Ethiop. J. Agric. Sci. 27(2) 99-109 (2017)

Familiarization and Application of ICTs in Agricultural Advisory Services to Farmers: The Case of Two Rural Districts of Ethiopia

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አህፅርኦት

ይህ ጥናት የግብርና ኤክስቴንሽን ባለሙያዎች የኢንፎርሜሽን ኮሙኒኬሽን ቴክኖሎጂዎችን በግብርና ዙሪያ የምክር አገልግሎት ለአርሶ አደሩ በሚሰጡበት ጊዜ ያላቸውን ዕውቀትና አተገባበር የሚያሳይ ነው። ጥናቱን ለማካሄድ 40 የግብርና ኤክስቴንሽን ባለሙያዎች ከሁለት ወረዳዎች የጉዳዩን ዓላማ መሰረት በማድረግ የተመረጡ ሲሆን ቀድሞ በተዘጋጀና በሌሎች የግብርና ኤክስቴንሽን ባለሙያዎች ላይ በተሞከረ መጠይቅ መረጃዎች ተሰብስበዋል። የተሰበሰበው መረጃም ገላጭ በሆኑ የስታትስቲክሳዊ መንገዶች እና በካይ ካሬ ስታትስቲክስ (chi-square statistic) ተተንትኗል። ለተደረገው ጥናት ምላሽ የሰጡት አብዛኞቹ የግብርና ኤክስቴንሽን ባለሙያዎች (87.5 በመቶ) መካከለኛ እና ዝቅተኛ ደረጃ የሆነ የኢንፎርሜሽን ኮሙኒኬሽን ቴክኖሎጂዎችን ዕውቀት እንደነበራቸው አረጋግጧል። በተጨማሪም 70 በመቶ የሚሆኑት የግብርና ባለሙያዎች የግብርና ምክር አገልግሎት በሚሰጡበት ጊዜ ተደራሽ የሆኑ የኢንፎርሜሽን ኮሙኒኬሽን ቴክኖሎጂዎችን አይጠቀሙም። ለዚህም እንደ ምክንያት የሚያስቀመጡት አሰራሩን የሚያግዙ ቴክኖሎጂዎች አለመሟላት ማለትም ውስን የሆነ የኢንተርኔት አገልግሎት፣ የኮምፒውተሮች አቅርቦት፣ የመረጃ ሲዲ የመሳሰሉ የኢንፎርሜሽን ኮሙኒኬሽን ቴክኖሎጂ መገልገያ መሳሪያዎች፣ ዝቅተኛ ጥራት ያለው የኢንተርኔት አገልግሎት፣ ውስን የሆነ የመረጃና የማጣቀሻ ቁሳቁስ ግንዛቤ፣ የኢንፎርሜሽን ኮሙኒኬሽን ቴክኖሎጂን ለመጠቀም የሚያስችል ክህሎት አነስተኝነት፣ ከምርምር ተቋማትና ከሴሎች የመረጃ ምንጮች ጋር ያላ ግንኙነት አነስተኛ መሆን ናቸው። በግብርና ዙሪያ የተሻሻ መረጃ ሊሰጡ የሚችሉ የተለያዩ የመረጃ ምንጮችን በወረዳና በቀበሌ ደረጃ ትስስር በመፍተር የኢንፎርሜሽን ኮሙኒኬሽን ቴክኖሎጂን ተደራሽነትና አጠቃቀም ማሳደግ ይቻላል። ከዚህ በተጨማሪ ለግብርና ኤክስቴንሽን ባለሙያዎች በተደጋጋሚ በኢንፎርሜሽን ኮሙኒኬሽን ቴክኖሎጂ አተቃቀም ዙሪያ ስልጠናዎችን መስጠት ያስፈልጋል።

Abstract

This study presents extension workers' familiarization and application of reachable Information and Communication Technologies (ICTs) to provide agricultural advisory services. For the purpose of the study, 40 Agricultural Extension workers at district and rural villages were purposively selected from two districts and data collected using paper based questionnaire. The data was then analyzed using descriptive statistical tools and chi-square statistic. The study identified that the majority of (87.5%) of the respondents interviewed had moderate and low familiarization levels of available modern ICTs. The study also found that 70% of the extension workers had not using available ICTs while giving advisory services to the farmers. This might be on account of many factors such as limited access to ICT tools (computers, internet service, agricultural information CDs, and other facilities,) poor quality of internet services, limited awareness on some information and reference materials, inadequate skill to apply ICTs, weak linkage with research centers and other information sources, etc. Hence, the study concluded with the need to improve the linkage by creating available information sources and resources at the district agricultural office so that it is possible to advance ICTs access, availability, and application. Moreover, on job short-term capacity building trainings on selected ICTs tools should repeatedly be arranged to agricultural extension workers in order to enhance the application of available ICTs in agricultural advisory services.

