

A Framework for Adopting ICT-Based Services Among Coffee Farmers in Uganda: Case Study of Bugisu Subregion in Bugisu



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1 Introduction

The most traded commodity in the world is coffee after oil. For stability and growth, the economies of many countries depend upon coffee production. New studies have found that *Coffea arabica*—the plant that almost all coffee is made from—may go extinct by the year 2080. Climate change already had and will continue to have a severe and negative effect on coffee production throughout the world [1].

The African economies remain predominantly agrarian, with the sector accounting for roughly 15% of the continent's GDP, employing 90% of the rural workforce and 60% of the total labor force in the urban and rural areas. The sector contributes about 40% of export earnings and provides over 50% of household needs and income [2, 3]. In Uganda, the greatest agricultural export earner is coffee. Uganda's Robusta production is the second largest in Africa, making it the seventh Robusta-producing country in the world. Uganda is also the third Arabica-producing country in Africa. On a national economic level, it accounts for the largest export revenue accounting for 20% of Uganda's GDP [4]. Coffee in Uganda is being grown by 1.7 million households, cultivating on average of less than 1 ha and contributes on average 70% to the incomes of these small-scale farmers [5]. Coffee exports for the 12 months (financial year 2020/2021) amounted to 6,078,638 60-kilo bags worth US\$ 559.26 million [6]. Although Uganda grows both Robusta and Arabica, the Arabica is the major type of coffee grown in the country, accounting for about 80% of production.

Bugisu region in Eastern Uganda is the third most successful coffee-growing regions in Uganda after central and western regions. Bugisu region produced about 675,850 bags of Arabica coffee in 2018/2019 [6]. Coffee in Bugisu is majorly grown

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in the higher, wetter slopes of Mount Elgon's foothills. However, while Bugisu region is the third most successful coffee growing region in Uganda, coffee farmers face numerous challenges that have significantly reduced the production of coffee. Coffee farmers in the region are grappling with pests which destroy large parts of farms leading to about 50% loss. There is also a challenge of diseases such as coffee wilt disease and coffee berry disease that lead to poor quality output. Limited land for coffee plantations due to the ever increasing population. Population density, for example, in Bugisu region especially on the coffee growing mountain slopes is very high. These areas are faced by land fragmentation due to the inheritance cultures of dividing land among siblings especially on Customary Land [7]. The region also experiences prolonged drought and landslides which destroy coffee trees leading to low output. For example, the 2010 landslide in Bududa District in Bugisu region destroyed over 60,000 coffee trees which meant a destruction of about 40.8 metric tons of freshly picked coffee [8]. Climate change, on the other hand, poses a significant threat to coffee farmers, with erratic rainfall and increases in temperature leading to reduced coffee yields and lower quality beans [9].

Therefore, there is a need to improve coffee production and one of the ways to improve coffee production is by using ICT innovations to curb some of these challenges. Information Communication Technologies (ICT) are defined as any application, device, or tool that enables the visualization, exchange, and collection of data through transmission or interaction. The use of ICT in agriculture involves the design, conceptualization, development, application, and evaluation of different innovative ways of using ICTs, with a primary focus on agriculture. The introduction of ICT into the agricultural sector has brought in a new modern paradigm that facilitates and improves the agricultural production. The ICT has rendered number of services that have boosted agricultural production over year—services such as online market access, online weather information systems, diseases and pests control systems, farm management systems, and many others. There is no doubt that ICT has demonstrated incredible potential of improving agriculture productivity in developing countries through innovations specifically that use ICT [10].

However, while ICT would help address most of the challenges faced by the coffee farmers in Bugisu region, there is a need to assess the farmer's readiness to adopt the use of ICT and also examine the necessary challenges that may hamper its adoption. This chapter explores the necessary factors for successful adoption of ICT among coffee farmers in Bugisu. In order to guide the study, technology–organization–environment (TOE) framework was used.

1.1 Technology–Organization–Environment (TOE) Framework

The process of adopting new innovations has been studied for over 30 years, and as a result, a number of technology adoption theories have been proposed. One of the most popular models adopted by many researchers is the technology–organization–environment (TOE) framework. This framework was first developed by Tornatzky

and Fleischer in 1990 [11]. The Technology-Organization-Environment (TOE) framework is a theoretical framework that explains how the use of a new technology is influenced by a number of factors. The TOE has proven over years to be a valuable tool for understanding the complex interplay between technology, organization, and environment.

- The technology in the TOE refers to the characteristics of the new technology that is being introduced. It considers aspects such as the functionality of the technology, how complex it is, how compatible the technology is with the legacy systems, and how user friendly the technology is.
- Organization, on the other hand, refers to the internal context in which the technology is used. It considers aspects such as the organization's size, managerial structure, the culture of the organisation, and resources.
- The environment considers the external context in which the organization operates, including factors such as market conditions, regulatory requirements, and social and cultural norms.

