Access and Use of Information Communication Technologies by Agricultural Extension Agents in Tanzania

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Abstract: *Many studies have focused on the use of ICT by farmers; however, little attention has been on the use ICT by agricultural extension agents who are the bridge between source of agricultural knowledge and technologies on one hand and the smallholders on the other. Based on a cross sectional study of agricultural extension agents enrolled at Sokoine University of Agriculture (SUA), in this paper we present, as a point of departure, the extent of access and usage of ICT by agricultural extension agents in Tanzania. Also, factors that influence the use of ICT by Agricultural Extension Agents are assessed. Finally, a conclusion is made and recommendations offered based on the findings.*

Key words: Access, ICT, extension agents, Tanzania

INTRODUCTION

The role of agricultural sector in rural development and Tanzania in general cannot be overemphasized. Agricultural sector accounts for more than 25% of the country's Gross Domestic Product,   65% of export earnings and employs about 80% of the work force (IFAD, 2010; CIA, 2015; URT, 2016). The country's average 7% annual GDP growth over the past decade has been principally attributed to mineral production and banking reforms (CIA, 2015). However, despite its huge contribution to the economy, on average the government spends only about 7% of its annual budget on the agricultural sector (USAID, 2013). As a result, the full potential of this sector has not fully realized. The sector is characterized by the use of archaic technologies, low productivity, low income and profitability, and underutilization of available land, among many other features of the sector (URT, 2013; URT, 2016).

Information Communication Technologies (ICTs) have been identified as having real potential to improve the effectiveness of existing agricultural extension efforts in developing countries where the extension agents often get difficulties to meet farmers in a timely or regular manner due to

limitedinfrastructure, budgets, and other factors. ICTs 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. Therefore, ICTs have emerged as complementary tools to deliver and improve agricultural extension services, allowing different stakeholders to interact across geographic barriers in nearly real time (USAID, 2013).

The communication linkage between agricultural stakeholders in Tanzania is by and large top-down where passing of information is through extension workers. As the result, large geographical distances are major hindrance (Nyamba, 2012). In addition, there is a high ratio of farmers to agricultural extension agent which limit farmers' easy access to technical information (Concern Worlwide, 2008; Harris-Coble, 2016). Because of these challenges, the use of ICT in the agricultural sector is highly encouraged. The suitability of ICTs to sharing agricultural information and provision of several services needed for agricultural production is due to the fact that most ICTs allow a two-way communication and can provide more than one service simultaneously (Sife *et al.*, 2010). Therefore, ICT is a channel necessary for building local capabilities, integrating new and traditional knowledge and increasing profits from agriculture.

Over the past 25 years, the government of Tanzania has recognized the potential of ICTs in national development and has in fact initiated a series of shifts in policies and investments (USAID, 2013). The state has made remarkable progress in developing ICT services. Access of technologies such as Internet, computers, satellite, radios and mobile phone has been growing fast in the past two decades. However, despite the availability of various communication channels, accessibility of agricultural information services among stakeholders in Tanzania has remained a challenge for many years (URT, 2008). Therefore, this draws attention to whether the agricultural extension agents have access and effectively use the available ICT facilities.

Despite the government target to achieve ICT-based agricultural extension systems to speed up agricultural development, there has been little attention on the use ICT by agricultural extension officers who are the bridge between research centers (source of agricultural knowledge and technologies) and the smallholders (the users). Available studies (Sife, 2010; Mlozi and Nyamba 2012; Tumbo *et al.*, 2012; Temba *et al.*, 2016) on ICT applications in agriculture in Tanzania have mainly focused on the roles of ICT in agriculture and the use of ICT by farmers. According to Ospina and

Heeks (2012), in order for ICTs to be effective it is important to have adequate infrastructure, affordable tariffs, and skills necessary for using them and for those which provide mass media services then programmes should be broadcasted at relevant time. This study therefore, was conducted to determine the extent of access and usage of ICT by agricultural extension officers. The next section presents the methodology where details about the population and sample of the study are highlighted.