Introduction

Information and communication technologies (ICTs) can play a critical role in facilitating rapid, efficient, and cost effective knowledge and information management and communicating to the farming community. According to Muriithi *et al.,* (2009), ICTs has provided a possible pathway to ameliorate access, efficiency, and affordability of agricultural information.

Kabura (2012) described the use of information and communication technologies (ICT) as it can improve business and networking between farmers, buyers and extension agents and also facilitate access to hidden markets. A World Bank report on ICTs for development indicated that connectivity, whether through Internet or mobile phones, is increasingly bringing market information, financial services, and health services to remote areas, and is helping to change people's lives in unprecedented ways (World Bank, 2009).

ICTs and mobile-enabled agricultural services act as instruments to deliver extension services and help to create awareness amongst farmers (Mittal, *et al*., 2010). In most of developing countries however, the extension system does not have a modern mechanism likewise ICT to acquire and deliver information to farmers (Kabura, 2012). This paper therefore, presents extension workers' familiarization and application of ICTs in order to capture and convey agricultural information to the farming community.

After years of listening on communication difficulties in the extension system of Ethiopia, it was found compelling into having understanding of the role of ICTs in agricultural extension.

The key objective of this research is to understand how familiar extension workers are using ICTs for communication. This paper reflects on the use by extension workers of ICTs in agricultural extension. The practical gaps, challenges, and implications are examined and positive contributions that such research may provide are explored.

Methodology

Study area

The data were collected from two rural districts of Ethiopia, such as Arsi-Negelle and Kalu Districts which were purposively selected from the south-east and north-east part of the Ethiopia, respectively.

Arsi-Negele: is one of the districts in the Oromiya Region, which is located in south east of the country at a distance of 203 km from Addis Ababa along the main road to the Hawassa. The minimum and maximum annual temperatures are 10° and 25°C, respectively. The climate of the area is divided into sub-humid (32%), semi-arid (42%) and arid (26%) zones with an average annual rainfall ranging from 500 mm to 1150 mm.

Except for the southeastern portion, the altitude of this district ranges from 1500 to 2300 meters above sea level.

Agricultural production of the district is of mixed farming system of crop and livestock production. Maize, wheat, sorghum, millet and finger millet, haricot bean and vegetables are main crops grown, and onion is an important cash crop. Among others rainfall variability and drought, natural resources degradation, high prices of inputs, shortage of water are identified as the main problem in the area. The district has high potentiality for irrigation in their lower courses. Dairy farming is practiced in urban and pre-urban areas of the district, though it is constrained by inadequate supply of drugs, poor AI service, and limited availability feed. About 90.5% of the total land surface of the district is arable land and grazing and forestlands covered 4.3% & 5.2% respectively. The district has 29.9% is arable or cultivable land, 4.3% pasture, 5.2% forest, and the remaining 60.6% is considered swampy, degraded or otherwise unusable.

Kalu: It is one of districts in South Wollo Administrative Zone of Amhara Region. It is situated at a distance of 370 km from Addis Ababa, in the northeast. Climate: In terms of traditional agro ecological classification, outsized proportion that is 89% of the district is mid highland (Woinadega); the rest 9% and 2% is described as high altitude (Dega), and low altitude), (Kola respectively, with an estimated total annual average rainfall of 750 to 900 mm. The rainfall in the district characterized by bimodal distribution pattern and the main rainy season (Meher) is between June and August. The average maximum temperature is 35^{o}C, whereas the average minimum temperature is 25^{o}C. The season for high temperature commence at March and extends to the beginning of October. Then again, the season for low temperature is from October to March. The altitude ranges from 1450 to 2680 m.