One of the reasons why the TOE framework was chosen was that it provides a holistic perspective on technology adoption and implementation. Rather than focusing solely on the technology itself or the organizational context, the framework recognizes that both internal and external factors are important in shaping technology adoption and use. This allows researchers to take a more nuanced approach to studying technology adoption, and it helps organizations to better understand the complex interplay of factors that influence their technology decisions (Fig. 1).

Using the TOE framework, the study identified the following three major objectives that were investigated.

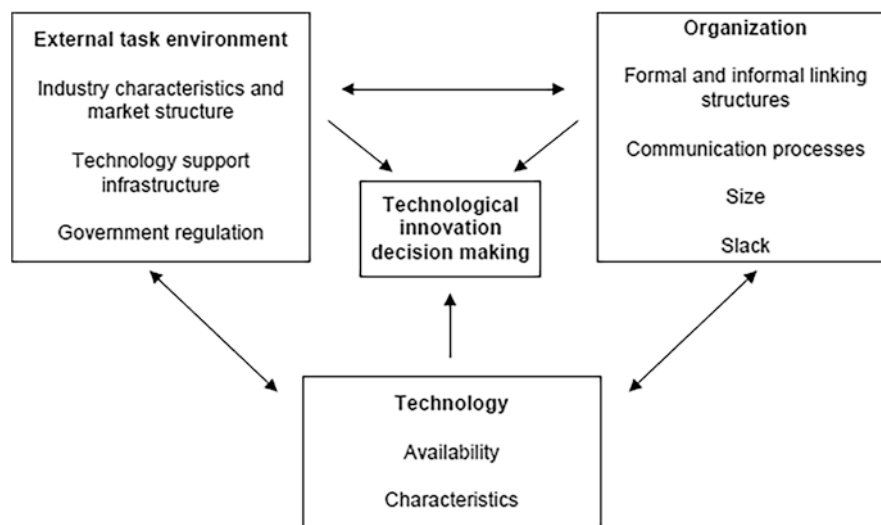


Fig. 1 Technology, organization, and environment framework [11]

2 Objectives

1. To assess the challenges associated with the adoption of ICT among coffee farmers in Bugisu sub region.
2. To establish the technology, organization, and environment factors that facilitate the successful adoption of ICT among coffee farmers in Bugisu subregion in Bugisu.
3. To develop TOE framework for successful adoption of ICT among coffee farmers in Bugisu subregion in Bugisu.

3 Methodology

Qualitative research was used since this study addresses the “what,” “how,” and “why” research questions and enables deeper understanding of experiences, phenomena, and context. Bugisu subregion, specifically Mbale and Sironko, was the study area where the sample selection was done from different coffee unions, extension workers, and the coffee farmers within the community. Purposive sampling technique was used to select the respondents. A total of 23 participants participated in the study. Interview and Focus group discussions were used data collection tools in the study with believe that the instruments will complement each other to enable validation of findings of this research. 3 Focus group discussions of 4 coffee farmers were convened and 11 participants’ were interviewed including 3 ICT leaders, 6 Union leaders and 2 district extension workers. The study used content analysis to determine the presence of certain words, themes, or concepts from the field data. These themes were later presented in the form of frequency tables and graphs for ease of presentation and discussion. The summary of the method used in the study is presented in Fig. 2.

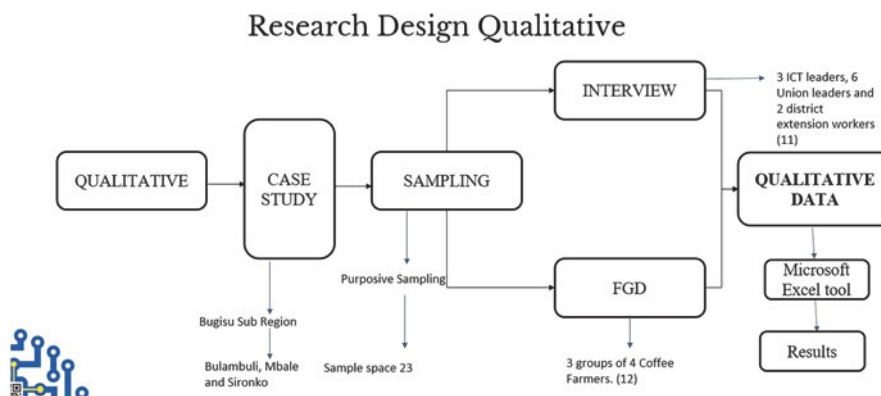


Fig. 2 The summary of the methodology

4 Presentation of the Findings and Discussions

This section presents the results and discussions concurrently. Different data collection instruments were used in the research because the researcher believed that the instruments would complement each other to enable validation of findings of this research. The instruments used were focus groups and interviews. About 23 participants were involved in both interviews (11 participants) and focus groups (12 participants). The purpose of the study was majorly to assess the challenges limiting the adoption of ICT by coffee farmers in Bugisu subregion and to define the necessary factors for increasing the adoption of ICT by coffee farmers. This section is organized as follows; demographic of respondents, ICT investments, challenges limiting the use of ICT by farmers, necessary factors for the increased adoption of ICT by coffee farmers. This chapter then presents a DOI model for adopting ICT among farmers in Bugisu region.