METHODOLOGY
The study employed a cross-section research design whereby the data were collected from one point at once (Babbie, 2016). The population for study included all extension agents enrolled for Bachelor of Science in Applied Agricultural Extension (BSc. AAE) at Sokoine University of Agriculture (SUA). The BSc AAE programme is a midcareer programme in which the majority (more than 75%) of students enrolled in this programme are working as extension agents in different parts of Tanzania. The study used both qualitative and quantitative methods to collect data from the respondents.

Although registration information at the department of Agricultural Extension showed that 150 were employed as agricultural extension agents, only 103 had working experience and the rest (47) either left for further studies before started working or were employed while already pursuing studies. Based on Yamane (1967) formula of sample size determination, a sample of 82 extension agents was obtained from those with working experience. After determining the sample size, a proportionate method was used get 35 out of 44 extension agents in first year, 26 out of 33 second year and 21 out 26 in third year. Structured questionnaire with both closed and open ended questions were self administered to the respondents for data collection. Additionally, one focus group discussion (FGD) was conducted to get more details on access and use of ICT in discharging their core functions. Nine members of FGD, three from each class, were chosen based on their rich experience in agricultural extension work. They comprised four (4) females and five (5) males. FGD guide was used to guide the discussion. Quantitative data were analysed using SPSS computer software whereas qualitative data were analysed using content analysis. Simple descriptive statistics involving frequencies and percentages were used to determine extent of access and use of ICT facilities. Challenges facing extension agents in access and use of ICTs were also explored.

RESULTS AND DISCUSSION
Respondents Socio-economic Characteristics
The study results in Table 1 show the distribution of the socio-economic characteristics of respondents. The findings show that there were more males (62.2%) than females (37.8%) respondents in this study. These results might be a reflection of the actual situation on the ground where it is reported that agricultural extension profession is dominated by males. Most (58.5%) respondents were within the age range of 20-30 years followed by those in the age range of 31-40 years (35.4%). These findings imply that most respondents were young. It was found that most (41.2%) respondents had household size of 4. This indicates that most respondents had no big family size which might be due low age of majority (58.5%) respondent.

Most (43.7%) respondents had an average monthly income ranging between Tsh. 401,000-500,000 and followed by those who had average monthly income ranging between 301000– 400000 (19.7%). This indicates that more than half of respondents had at least 300,000 monthly average incomes, hence they did not belong to the poor category as their average minimum daily income is above 1$ (i.e. TSH. 2000). In terms of place of living, almost half (48.8%) of respondents came from rural areas and more than half (58.7%) reported to work in rural areas. This was expected because certificate and diploma holders in agricultural extension are referred to as field officers and therefore are expected to work at the village and ward levels respectively. Majority (69.5%) of the respondents had working experience ranging from 3 to 6 years and more than half (51.3%) were working at the ward level. These findings indicate that majority of respondents involved in this study had some experience of working as extension agents, hence they have required information on ICT access and use in extension services.

Table 1: Socio-economic characteristic of respondents (N = 82)

Characteristics	Frequency	Percentage
Sex		
Male	51	62.2
Female	31	37.8
Age		
20-30	48	58.5
31-40	29	35.4
41-50	5	6.1
Marital Status		
Single	31	37.8
Married	51	62.2

Average monthly income

Below 100 000	1	1.4
100 000 - 200 000	3	4.2
201 000 - 300 000	2	2.8
301 000 - 400 000	14	19.7
401 000 - 500 000	31	43.7
501 000 - 600 000	6	8.5
Place where extension agent is living		
Rural	40	48.8
Urban	20	24.4
Rural-Urban	22	26.8
Work location of the respondent		
Rural	44	58.7
Urban	12	16.0
Rural-Urban	19	25.3
Experience		
6moths-3years	13	15.9
3.1-6 years	57	69.5
6.1-9 years	6	7.3
Above 12years	2	2.4
Not employed	4	4.9
Working coverage		
Village	19	24.4
Ward	40	51.3
District	15	19.2
Ministry	4	5.1
Household size		
2.00	9	17.6
3.00	10	19.6
4.00	21	41.2
5.00	6	11.8
6.00	5	9.8