Agriculture is mainly subsistence, typically traditional, and primarily depends on rainfall. Subsistence mixed farming is the dominant farming system in the study area. In the district cereals, pulses, and vegetables are cultivated annually and sorghum and maize being the leading cereal crops, which takes a high proportion of the cultivated area. The crop sub-sector in district is characterized by low productivity because of soil infertility, poor land use and arrangement system, limited use of agricultural inputs, limited access to and adoption of agricultural technologies, in adequate extension and credit service, inadequate market access and so on. Poultry and bee keeping are carried out in the district and served as income sources to the farmers.

Feed shortage, disease, lack of improved husbandry practices, etc., are the major constraints to livestock production in the district. Of the total land of the district, cultivated land, grazing land, and shrub covers 31.4%, 1.1% and 53.8%, respectively. Of the total land, 5.2% is forestland, constructions and buildings cover 4.2% and 4.3% is land cannot be used for agriculture.

Agricultural advisory services and ICTs

Likewise in other districts of Ethiopia, the extension system in both of the districts operates under district agricultural office of the districts, having their own agricultural offices with extension process owners and Subject Mater Specialists (SMSs), and three

Development agents who are assigned at each of the kebeles (the lowest administration level) found in the directs. In each kebele, there is one Farmers' Training Centre (FTC) and in each FTC three development agents (DAs) specialized in crops, livestock and natural resource management are deployed to provide extension services to development groups.

Therefore, the study was conducted by assuming Extension workers in the districts most likely have equal access to both modern and conventional ICTs infrastructure because both districts are located along the main road. Moreover, the study assumed there is a common understanding among extension workers that ICTs is important sources and channel of information.

Sampling method

For the purpose of the study, Amhara and Oromiya Regions were chosen because of their large area coverage and outsized number of districts found in each regions. From each of the regions, one district was selected purposively by taking its ICTs infrastructural development and available resources for data collection in to account. Arsi-Negelle and Kalu districts were selected because they are located along the main road of having better and relatively similar access to both modern and conventional ICTs, and network that enables to acquire new information. Hence, the extension workers working in these districts have relatively better access to Internet as compared to other extension workers in other districts farm away from main road and towns. Therefore, considering extension workers in these districts as source of information help us to find out the existing extension workers' familiarity to ICTs and its subsequent practices in agricultural advisory services; while there exits better access to internet and various information sources.

Data collection, analysis, and interpretation

The study was intended to find out whether there exists capacity and variability in different ICTs tools on extension works to familiarize ICT applications for agricultural advisory services. Although the Districts did not apply different extension systems, including organizational structure, staffing and service delivery mechanisms they were selected to capture reliable information by way of focusing on the two districts.

Specific information such as, experts' knowledge in using ICTs, application of ICT in agricultural information communication, knowledge about agricultural information centers or websites, access to computer and internet, browsing online resources, experts' basic computer skills, and application of mobile texting for information communication were generated from available 40 agricultural extension workers from the two districts using structured questionnaires.

The information was generated based on perception of extension workers having on their familiarity, skill and practices of ICTs in agricultural advisory services. In order to capture their perception, a set of predefined questions were developed and posed to be opted by themselves under the category of low, moderate and high level of rates. They rated their level of knowledge, skill and practices of ICTs accordingly. The responses on this specific information obtained from extension workers were then analyzed using

descriptive statistics and chi-squire statistics. The challenges in deploying ICTs for agricultural advisory services were discussed based on the result of the study and review of available secondary documents.

Conceptual Framework

Poor access to information regarding modern agricultural technologies, best practices and any other important information for farming is often supposed as a challenge in any developing country. Therefore, ICTs enabled information communication in agricultural advisory services has assumed to play important role in filling this information gap.

As a result of which, in order to systematically explore the experiences of extension workers we developed a concentric model (Figure 1) by engaging a field assessment/survey to capture the application of ICTs and its associated challenges. For instance, the communication challenges associated with proper use ICTs by extension workers especially mobile phones; whilst messaging on activities appropriately and sufficiently within the farming community.

The system framework entities are described as follows

- Extension workers: the description is the characteristics of the extension worker in district;
- ICTs: different kinds of ICTs that extension workers are using;
- Agricultural advisor services: key information that the extension worker is transferring to the farmers. Or key questions responded by the extension worker; and
- Information sources: the information sources in this case include virtual/online agricultural resource centers, research institutes, and so on.
- Farmers: farmers in sample districts.

