty at household level. Harnessing this potential, however, requires a consolidated effort and an appropriate framework for ICT utilization. The platform is to integrate with government strategies and international development agencies and stimulate the youth. Conducting agricultural research and technology development has little value if the information does not reach the farmers and stakeholders without loss or delay. To date, few farmers utilize agricultural farming technologies and techniques due to lack of access to timely relevant information, requiring more innovations in ICT.

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