ICT items owned by respondents

In order to study the extent of ICT access and use, firstly the study
established the types of ICT items owned by the respondents. Findings in
Table 2 show that a majority of respondents had mobile phones (93.8%);
radio (76.3%) and television (66.3%). In addition, more than one third (45%)
reported to own internet connected computer.

Table 2: Items owned by respondents

ICT item owned	Count	Responses	% of cases
Radio	61	24.3	76.3
Radio	53	21.1	66.3
Mobile phone	75	29.9	93.8
Telephone (landline)	5	2.0	6.3
Internet connected computer	36	14.3	45.0
Geographic information system (GIS)	4	1.6	5.0
Cassette recorder/player	17	6.8	21.3
Total responses	251	100.0	313.8

Sources of ICT items which are not owned but have access The respondents who did not own certain ICT tools, had accessed through other means. The results in Table 3 show that the majority of respondents who did not own mobile phones, television, modem and radio they accessed them through friends. The extent of using this means of access was 100% for mobile phones, 62% for television, 56.5% for modem and 52.4% for radio.

This implies that social networks had played a role in supporting respondents to use ICT tools in their extension works. Employers also enabled access to ICT facilities for extension agents who did not own them. All extension agents (100%) who did not own telephone accessed it through the employer. Also, the employer enabled access to GIS and projector by 75% and 78.6% respectively.

These findings suggest that the employers had assisted most of respondents in accessing ICT tools which were not owned by them and could not be obtained from friends. For internet computers, respondents who did not own internet connected computers accessed them in the market place (57.1%). This implies that sometimes extension agents incur costs in discharging their core functions.

Table 3: Source of the ICT items which are not owned but have accessed

Source of ICT item	Frequency	Valid Percent
Radio		
Open market	1	4.8
Friend	11	52.4
Community centre	9	42.9
Open market	1	4.8
Television		
Open market	1	4.8
Friend	13	61.9
Community centre	7	33.3
Open market	1	4.8
Mobile phone		
Friend	5	100.0
Telephone (landline)		
Employer	15	100.0
Internet connected computer		
Employer	14	33.3
Open market	24	57.1
Friend	3	7.1
Community centre	1	2.4
GIS		
Employer	3	75.0
Friend	1	25.0
Cassette recorder/player		
Open market	11	78.6
Friend	3	21.4
Modem		
Employer	4	25.0
Open market	3	18.8
Friend	9	56.3
Projector		
Employer	11	78.6
Open market	1	7.1
Friend	2	14.3

Challenges in accessing ICT tools

The results in Table 4 show that cost of accessing ICT tools was mentioned by many respondents to be a challenge in accessing radio (65%), modem (62.7%), mobile phones (51%), GIS (45.5%), and internet connected computer (38.6%). During FGD, members raised concerns that in other places ICT facilities are available far away and it requires someone to

private or public transport in order to get access. They further lamented that sometimes the employer expects them to use ICT although are not facilitated to gain access to them. One male respondent said;

> "For us whose working stations are in rural areas, accessing ICT is a challenge as you are required to move to a town center to access computer connected to internet or buy your own modem which also requires you to have your own computer… all these need money" Another male respondent interrupted;

> "If our offices had ICT facilities like computers and GIS it would have helped us and could motivated us to use ICT in our activities. Unfortunately, we are not equipped with any of those and sometimes we are expected to use them in our activities…"

Electricity was also reported by many respondents as a challenge in accessing cassette recorders/players (46%), televisions (53.6%), mobile phones (45%) and internet connected computers (33.3%). This might be due to what was revealed in this study that the majority of respondents were living and working in rural areas where shortage of electricity is inevitable because of poor infrastructure. These results are similar to the study findings by Omotesho *et al*. (2012) who found that high cost of ICT equipment, inadequate electricity supply, and high cost of internet access were major constraints common to Extension agents for their access to ICT in Kwara state. Unavailability of telephones (50.1%), GIS (41.8%) and projectors (35.1%) was also reported by most respondents.