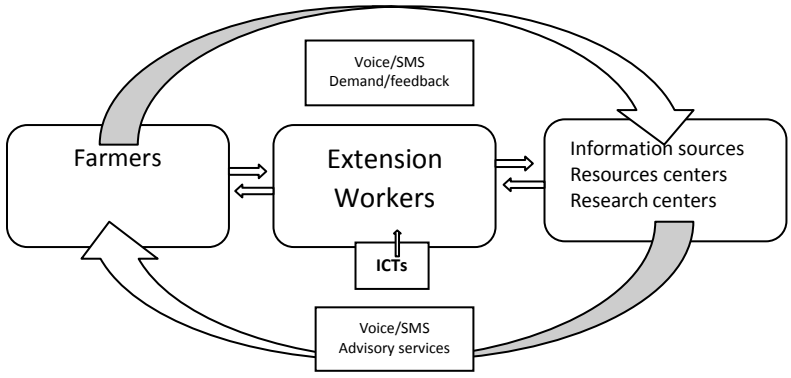

Figure 1. ICTs enabled agricultural advisory system

Results and Discussion

As part of this study, an exciting opportunity arose for expanding the boundary of using ICTs in the extension system. The fundamental role played by the government of Ethiopia in expanding the capabilities of ICTs is one among the most encouraging experience to expand use of ICT to better serve societal interest. The study also included exploring the barriers and facilitators to use ICTs and assess uses satisfaction with ICTs. It is hoped that the outcomes from this study will inform relevant stakeholders on the kind of action they should consider.

Familiarity of extension workers with ICTs

The respondents were asked with predefined questions that how they perceived their level of awareness, knowledge and skill with the various types of information communication technologies (ICTs) such as conventional ICTs tools including mobile telephone, radio, television, video; and modern ICTs tools comprising of hardware, software, media for collection, storage, processing, transmission and presentation of information in any format (i.e., voice, data, text and image), computers, the Internet, CD-ROMs, email, digital cameras, etc. Based on their response to posed questions, the level of respondents' perceived awareness, knowledge and skill were rated under low, moderate, and high refereeing their familiarity accordingly. The study therefore, found that half of the extension workers interviewed had moderate familiarization with modern ICTs; whereas the reset 37.5% and 12.5% of extension workers had low and high level of familiarization, respectively. Amid the districts, familiarity of extension workers with modern ICTs was as perceived by respondents relatively higher in Arsi-Negelle (61.9% moderate familiarity with ICTs) than in Kalu District (36.8% moderate familiarity with ICTs) (Figure 2).

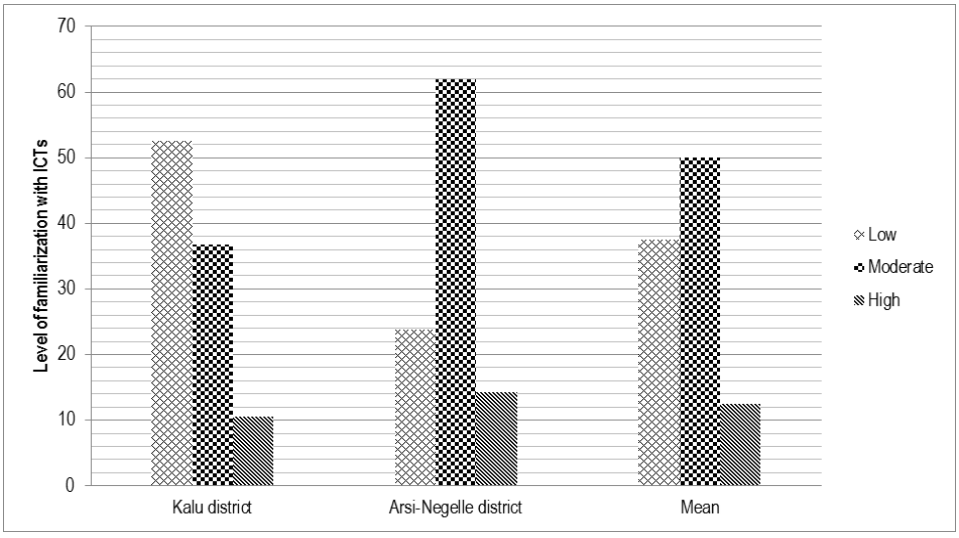

Figure 2: Extension workers' familiarity with ICTs (%)

Application of ICTs for agricultural advisory services

The graph below shows that the majority (70% with slight variation between the districts) of the respondents have not been using modern ICTs while they are communicating with farmers about new technologies, farming practice, agricultural inputs, etc. (Figure 3). Respondents indicated that application of ICTs is limited on account of lack of knowledge about agricultural information centers or websites (75%), inadequate access to desktop/laptop computer (67.5%), limited access to internet (55%), low level of basic computer skills (53%), and lack of experience in browsing online resources (62.5%) (Figure 4). Besides, 55% of extension workers do not have personal email account. This finding is in line with a study by Derso et al., (2014) conducted in central highlands of Ethiopia that lack of training in ICTs, lack of ICTs use awareness, poor infrastructure, lack of agricultural information center were the major constraints while using ICTs in agricultural extension.

