Minireview Article

The Potential and Challenges of Using ICT as a Vehicle for Rural Communication as Characterised by Smallholder Farmers.

ABSTRACT

Agricultural extension is a communication network linking different stakeholders in agriculture to improve their productivity and Information Communication Technology (ICT) has been utilised as an extension tool for enhancing information flow between agricultural extension services and their clients. The application of ICT in agricultural extension and rural development has significantly increased in several countries where it has provided an adequate access to agricultural information. Efforts are, therefore, needed to scale up investments in physical ICT infrastructure and services across developing country. This could be realised through the implementation of interventions aimed at speeding up assimilation and adoption of improved agricultural technology and management practices of the less productive smallholder farmers. Drawing on relevant published works, this paper argues that agricultural knowledge and information management within an extension system can improve productivity of smallholder farmers. The role of ICTs in agricultural extension is discussed together with its challenges towards the improvement of productivity among smallholder farmers. Smallholder farmers need to develop and utilize ICT based knowledge management techniques to implement strategies and interventions to transform the agricultural sector and improve their productivity. Agricultural extension is the ideal mechanism that can facilitate the introduction and subsequent adoption of ICTs for effective knowledge and information management.

Key-words: Knowledge, ICT, Extension, Swaziland, productivity, sugarcane.

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INTRODUCTION

One of the primary functions of an agricultural extension service is to disseminate knowledge and information to farmers (Richardson, 2005). Knowledge and Information can be disseminated in many forms such as printed materials, radios, television, cell phones, group discussions, individual visits and all of these are routinely included in the communication strategies of extensions services however there are some challenges that hinder the delivery of agricultural extension services. These challenges include; the inability to relay knowledge and information on time; farmers having difficulty to access knowledge and information directly; costs and logistics of knowledge and information dissemination; Inability to reach masses as well as the commonly used top-down approach system of knowledge and information dissemination. The advent of ICTs presents a new opportunity for the extension service to overcome all these challenges in their quest to effectively disseminate knowledge and information.

Information communication technology (ICT) is the assembling of different technologies aimed at managing knowledge and information to enhance communication. ICT holds the potential to enhance decision-making in agriculture thus influencing the effective management and success of agricultural organizations – including farmers. It also connects the world, dramatically changing lifestyles. Technology also provides an opportunity to under-developed nations to establish strategies for competing with their developed counterparts (Zahedi and Zahedi, 2012).

Past studies have shown that agricultural extension should be looked at as a communication network linking different social actors (Leeuwis and Van den Ban, 2004). ICT has been utilised as an extension tool, which has enhanced the knowledge and information flow between agricultural extension services and their clients. The application of ICT in agricultural extension and rural development has significantly increased in several countries where it has provided a medium to adequate access to agricultural knowledge and information (Richardson, 2005). Extension workers have a direct link with farmers and other actors, and thus are well positioned to make use of ICTs to access modern knowledge and information that could assist farmers to improve their productivity (Jones, 1997)

PURPOSE OF ARTICLE

ICT should serve as a repository of knowledge and information created by researchers and farmers; and also a platform for experience sharing so that more smallholders can benefit from it. This would undoubtedly strengthen the research-extension-farmer linkage and enable the flow of up to date knowledge and information among the stakeholders. The role of the extension worker would be improved from transferring technology packages to that of transferring knowledge and information packages. Extension activity of this kind will be more knowledge intensive and more effective as it meets the timely knowledge and information needs of farmers. Furthermore, access to ICT service will enable extension

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workers to engage in the full knowledge management activity and be in the position to gather, store, and disseminate knowledge and information that are demanded by farmers. The purpose of the article is to establish the value of ICT in extension and to explore the challenges in implementing an ICT strategy. The article also discusses how knowledge and information is managed in agricultural extension as well as the role of ICT in the dissemination of agricultural knowledge and information in extension.

