Original Research Article

Impact of Training on Adoption of Information and Communication Technology Tools in Agricultural Extension among Smallholder Cassava Farmers in Rangwe Sub-County, Kenya

ABSTRACT

Problem: Despite the potential of Information and Communication Technology (ICT) tools to enhance agrarian development through sufficient dissemination of agricultural information, its adoption is low. This could be attributed to inadequate assessment of the determinants of ICT tools adoption. **Aim**: The purpose of this study was to describe the level of access to training on ICT tools, the level of ICT tools' adoption, and determine the correlation between access to training and the use of ICT tools among the Small Holder Farmers (SHFs). **Study design**: A correlation research design was employed in this study at Rangwe Sub-County, Kenya from 8th December 2021 to 14th January 2022. **Methodology:** The study used pretested structured questionnaire to collect data from 106 SHFs who grow cassava in the Sub-County. Data analysis was done using Statistical Package for Social Science Version 25 to run Spearman's correlation and descriptive statistics. **Results:** The study realized a response rate of 100%. Out of the total percentage of respondents, 36% had used ICT tools in agricultural extension while 64% had not. About 37% had access to ICT training while 63% had no access. A majority had received the training once from a private extension system. Spearman's correlation analysis showed that a correlation between access to training and the use of ICT tools among the SHFs was statistically significant at a 1% level of significance ($R = +.776^{**}$, $P = .000$, $R^2 = 0.602$). **Conclusions:** Training on ICT tools explains about 60% of the use of the tools among the SHFs. An increase in access to the training enhances the use of ICT tools in agricultural extension. The availability of training centers was recommended to increase the use of ICT tools.

Keywords*: Access to training, Agricultural extension, Information and Communication Technology tools, Agriculture*

1. INTRODUCTION

Across the world, the dissemination of quality agricultural extension services promotes the use of new agricultural technologies which in turn improve farm productivity. Traditional agricultural extension officers introduced the new farming technologies to the farmers. However, their impact was limited by the challenges such as a vast number of farmers distributed over a wide geographical area (Department of Agricultural Extension [DAE], 2020). The constraints were exacerbated after the spread of coronavirus. The movements and physical interactions between agricultural extension staff and smallholder farmers were restricted. The restrictions interfered with the sharing of agricultural extension services and technology adoption among the smallholder farmers (Ozili, 2020).

Training smallholder farmers on how to access agricultural information such as input supply, management practices, and reliable marketing services through ICT tools play a crucial role in the decision making to adopt or reject such tools. The same training may become more useful when agricultural extension officers are also included (Kabir et al., 2022). According to Ulhaq et al. (2022), numerous and repeated training for smallholder farmers increases the extent of agricultural technology adoption. Lack of knowledge, skills, and awareness are some of the most suggested barriers that block smallholder farmers from adopting some of the agricultural technologies (Çetin et al., 2021).

In Africa, it is reported that the effectiveness of smallholder farmers' training on the use of new agricultural technologies depends more on the number of times an individual receives the training. The training programmes that are well-strategized and focused on might increase the use of ICT tools in cassava production (Sa'adu et al., 2022). According to Parvand and Rasiah (2022), training on the use of ICT tools is a very important and effective factor in the adoption of ICT tools in agriculture among smallholder farmers. It is well noted that a well-trained and skilled workforce is crucial in work progress and project performance.

In Kenya, one of the major solutions for the agricultural extension challenges is the use of ICT in the sharing of agricultural extension services. The ICT is an electronic tool used to enter data, store, process, and share information. Common ICT tools among smallholder farmers include mobile phones, televisions, computers, and radios (Birke & Knierim, 2020). These tools have the potential to improve the diffusion of agrarian technologies and connect rural smallholder farmers with agricultural extension officers easily.