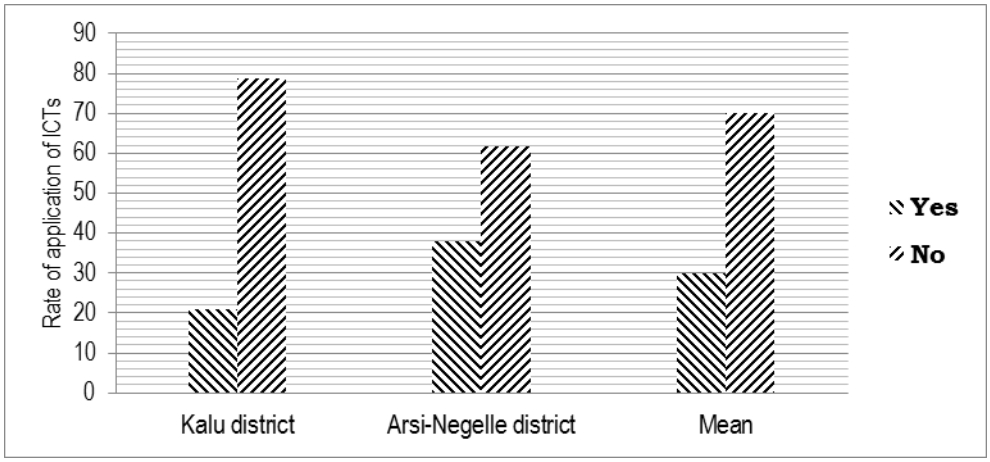

Figure 3: Rate of application of ICTs for agricultural information delivery (%)

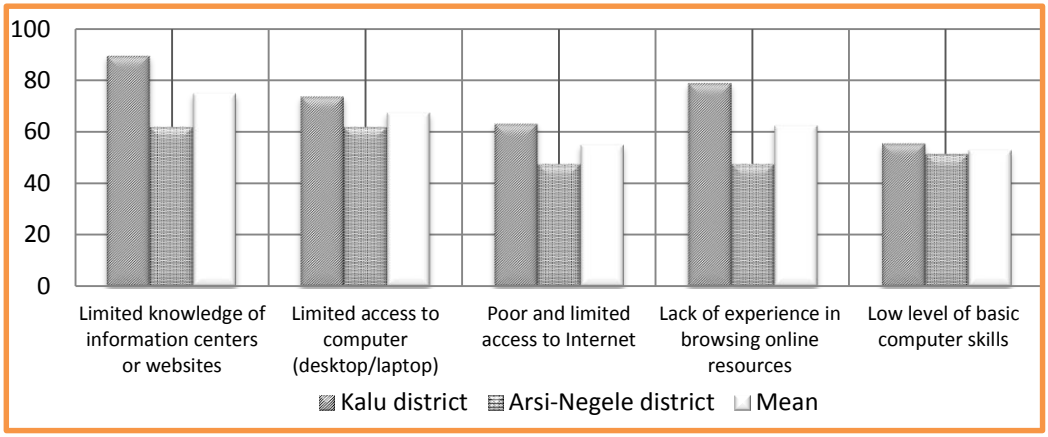

Figure 4: Challenges of using ICT in extension communication (%)

Basic computer skills

Of the total extension workers interviewed, 53%, 32.5% and 14.5% of them rated their skill of basic computer programs as low, moderate and high, respectively (Table 1). The chi-square results also indicated that the condition is similar in both of the study districts. Among basic skills, Micro Soft word processing (46.2% of them has moderate skill) was relatively higher than that of the reset of the other skills. Whereas, basic computer skill required operating with Micro Soft spreadsheet (57.7% of them has low skill), process Micro Soft access (69.2% of them has low skill) and email communication (61.5% of them has low skill) was found to be very low comparing to other basic computer skills. Briefly, this is mainly because of absence of tailor made short term training to upgrade and refresh basic computer skill of those already engaged in agricultural extension service (UNDP, 2012).