EXPLORING ICT IN AGRICULTURAL EXTENSION

To make informed decisions in the agricultural industry, according to Zahedi and Zahedi (2012), participants require bringing together, processing and manipulating data. Agricultural operational decisions such as timely land preparation, planting, weeding, irrigating, harvesting, storage and marketing are central concerns to agricultural stakeholders. The agricultural workforce requires greater technological skills than before because of technological advancements. ICT supports new methods such as precision agriculture which uses computerized farm machinery to apply fertilizers and herbicides, and other computerized technologies to buy and sell online and many electronic technologies for other pre- and post-harvest operations. However, despite the growing popularity of such ICT-supported operations, the most important role of ICTs remains communication (Zahedi and Zahedi, 2012).

Effective agricultural development requires access to information on all aspects of production, processing and marketing. ICT shows potential to play that role in the [two-way] delivery of information in both developed and developing countries (Zjip, 1994). In the context of agriculture, the potential of ICTs can be assessed broadly under two categories: (a) as a tool for direct contribution to agricultural productivity; and (b) as an indirect tool for empowering farmers to make informed and quality decisions, which positively impact on the way they conduct agricultural activities. (FAO, 2006).

DIFFERENCES BETWEEN DATA, INFORMATION AND KNOWLEDGE

The term knowledge has often been used interchangeably with information and data, yet these are different.

Data denotes a combination of records of figures, facts, words, numbers, images, and the like. It refers to unprocessed facts and figures without any added interpretation or analysis. As symbols, ‘Data’ is the storage of intrinsic meaning, a mere representation. The main purpose of data is to record activities or situations, to attempt to capture the true picture or real event. Therefore, all data are historical, unless used for illustration purposes, such as forecasting (Tuomi, 1999; Lang, 2001).

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Information is data that has been collected, analysed and put into context. Information only becomes knowledge when meaning is given to it via interpretation. Information refers to data that has been interpreted so that it has relevant meaning, implication, or input for decision and/or action. Information comes from both current and historical sources. In essence, the purpose of information is to aid in making decisions and/or solving problems or realizing an opportunity (Tuomi, 1999).

Knowledge stems from information and data, as shown in the knowledge value chain (Figure 1). It is an individual's belief that is context-specific and it results from the individual's perspective and experiences (Handzic, 2003). Knowledge is the combination of information, experience and insights that may benefit an individual or an organization. The purpose of knowledge is to improve our lives and create value for any enterprise and all its stakeholders. In short, the ultimate purpose of knowledge is for value creation.