Farm digitalization and promoting data-based agrarian tools are essential in fostering farming innovation. Giua et al. (2022) noted that digitalized farm innovations are modern farm inputs to solve agricultural extension problems. Numerous ICT-based development initiatives around the world have beneficial impacts, starting from the Information Technology application in Europe, the IKisan portal in India, mobile phone-based animated videos in Burkina Faso, and the Agriculture portal in Bangladesh (DAE, 2020; Sa'adu et al., 2022). The effective use of ICT tools in agricultural extension depends greatly on the ability of institutions to ensure that smallholder farmers get access to necessary training. The ability of the smallholder farmers to use various ICT tools depends on continued training and funding from organizations (Chohan & Hu, 2022). Giua et al. (2022) noted that promoting farm technologies instead of addressing communication constraints of smallholder farmers is one of the reasons for agricultural extension failures in the adoption of ICT tools.

García et al. (2019) reported that farmers' training on the benefits and costs of the technology enables them to receive the details of what is required and improve the rate of its adoption. Training smallholder farmers on the knowledge and skills of the use of technologies as well as why they should be used through training play a role as an incentive for their adoption (Kabir et al., 2022). Similarly, access to training on ICT tools might enable smallholder farmers to familiarize themselves with the use of ICT tools in agriculture. This might translate into the adoption; nevertheless, there is no information on the number of times smallholder farmers should be trained to improve their skills effectively. In addition, (Martinez-Gomez et al., 2022) reported that smallholder farmers were able to use mobile phones and radios in sharing agricultural information without attending any training. This revealed inconsistency on whether there is a relationship between access to training and the use of ICT tools that this study sought to determine among smallholder cassava farmers in Rangwe Sub-County, Kenya is limited.

2. MATERIAL AND METHODS

2.1 Study Location

National Commission for Science Technology and Innovation (NACOSTI) approved this study under license No. NACOSTI/P/21/14779. The study was carried out in Rangwe Sub-County, Kenya (Figure 1). The Sub-County is sitting on an approximate area of 273.2 km^2 and is located at a latitude of 0° 34' 30" S

and a longitude of 34° 9' 20" E. The Sub-County comprises four administrative wards including Kagan, Kochia, Gem East, and Gem West (Rangwe Sub-County Ministry of Agriculture Annual Report, 2021). It receives an average bimodal rainfall of about 1150 mm and has a population of 3808 smallholder cassava farmers (County Integrated Development Program [CIDP], 2021). Agriculture is the major economic activity; where about 60% of the residents cultivate approximately 86% of the land and grow cassava, maize beans, sweet potato, kales, millet, pineapple, sugar cane, and rice (Cheboi et al*.,* 2021). The study selected Rangwe Sub-County because the government promotes cassava production and the use of ICT tools in agricultural extension service delivery. However, there was low adoption of ICT tools in the Sub-County.

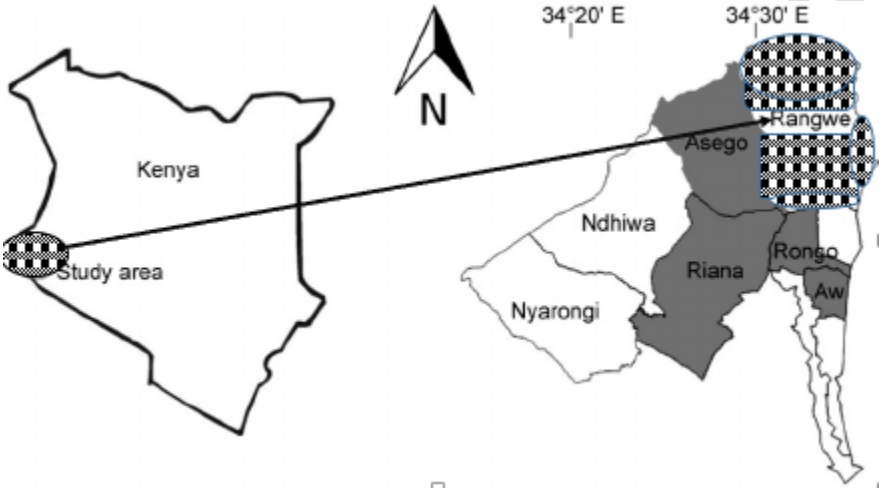

Figure 1: Rangwe Sub-County, Kenya (CIDP, 2021).