Table 4: Challenges of accessing ICT items

Challenges	Frequency	Percent
Radio		
Not readily available	5	12.5
Cost	26	65.0
Electricity	9	22.5
TV		
Distance	8	14.3
Cost	18	32.1
Electricity	30	53.6
Mobile		
Cost	26	51.0
Electricity	25	49.0
Telephone		
Distance	9	16.4
Not readily available	28	50.9
Cost	9	16.4
Connected computer		

Challenges	Frequency	Percent
Distance	10	15.2
Not readily available	14	21.2
Cost	17	25.8
Electricity	22	33.3
GIS		
Distance	3	5.5
Not readily available	23	41.8
Cost	25	45.5
Electricity	4	7.3
Cassette recorder/player		
Distance	11	22.0
Not readily available	2	4.0
Cost	14	28.0
Electricity	23	46.0
Modem		
Distance	7	11.9
Not readily available	2	3.4
Cost	37	62.7
Electricity	13	22.0
Projector		
Distance	10	17.5
Not readily available	20	35.1
Cost	22	38.6
Electricity	5	8.8

Members of FGD reported that to a great extent telephones have been replaced by mobile phones and therefore they are not readily available. With regard to GIS, eight out of nine members of FGD perceived GIS as a difficult tool to use. They also thought that unless extension agents learn how to use GIS, their availability and use in extension work will remain low.

> "We just see GIS being used by extension agents working with international NGOs; for us in the government, using GIS is still a dream. After all, who can afford to give you a tool which he/herself cannot use…" One female extension agent explained.

The reported results of FGD are in congruent with the results of the survey but also confirm what Temba *et al*. (2016) observed in their study on accessibility and use of ICT facilities among poultry keepers in Morogoro Municipality.

Extent of using ICT tools in agricultural extension work
Table 5 shows that nearly all (96.3%) respondents were using mobile phones in extension work followed by those using radio (52.4%) and television (50%). Almost all (95.1%) respondents did not use GIS at all. In general, a mobile phone was the mostly used ICT tool followed by radio, television, cassette recorder/player, computer, telephones and GIS. Greater use of mobile phone might be influenced by ownership and convenience in using it.

A study conducted by Katengeza *et al*. (2011) found that intensity of use was influenced by ownership of mobile phone. Low extent use or not using these ICT tools such as internet connected computers, GIS, television, and telephones might be due the challenge of cost and lack of electricity as mentioned by most respondents as challenge in accessing these ICT tools.

Challenges of using ICT items
Table 5 shows that many respondents reported that inadequate electricity was a challenge of using television (54.7%) and radio (39.4%) in extension work. In addition, many respondents reported that narrow coverage of radio (32.4%) and television stations (23.3%) that address agricultural issues was a challenge. This was also reported in FGD where one participant gave an example of SUA TV which air agricultural programmes but only farmers and extension agents living in Morogoro and regions close to Mororogo can access them.

This suggests that in most rural areas ICT infrastructures are not well developed. Expanding "primary service area" which is the area served by a station's strongest signal may help to overcome the limitation. Also, for radio and television stations which have broad "primary service area" airing agricultural programmes should be part of their mission for them to contribute significantly to agriculture development in Tanzania.