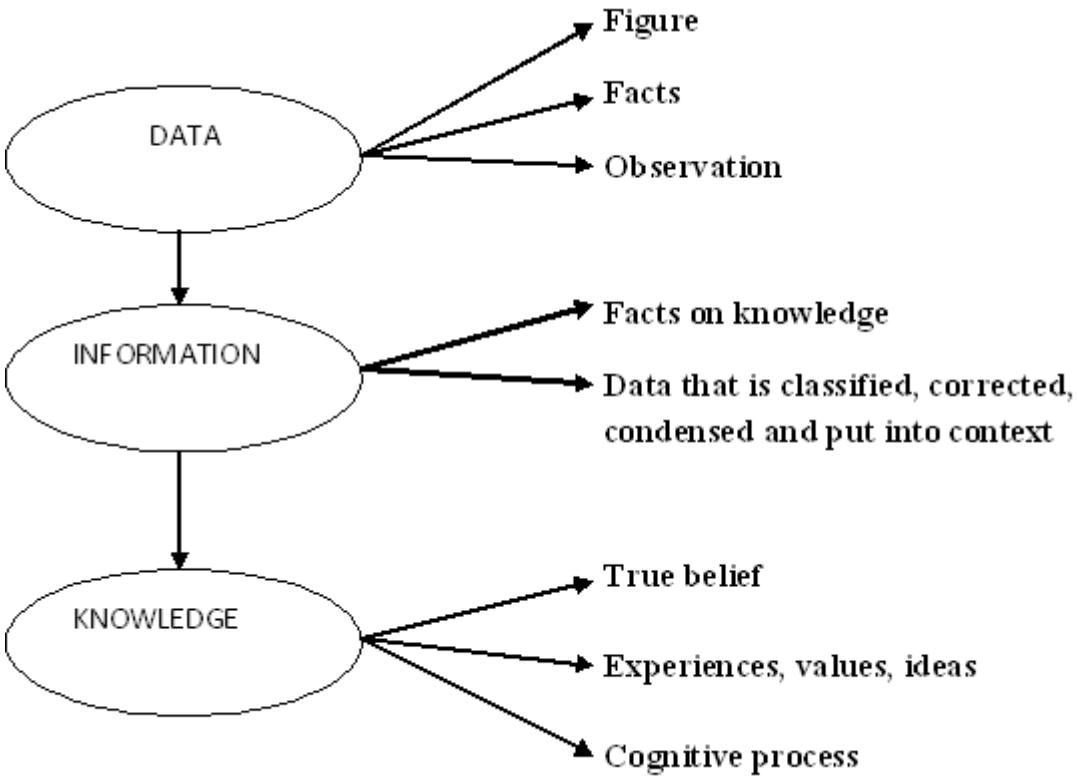

Fig 1: The knowledge value chain (Source: Ndoro, 2011)

Knowledge is subjective when it is based on an individual's perspective and experiences, but becomes more objective when individuals share their knowledge and experiences with others. The knowledge that has been shared will then influence the manner in which problems are tackled as well as the decision-making process. Communication, knowledge and information management are critical factors in any organization. They influence practical interactions affecting institutional goals and efficient service delivery. (Turner, 2003; Hastings, 1993; Salomon and Engel, 1997; Powel, 2003). Kunnumkal (2001) and Benyon (1997) concur that communication is connectivity of actions for the timely implementation of decisions to improve productivity. According to Okyere and Mekonnen (2012), almost every activity nowadays has become more ICT-reliant for one use or the other, and the benefits reach even those without first-hand access to it. We need knowledge and information for the development of agriculture so as to improve a lot of farmers, especially in the countryside of Africa (Salau, Saingbe, and Garba, 2013). Without farmers' exposure to agricultural information, agricultural transformation cannot be realized.

UNPACKING ICT IN AGRICULTURAL EXTENSION

Unpacking ICT in agricultural extension cuts across three factors: Information; information communication; and communication technology. These are addressed briefly.

Information: This is data that has been processed in such a way as to be meaningful to the person who receives it. For productivity to improve, new information must be generated that will bring solutions to existing problems hindering maximum, profitable productivity. Research institutions, among others, are responsible for the creation of new information through practically investigating farmer's problems. The generated information must provide practical solutions to the existing farmer's productivity challenges. Ideally, for this new information to be relevant and accepted by the farmers, the farmers must be involved in the investigation process from its initial stages until the release of results. Smallholder farmers are, in most cases, side-lined during the process of information creation thus making them merely receivers of end results. This often results in the smallholder farmers not adopting such results because the results do not address the farmer's existing problems or fit his particular circumstances. This approach to creating information contributes to the low productivity of smallholder farmers. Approaches such as Agriculture Innovations Systems suggest that farmers who are part of the innovation process will end up with answers to their productivity challenges that are specifically suited to their farms, their capacity and their particular circumstances (Klerkx, et al, 2012).

Information Communication: This is the process through which information is transferred from a source to a receiver and back via a medium. "Effective knowledge and information management in the agricultural sector will be achieved when the right knowledge and information is delivered to the

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farmers and other stakeholders at the right time, in a user-friendly and accessible manner" (UNDP ETHIOPIA, 2012: 32). Because information communication systems are often weak, while many research agencies, in the private and public sector continuously develop and release new technologies, not all these findings reach the intended farmers. More attention should be paid to effective two-way communication (Asopa and Beye, 1997).

Information communication has a direct bearing on farmers' decision-making, particularly with regards to agriculture. Information communication is a skill which is learnt and there are a number of factors that influences effective communication. For communication to be effective there has to be feedback that confirms understanding of what has been communicated (Dwumah et al, 2015). Most of the information in agriculture is generated and presented in the English language yet most of the smallholder farmers are illiterate. This makes it difficult for them to utilise such information for improved productivity. Large-scale farmers, on the other hand, have employees who can understand and put into practise any information presented in English [personal observation]. Failure to take account of the communication needs of smallholder farmers puts them at a disadvantage.