Text messaging

The application of mobile telephone has quickly become the most common way of sending information and services. Particularly, in agricultural extension communication, mobile telephone provides the most affordable and swift way to access information including technologies, markets, weather forecasts, and early warning. Although there is significant difference between the study districts, the majority (71%) of the extension workers reported that they applied mobile text to convey extension message, and other related information to the farmers (Table 2).

This happened because of the increasing expansion of mobile network and cell phones due to noticeable improvement registered in recent years in rural areas of Ethiopia. As a source indicated, mobile telecommunications in Ethiopia grew from a mere 1.2 million subscribers in 2007 to around 23.7 million subscribers in 2013 (Adam, 2012). The total number of subscribers both in mobile pre-paid and post-paid systems have reached 38 million in 2014/15 (Ethio-Telecom, 2016). However, the mobile texting in agricultural extension is not regularly programed and formally linked with Ethio-Telecom service.

Similarly, a study in India indicated that the application of mobile text is increased due to an increasing penetration of mobile networks and handsets as it presents an opportunity to make useful information more widely available (Mittal, et-al., 2010). A study in Kenya also indicated that the use of ICTs especially mobile telephones is currently widespread in the rural areas of Kenya and the extension service providers have harnessed this technology by putting it into profitable use in rural Kenya (Muriithi, et-al., 2009). In similar way another study by Bhavnan, et-al., (2008) also justified that the role of mobile telephony services as a means of two-way communication in rural areas is increasingly being used because of its affordability, flexibility, low barriers to entry. However, relatively little is known about how rural communities benefit from modern telecommunications services and what impact it is having on their lives and livelihoods.

Table 1: Extension workers' skill about basic computer programs (%)

No	Rate of knowledge and skill	Kalu			Arsi-Negelle			Mean			X^2
		Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	
1	MS word processing	30	30	40	37.5	56.3	6.3	34.6	46.2	19.2	7.395^{NS}
2	Working with spreadsheet	40	20	40	68.8	25	6.3	57.7	23.1	19.2	6.860^{NS}
3	Access processing	80	10	10	62.5	31.3	6.3	69.2	23.1	7.7	4.613^{NS}
4	Email Communication	50	30	20	68.8	18.8	12.5	61.5	23.1	15.4	3.524^{NS}
5	Chatting on social media	50	50	0	50	31.3	18.8	50	38.5	11.5	5.055^{NS}
6	Attaching file	50	40	10	43.8	37.5	18.8	46.2	38.5	15.4	3.897^{NS}
7	Searching on website	60	30	10	43.8	43.8	12.5	50	38.5	11.5	3.075^{NS}
8	Use of webpage	70	20	10	43.8	37.5	18.8	53.8	30.8	15.4	4.588^{NS}
9	Use of power point	70	10	20	43.8	43.8	12.5	53.8	30.8	15.4	5.843^{NS}
Grand total (%age)		***55.6***	***26.7***	***17.8***	***51.4***	***36.1***	***12.5***	***53***	***32.5***	***14.5***	

Source: Survey Data, 2015

Table 2: Rate of mobile text application (%)

Mobile texting	Kalu	Arsi-Negelle	Mean	X^2
Low	42	19	30	8.117*
Moderate	26	19	23	
High	32	62	48	
Total	100	100	100	

Source: Survey Data, 2015

** Significant at less than 10% probability level*

Conclusion

The study proves that there exists a gap in creating access to useful information more widely to the farming community of the districts through ICT enabled agricultural advisory services.

Therefore, it is imperative to conduct systematic assessment of knowledge and skill gaps that the extension workers lack relative to all categories of ICTs. Training needs assessment; context specific short-term training programs should be designed and offered to enhance their knowledge and skill in using ICTs in their information delivery activities. Furthermore, periodic tailor made training session should be organized on specific application of ICTs in agricultural fields.

Efforts should be made to improve access to ICTs, such as internet services, computers, storage devices etc. at agricultural offices by extension workers. Concerned actors, such as agricultural research centers, ethio-telecom, and TV and Radio media should jointly initiate projects for reliable and effective agricultural extension system by utilizing both modern and traditional forms of information communication technologies.

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