Table 5: Extent of using ICT tools in agricultural extension work

Extent of using	Frequency	Percent
Mobile phone		
Greater extent	12	96.3
Low extent	3	3.7
Telephone		
Greater extent	10	20.7
Low extent	15	18.3
Very low extent	13	15.9
Not using at all	37	45.1

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Extent of using	Frequency	Percent
Radio		
Greater extent	16	52.4
Low extent	22	26.8
Very low extent	8	9.8
Not using at all	9	11.0
Television		
Greater extent	20	50
Low extent	24	29.3
Very low extent	4	4.9
Not using at all	13	15.9
Computer		
Greater extent	11	25.6
Low extent	18	22.0
Very low extent	11	13.4
Not using at all	32	39.0
GIS		
Very low extent	4	4.9
Not using at all	78	95.1
Cassette player		
Greater extent	17	26.8
Low extent	12	14.6
Very low extent	22	26.8
Not using at all	26	31.7
Projector		
Greater extent	11	17.1
Low extent	26	31.7
Very low extent	29	35.4
Not using at all	13	15.9

Also, high cost was reported by many respondents as a challenge of using mobile phones (57.7%), projector (50%), telephone (36.7%), television (32%) and internet connected computer (30.6%). These findings imply that even though most respondents owned ICT tools like mobile phones and other, using them for agricultural extension work was limited by the high charges. FGD members pointed out that buying airtime to communicate with farmers and buying internet bundles to use World Wide Web sources is really costly. It was reported that because of the high charges it was difficult for extension agents to keep abreast of what is happening in their field. Furthermore, lack of skills (technical know-how) was reported by

many respondents as a challenge of using GIS (80.5%), cassette recorder/player (52%), projector (40%) and internet connected computer (25%). A study by Temba (2016) on accessibility and use of information and communication tools among farmers for improving chicken production in Morogoro municipality, Tanzania reported similar results.

Table 5: Challenges of using ICT tools

Challenges of using	frequency	Percent
Radio		
High cost	14	19.7
Low kills (Technical know-how)	1	1.4
Weak communication	23	32.4
Fear of ICT usage	2	2.8
Long distance	1	1.4
Inadequate electricity	28	39.4
No time to listen	2	2.8
Television		
High cost	24	32.0
Low skills (Technical know-how)	2	2.7
Weak communication	6	8.0
Fear of ICT usage	2	2.7
Inadequate electricity	41	54.7
Mobile phone		
High cost	41	57.7
Low skills (Technical know-how)	7	9.9
Weak communication	12	16.9
Fear of ICT usage	5	7.0
Inadequate electricity	6	8.5
Telephones		
High cost	11	36.7
Low skills (Technical know-how)	1	3.3
Weak communication	7	23.3
Long distance	4	13.3
Inadequate electricity	5	16.7
Not available	2	6.7
Internet connected Computer		
High cost	22	30.6
Low skills (Technical know-how)	18	25.0
Weak communication	10	13.9
Long distance	10	13.9
Inadequate electricity	6	8.3
Lack of training on ICT	6	8.3
GIS		
High cost	3	7.3
Low skills (Technical know-how)	33	80.5
Fear of ICT usage	5	12.2

Challenges of using	frequency	Percent
Cassette recorder/player		
High cost	5	20.0
Low skills (Technical know-how)	13	52.0
Fear of ICT usage	7	28.0
Projector		
High cost	5	50.0
Low skills (Technical know-how)	1	40.0
Weak communication	1	10.0

CONCLUSION

This study aimed at assessing the access and use of ICT tools by agricultural extension agents and challenges encountered in Tanzania. Based on the findings of this study, mobile phones, television and radio were the most accessible and used ICT tools. However, three, major challenges including high cost of access and use, shortage of electricity and unavailability of some of ICT tools such as GIS, telephone and cassette recorder/player constrained access and use of ICT in agricultural extension work. In order for ICT to contribute significantly to agricultural sector and rural development at large the government and other development stakeholders should encourage farmers and extension agents to tap opportunities of ICT tools in extension work. Government can support this endeavor in many ways such as tax reduction that can reduce the cost, put in place or improve ICT infrastructure especially in rural areas, and offering retooling courses in ICT use in extension work.

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