Communication Technology: This involves facilitating communication between two people. It involves the use of means of communication to transfer information such that the message reaches a large number of people within a shortest time possible. Communication technology includes devices (hardware) such as computers, radio, TV, telephone, cellular/mobile phones and faxes (Chhachhar, et al, 2014), as well as social media platforms such as specialised chat rooms, Facebook, Instagram and WhatsApp (Suchiradipta and Saravanan, 2016). It also includes software programs that are used to store, process and retrieve data.

KNOWLEDGE MANAGEMENT IN EXTENSION

Knowledge management can be defined as the condition of knowing a concept with a considerable degree of familiarity acquired through experience, association or contact (Seidman and McCauley, 2005). Knowledge management encompasses processes and practices concerned with the creation, acquisition, sharing and use of knowledge, skills and expertise. This then follows a circular non-stop process that continually updates itself (Bwalya, Okyere and Tefera, 2012).

For the circular flow of knowledge management to take place, knowledge that is sufficiently better than the existing knowledge and means for transmitting it must be both available. The consumers of the new knowledge must be willing and be able to use the better knowledge (Bwalya et al., 2012). The attainment of effective knowledge management in the agricultural sector requires the systematic and continuous interaction of stakeholders that include farmers, farmer organizations, research scientists,

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policy makers, extension agents and the private sector among others (ASARECA, 2010). Therefore, to be effective, knowledge management in agriculture must embrace the following four issues, according to Bwalya et al. (2012), (i) comprehensive knowledge of what needs to be done to solve the sector's problems or to exploit its potential, (ii) identify how the problem could be solved or opportunities that could be exploited, (iii) the source of knowledge required for success, and (iv) determining who will be responsible for taking the actions needed to solve the problem or exploit the identified opportunities.

In order to obtain satisfactory results out of knowledge and information management, farmers need to be engaged in the whole knowledge management process. This is crucial as it will enable better integration of tacit and explicit knowledge. The knowledge and information created out of this process is also more likely to be accepted by the farmers as it would have incorporated knowledge and practices developed and passed on to them through generations. Such knowledge and information has a high potential of being implemented by these farmers in their daily farming activities hence improving their productivity. Farmers can also improve their existing indigenous knowledge not only through the interaction with modern knowledge but also by sharing experience with other farmers. However, in order to scale up knowledge to other farmers, the knowledge and information needs to be codified, made explicit, and upgraded or modernized with research-based evidence (Bwalya et al., 2012).

Smallholder farmers in the developing world require up to date knowledge and information in order to be able to efficiently and effectively perform their farming practices. Bwalya et al. (2012) noted that the knowledge and information that farmers demand ranges from accessibility of new farming methods, availability of weather forecast, and supply of inputs and output prices among others.

ICT FOR THE DISSEMINATION OF AGRICULTURAL KNOWLEDGE AND INFORMATION

ICT can play a crucial role in benefiting the resource-strapped farmers with up to date knowledge and information on agricultural technologies, best practices, markets, price trends, and weather conditions. The experiences of most countries indicate that rapid development of ICT, which facilitates the flow of data and information, has tremendously enhanced the knowledge management practice in agriculture.

Knowledge is considered as the fourth factor of production after labour, land and capital (AFAAS, 2011) and is particularly critical in the agriculture sector. Making relevant knowledge accessible to the farming community helps improve production and brings higher returns. If the practice of smallholders is not supported by modern agricultural knowledge and information, agricultural households are likely to remain trapped in low productivity, food insecurity and poverty. Generating new agricultural knowledge

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and information and making it available for use by smallholder farmers through the extension service is important in promoting sustainable livelihoods and reducing rural poverty (Isaacs, 2007). ICT plays a very crucial role in enhancing information flow from its creation, storage, dissemination and usage by farmers. Figure 2 shows the flow of agricultural knowledge and information from creation to end use.