2.2 Sampling Procedure and Sample Size

The study chose the Sub-County purposively based on its low use of ICT tools among the smallholder cassava farmers. The appropriate number of respondents was arrived at with the aid of the Naissuma (200) formula as illustrated.

$$n = \frac{\boldsymbol{NC^2}}{\boldsymbol{C^2 + (N-1)e^2}}$$

Where: e = Standard error, *n* = appropriate sample size, N **=** accessed population in the area, C**=** Coefficient of Variation.

$$n = \frac{3025x(0.21)^2}{(0.21)^2 + (3025-1)x(0.02)^2} = 106$$

The study expected 95% confidence (5% sampling error) to obtain an appropriate sample size of SHFs from Rangwe Sub-County.

The study employed a proportionate sampling technique to get respondents' sampling proportion from the four wards in Rangwe Sub-County. The sampling technique was appropriate due to its ability to provide sampling equity. The study also used a simple random sampling method to choose 106 SHFs in the sampling frame.

2.3 Ethical Considerations

This research study considered a number of ethical issues which included presenting a research permit to the Rangwe Sub-County Agricultural Ministry, conducting proper self-introduction to the farmers, and explaining the real purpose of the study. The study also respected the confidentiality, anonymity, dignity and culture of the farmers. Full consent was obtained before the data collection process.

3 RESULTS AND DISCUSSION

The objective of this study was to describe access to ICT training, the level of ICT tools' usage, and determine the correlation between access to training and the use of ICT tools among smallholder farmers. The results obtained from this study were analyzed and discussed as follow.

3.1 Descriptive Statistics for Access to ICT Training among the Farmers

The sampled smallholder farmers were asked to describe how they respond to training on ICT. The results were recorded and discussed in this section.

3.1.1 Level of Access to ICT Training

Based on access to training, it revealed that 63% had no access to training on the use of ICT tools to access agricultural extension services, while 37% had access to the training (Figure 2). The relatively low percentage of the farmers who had access to the training could mean that the farmers had some drawbacks keeping them away from the training. This may contribute to the low use of the tools. This is because training exposes the smallholder farmers to institutions that support the use of ICT tools in agriculture and equip them with the skills and knowledge necessary to operate the tools. The training also adds value to the tools as farmers learn the benefits of using them. The results concurred with Ankit et al.

(2021), who noted that ICT training also equips them with the skills and knowledge they require to adopt ICT tools in agriculture effectively. However, it opposes Wang et al. (2021), who found a higher percentage of farmers trained on the benefits and use of ICT tools.