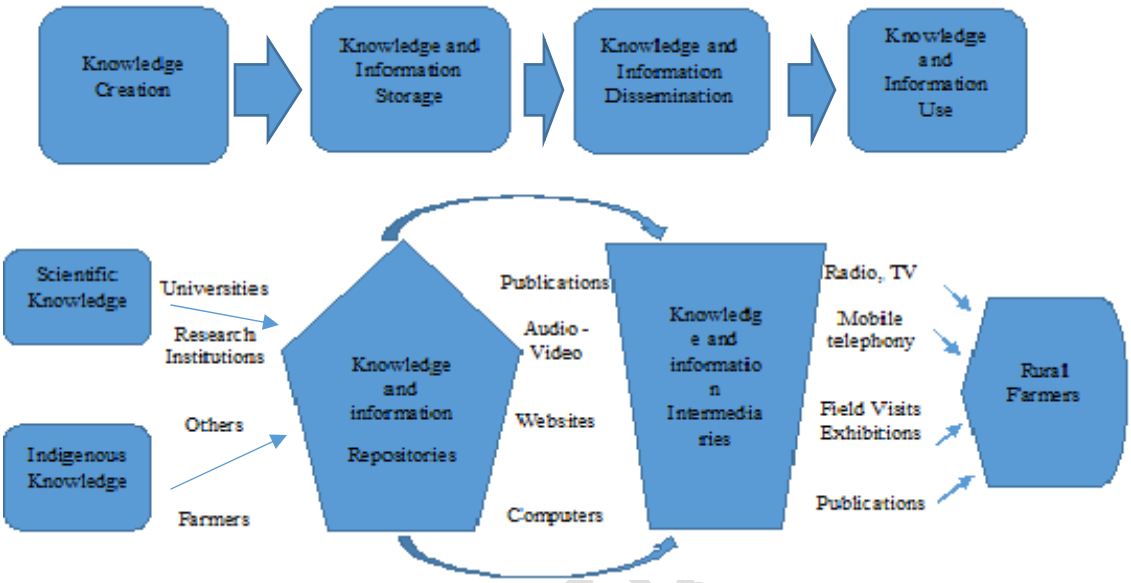

Fig 2: Tools of knowledge and information management in agriculture (Source: Bwalya et al., 2012)

Knowledge and Information creation - Various entities are engaged in the creation and development of knowledge and information. Likewise, several repositories and intermediaries play their role to bring information and knowledge to the ultimate users. Agricultural knowledge and information is created from modern and indigenous sources. The modern knowledge and information is created through scientific research by universities and research institutions. Indigenous knowledge and information on the other hand, refers to traditional knowledge, innovations and practices of local communities and is developed outside the formal education system (Bwalya et al., 2012).

Knowledge and information storage - Once it is created from these sources it is then stored in various forms before it is disseminated for use. Knowledge and Information creation requires the use of various ICT gadgets to enhance the collection and interpretation of data and these include but not limited to cell phones, video recorders, and internet for data collection as shown in figure 2. The creation of knowledge and information management by these institutes begins with the identification of knowledge and information gaps, and the capturing, storage and dissemination of the knowledge and information to the users. This is conducted through a participatory approach involving stakeholders such as farmers, researchers, extension experts among others. The major sources for capturing knowledge and

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information are publications, conferences, events (field days, exhibitions, visits, etc.) and research reports. Whatever is obtained in this way is stored in various forms including publications, audio-visuals, library services and websites among others.

Knowledge and Information retrieval - The stored knowledge and information is then disseminated to users such as rural farmers, through intermediaries notably during trainings, field visits, exhibitions, publications and using traditional forms of ICT (TV and radio), modern forms of ICT (Internet, mobile phones, etc.) and others. Effective knowledge and information management is achieved when the right knowledge and information is delivered to the right people at the right time in a user friendly and accessible manner that helps the recipients to perform their jobs efficiently (Islam, 2010). The outcome of effective knowledge and information management includes improved productivity and performance of the agricultural sector.

Knowledge and Information dissemination - The knowledge and information is then disseminated to researchers, extension experts, farmers and the public at large through publications, mass media (radio and television), internet, field days, exhibitions and interviews. In practice, however, field day's radio and TV programs were the major tools usually used to share knowledge and information to the smallholder farmers while internet and other modern ICT tools were seldom found to be used (Bwalya et al., 2012)

Knowledge and Information use – ICT can play a crucial role in benefitting the resource trapped smallholder farmers with up to date knowledge and information on agricultural technologies, best practices, markets, price trends and weather conditions. The experience of most countries indicates that rapid development of ICTs which facilitates the flow of data and information, has tremendously enhanced the knowledge and information management practice in agriculture. For information to be accepted and used by farmers, it has to be timely, accurate, well understood and relevant to the farmer's problems. Extension service providers use ICTs to ensure that accurate knowledge and information is delivered on time and in a form that will be well understood by the farmers. The knowledge and information delivered to the farmer must also be relevant to the farmer's problems.

ICT CHALLENGES IN AGRICULTURAL EXTENSION

In Africa, this process of ensuring the effectiveness of knowledge management is limited by a range of constraints such as inadequate mechanism for capturing, systematizing and sharing available knowledge; inadequate analysis of agricultural sector communication stakeholders, their knowledge needs, attitudes and practices to knowledge management; use of less effective media and channels for communicating with different stakeholders; and weak monitoring and evaluation of knowledge management systems (ASARECA, 2010).

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Various institutions and organizations in Swaziland are engaged in the creation, accumulation and dissemination of agricultural knowledge. Nevertheless, the use of ICT in knowledge and information management is so far not only low but also dominated by traditional ICT tools (radio and TV). The use of modern ICT (internet, mobile phones, etc.) in storing and disseminating knowledge and information remains very low, despite their huge potential. In this knowledge and information age, it is important to address the challenges that limit the use of such tools and identify the opportunities that should be tapped to assist smallholder farmers in their endeavour to improve production and match the standard of the large-scale producers.

ICTs that will educate smallholder farmers are very crucial because some of these farmers do not have control over the selling price of their produce. The only option they have is that of maximising their productivity at the lowest cost possible. Therefore it is imperative to harness the use of ICTs for the dissemination of all production knowledge and information, especially to the smallholder farmers. However, while the use of ICTs seems relatively easy once in place, there are challenges associated with it.

Availability and affordability - Despite the fact that ICT has immense potential in disseminating agricultural knowledge and information, the low level of ICT infrastructure in developing countries is believed to have hindered the sector from realizing its potential. This has inhibited the effectiveness of research institutions and extension agents from creating and delivering agricultural knowledge for use by rural farmers to increase productivity. In most cases extension agents and farmers are not connected to modern ICT infrastructure and services. As a result, research-extension-farmer linkages are weak and costly. Such a linkage ends up having to be fostered through physical contact such as training, field demonstrations, field day program visits.

In most cases, rural people live sparsely and this makes the provision of infrastructure and public utilities such as electric power, water, health facilities and some devices of modern ICTs very difficult to deploy in rural areas. The low level access to ICT infrastructure have slowed the sharing and exchange of knowledge and information generated from research centres at national and regional levels. Electricity infrastructure coverage in rural parts of developing countries remains low despite recent efforts to extend the electricity grid to rural areas through the rural electrification program. The low level of electricity coverage has in turn inhibited the expansion of ICT services to rural areas. (National Information and Communication Infrastructure policy, 2005). The incomes of rural people are very low compared to urban areas thus it becomes difficult for the rural people to afford modern ICTs. This then leads to a digital divide between urban and rural areas which then lead to rural areas remaining marginalised forever. (ITU, 2010; Gillward and Stock, 2008).