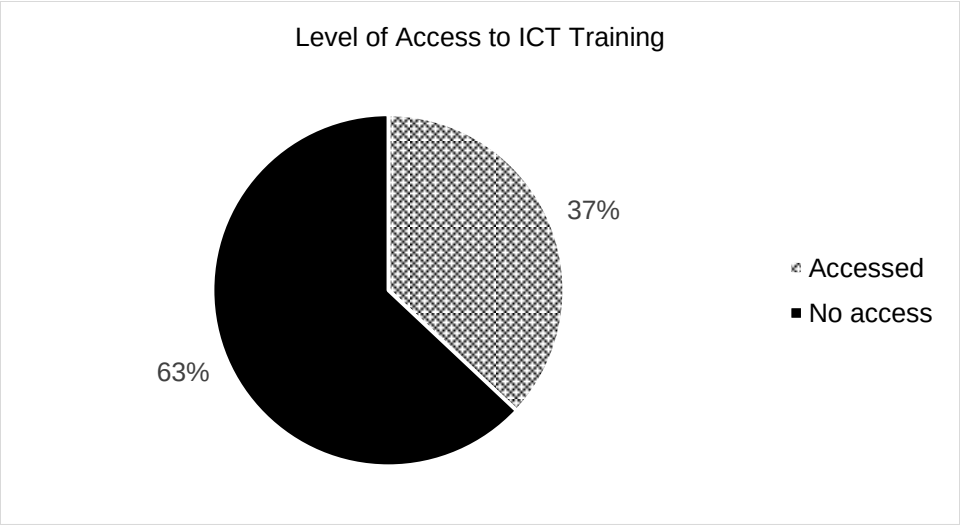

Figure 2: Level of access to ICT training

3.1.2 Sources of ICT Training Accessed

The majority (54%) of those who had access to training, were trained by agents from the private sector, followed by 39% who received the training from the public sector, and lastly, 7% of them received it from the institutional sector (Figure 3). The greater percentage of farmers receiving training from the private sector could mean that there are many privatized companies working to subsidize the low number of public extension agents in the field. The number of the farmers to be served by extension officers are greater and widely spread across the world. This called for the need for more extension systems to subsidize extension service delivery. The results supported (Gikunda et al. (2022) who noted that Kenya has many private extension systems engaging in the training of farmers.

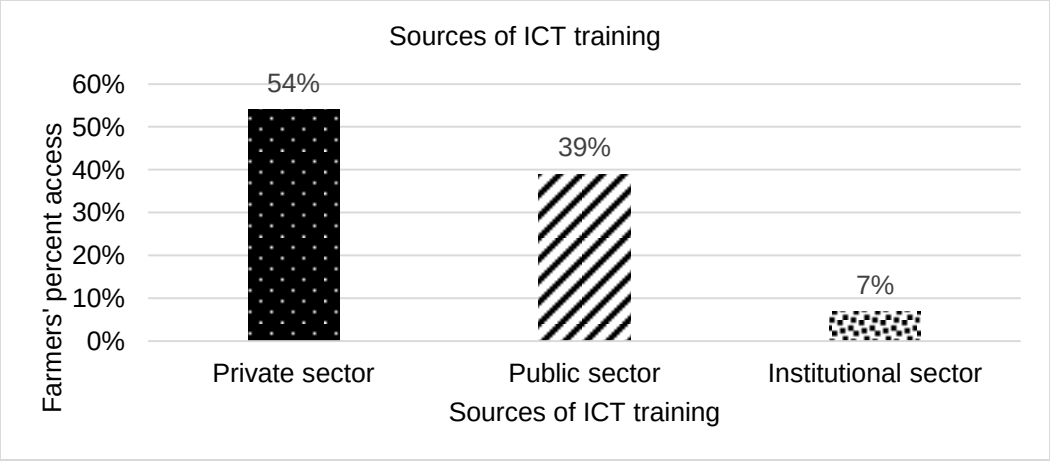

Figure 3: Sources of ICT training accessed

3.1.3 Number of ICT Training Accessed per Year

The majority (46%) of those who received ICT training had attended the training once a year, while 39% had attended 2 to 3 times. Lately, 15% had attended more than 4 times in a year (Figure 4). The fact that the majority of the farmers had a lower number of training could mean that there were inadequate skills and knowledge necessary to use ICT tools in agricultural extension. This could contribute to the low use of ICT tools in agricultural extension service delivery. The farmers should be trained regularly to equip them with skills, and knowledge and change their negative attitude toward the ICT. The results opposed Ravikishore et al. (2022) that repeated training did not change farmers' perception of new technology due to some factors such as inadequate incentives. On the other hand, it agreed with Addison (2022) that exposing farmers to several extension training programs improves the adoption of technology.