ICT operators on the other hand, are not willing to invest in the rural areas due to low returns unless there are strong incentives to do so. This is mainly because of the high investment costs given the

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capacity of the rural people to pay for the services offered. Actually, the high cost of services is the very reason that continues to delay the uptake of many different forms of ICT in most of the African rural areas. Gillward and Stock, (2008) confirmed that the low income of the people in the African rural areas is the main adoption barrier of modern ICTs.

The other challenge is how to make ICT both affordable and available in venues that are convenient to smallholder farmers. Availability of venues refers to the presence of various access points particularly information kiosks, tele-centres, call centres, and so on in a manner that is accessible to the majority of the farmers. These services are not adequately available and accessible to the small farmer in developing countries.

Some of the African countries such as Ghana, Kenya, Nigeria and Senegal have a very dynamic telecommunications sector however Africa as a whole continues to lag behind other regions of the world in terms of its communication policies (Calandro et al., 2010). The national objective according to Calandro et al. (2010) of achieving universal and affordable access to the full range of communication services have been undermined either by poor policies constraining market entry and the competitive allocation of available resources; weak institutional arrangements with low technical capacity and competencies; and in some instances, regressive taxes on usage. Gillward and Stock, (2008) argued that in addition to competition and open access regimes, effective regulation of other factors such as spectrum, interconnection and tariffs are required to stimulate market growth, improve access, and lower prices.

Accessibility and usability - Gillward and Stock, (2008) discovered that diffusion of ICTs is highly uneven, concentrated in urban areas, and leaving some rural areas almost untouched. Income is the major barrier to the uptake of these technologies but as they become complex, they are increasingly constrained by literacy and education. The study also revealed that women are not equally able to access and use even the most prevalent forms of ICT. It was also reported that issues of income, education and social position played a role in explaining ICT access and usage. Statistics have indicated that a woman in a low- income country is 21% less likely to own a mobile phone than a man (Gillward and Stock, 2008). This scenario is disturbing for agricultural development in Africa where more women are involved in agriculture than men especially because they need technology and production information to improve their productivity.

The challenges of access to ICT can be divided into two: (i) access to ICT infrastructure and (ii) access to ICT services. The access to ICT infrastructure in developing countries is still very low. In spite of being a necessary condition, access to ICT infrastructure by itself is not sufficient for the dissemination of knowledge and information to occur through it. Access to ICT infrastructure must be accompanied by access to ICT services.

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Awareness Culture and attitude - In addition to income, educational attainment, social and cultural constraints are other factors that affect the likelihood of an individual having the necessary e-skills to use different technologies optimally (Gillward and Stock, 2008). Munyua (2008) conducted a study on ICTs and smallholder agriculture in Africa and found low usage patterns and adoptions. The main challenges that influenced the use of ICT were summarised as: high costs of available technologies, inadequate infrastructure and low ICT skills, poor and expensive connectivity, Inappropriate ICT policies, language barrier, low bandwidth, inadequate credit facilities and systems. Moreover the author also identified inappropriate local content, weak institutions, inadequate collaboration and awareness of existing ICT facilities and resources, a poor sharing information culture as well as low awareness of the role of ICTs in development at all levels.

CONCLUSION

Smallholder farmers in the developing world require up to date knowledge and information in order to be able to perform their farming practices. The development of ICTs has facilitated the dissemination of knowledge and information and has revolutionized the use of technology in agricultural production for increased productivity. There is evidence that yield among rural smallholder farmers does improve with the use of ICT to access knowledge and information. However there are challenges in making ICT platforms available to a large number of the rural smallholder famers and these include availability and affordability of ICT infrastructure and its services. Accessibility and usability of such services is also a challenge among the smallholder farmers. Awareness, culture and attitudes of smallholder farmers towards the use of these ICT facilities are other factors hindering its adoption. For knowledge and information management to be effective, it must be timely delivered to the farmer in a user-friendly and accessible manner. Developing countries need to ensure the availability of various access points particularly information kiosks, tele-centres, call centres, and so on in a manner that is accessible to the majority of the farmers. Agricultural Extension is the ideal mechanism that can facilitate the introduction and subsequent adoption of ICTs for effective knowledge and information management especially among smallholder farmers.

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