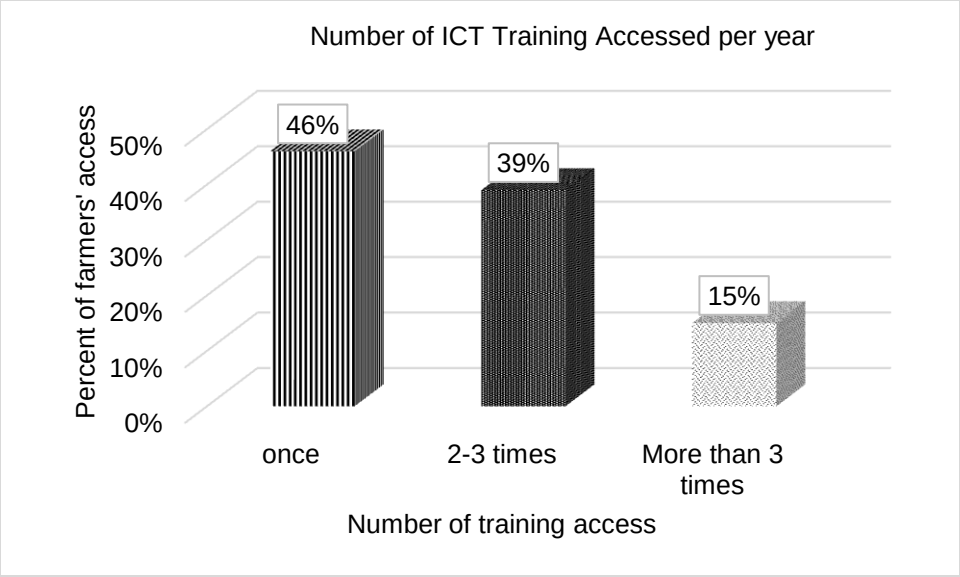

Figure 4: Number of ICT training accessed per year

3.1.4 Types of ICT Training Accessed

The majority (49%) of those who had access received training services such as the importance of ICT, operation skills, opportunities, and programs available. This was followed by 36% who received training on the importance of using ICT tools in agriculture and how to operate the tools. Lastly, 15% received the training on the available ICT programs and opportunities that exist in the use of ICT (Figure 5). The fact that the majority received knowledge on the importance, operation skills, opportunities, and available programs means that the training equipped them with the necessary information to use the tools in agricultural extension. This could be the reason some of the farmers adopted the use of ICT tools. The results were in line with Rengaraj and Shibu (2022) who reported that farmers need ICT training on how they can operate the devices and how the knowledge to access the information.

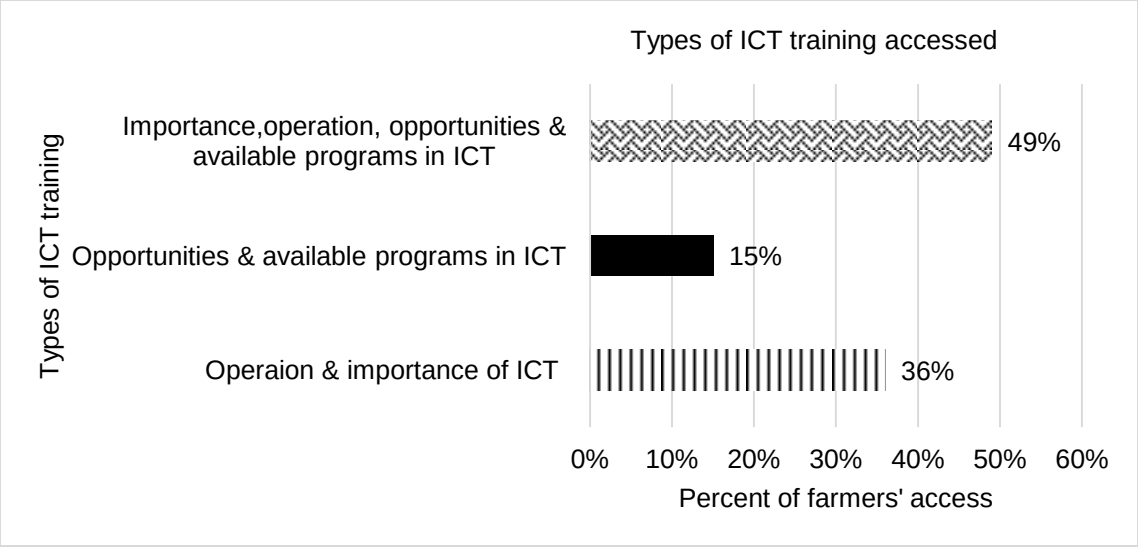

Figure 5: Types of training accessed

3.2 Level of ICT tools' Adoption

The study analyzed the degree to which smallholder farmers in the Sub-County had used the ICT tools in agricultural extension services (Figure 6). It showed that a greater percentage (64%) had not used ICT tools while only 36% had used them. The revealed low use of ICT tools in agricultural extension could be caused by a greater number of unknown factors. Determining these undefined factors would act as a starting point for solving and improving the condition of low use of ICT tools in accessing agrarian information. The results supported Spielman et al. (2021) that the use of ICTs in agriculture has not been optimized among farmers. However, it opposes Kabir et al. (2022) that the majority of smallholder farmers utilized mobile phones in farming.

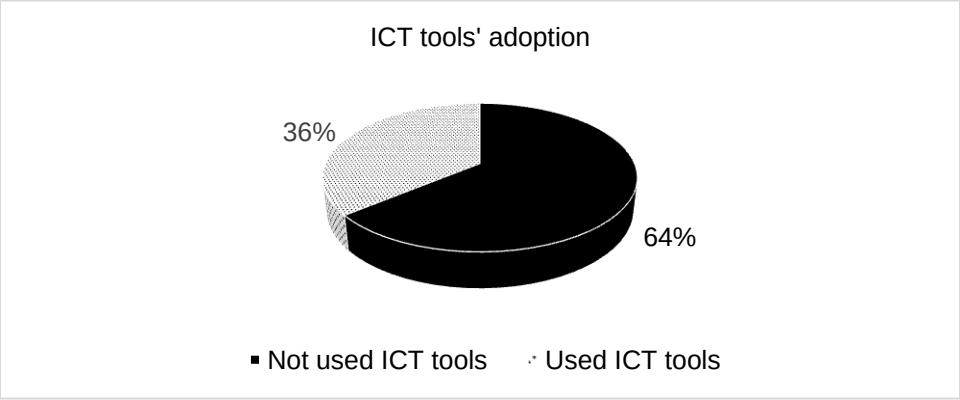

Figure 6: ICT tools' adoption

3.3 Access to Training and Use of ICT Tools

Access to training on ICT was cross-tabulated with the use of ICT tools in agricultural extension and frequency results were recorded (Table 1). The results showed that out of the total number of those who received the training (39), the majority (33) used ICT tools in agricultural extension. This means that an increase in access to training appears to increase the use of ICT tools in agricultural extension among the smallholder farmers. The results were in line with Bansal et al. (2021) who noted that training of farmers facilitates them in the adoption of agricultural technologies.

Table 1

Access to training and use of ICT tools

		Access to ICT training		
		No Access	Access	Total
Use of ICT tools	No Use	62	6	68
	Use	5	33	38
Total		67	39	106

3.4 Correlation between Access to Training and Use of ICT Tools

The study used Spearman's correlation to determine the correlation between smallholder farmers' access to training and the use of ICT tools in agricultural extension (Table 2). It revealed a high, positive correlation between access to training and the use of ICT tools, which was statistically significant at a 1% level of significance ($R = +.776^{**}$, $P = .000$, $R^2 = 0.602$). Access to training appears to provide a substantial guide to the use of the ICT tools as it predicts at 60% of the use of ICT tools among smallholder cassava farmers. The remainder (40%) of the unexplained variance may involve other variables. The use of ICT tools increases with an increase in access to the training. This concurred with Malik et al. (2021) that there is a relationship between access to training and the use of technologies. Nevertheless, it opposed Coggins et al. (2022) who noted that the farmers with no training could still use mobile phones in agriculture.

Table 2

Spearman's correlation between access to training and ICT tools' usage

Number of respondents	Correlation coefficient (R)	*P*-value	R^2
106	+0.776**	.000	0.602

*Note: ** indicates correlation is significant at the 0.01 level (2-tailed)*

4. CONCLUSION

The results proved that there was a statistically significant correlation between access to training on ICT tools and the use of the tools in agricultural extension among smallholder cassava farmers in Rangwe Sub-County, Kenya. The analysis confirmed that ICT tools were used more among those who had the access to the training on ICT tools. This could mean that the training equipped the farmers with the necessary skills, and knowledge required to successfully use the tools. Repeated training also increases the use of ICT tools among the farmers. Policymakers should prioritize policies that support the establishment of local ICT training centers to increase the level of the farmers' access to the training.

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