4.1 Types of Coffee Processed by the Unions (Table 1)

Table 1 Types of coffee processed by the unions

Coffee source	Type of coffee processed
Namatyo Falls	Honey
Budwale	Washed
Wanale	Honey and washed
Bukhanakwa	Washed and natural
Bududa	Natural
Sipi Falls	Washed and natural

4.2 Respondents

In total, 12 coffee farmers, 6 coffee union leaders, 3 ICT officers from the union head offices, and 2 extension workers participated in this study. Both focus groups and interview methods were utilized for gathering data from the respondents as seen in Table 2.

4.3 Demographic Profile

The respondents' demographic details are presented in this section. All the respondents were requested to share details of their age range, educational level, land ownership type, and their, which comprised the key characteristics of the study population.

4.3.1 Responses by Age

The age ranges of the correspondents are shown in Table 3. As shown in Table 3, three correspondents were between the age group of 20 and 30 years, eight respondents between 31 and 40 years, nine respondents between 41 and 50 years, two respondents between 51 and 60 years, and one respondent was above 60 years.

Table 2 Respondents

Respondents	No. of respondents	Tool utilized
Coffee farmers	12	Focus group discussions
Union leaders	6	Interview
ICT officers	3	Interview
Extension workers	2	Interview
Total	23	

Table 3 Age of the respondents

Age	Number of respondents
20–30 years	3
31–40 years	8
41–50 years	9
51–60 years	2
Above 60 years	1
Total	23

Table 4 Level of education

Correspondent	Educational level			
	Primary	Secondary	College	Degree
Coffee farmers	7	3	2	
Union leaders			2	4
ICT officers				3
Extension workers				2
Total	7	3	4	9

4.3.2 Level of Education

Table 4 shows the level of education of the respondents. There were no registered masters and PhD holders. Degree holders were the highest to participate in this study with a total of 9 respondents, followed by 7 farmers whose level of education was primary education, 3 having secondary education, and 4 having college education.

4.4 Type of ICT Investments

During the focus group discussions and interviews, the farmers, extension workers, union leaders, and ICT officers were asked to indicate on the ICT type they own and its frequency of use. The results are presented in Table 6 and Fig. 1. Figure 1 shows that mobile phone is the most widely used ICT devices in the area with 83% usage. This result suggests that this device is the most reliable sources of innovation and any information about coffee. Similarly, 30%, 17%, 17% and 17% indicates that internet, Market information system, printers and computers respectively are also readily available for use, which as well shows that they are not readily available but, still serve as a medium of getting relevant coffee information. This could be attributed to the high cost of purchasing a computer and printers, which are relatively expensive. Also, the high cost of internet subscription or poor network coverage may prohibit the respondents from using the available market information system. TDRS (soil moisture tester), GPS, and external storage devices with 13%, 9% and 9%, respectively, are also not readily available and not much used. The results of the interviews and focus group discussions show that only coffee unions use these devices.

Least percentages of 4% and 4%, respectively, were observed for regulatory system and television, which confirms that they are the least available ICT devices through which smallholders' source relevant agricultural information in the study area. In summary, the results revealed that phone is the most readily available ICT device for the respondents in the area (Fig. 3).

During a face-to-face interview, one union leader stated, "*These featured type of phones are the most owned and used phones by our farmers to make calls and*

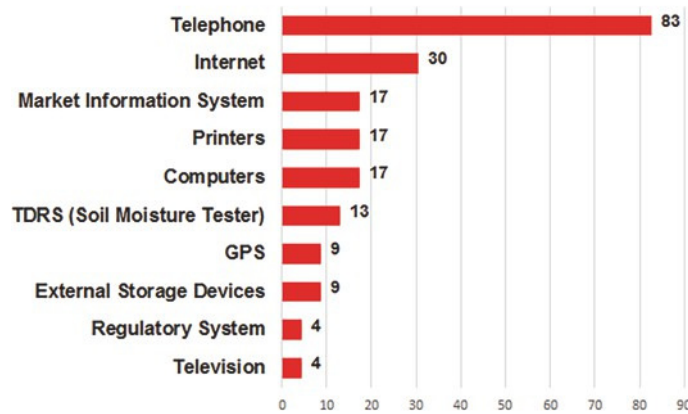


Fig. 3 ICT type ownership

receive any messages. We usually share knowledge and any kind of awareness through SMS with them.”

4.5 Factors Limiting the Use of ICT by Coffee Farmers

The respondents were also asked to rate the possible factors limiting the use of ICT by farmers (Fig. 4).

Figure 4 clearly shows the factors that limit ICT usage by coffee farmers and are discussed below.

Lack of Electricity

It was realized that 100% of the respondents stated lack of electricity to be a major limiting factor for adopting ICT. The farmers who could access electricity reported that they face a big challenge of load shedding. The costs of electricity are also too high, which limits the usage of ICT devices as they need power. During one of the focus group discussions, one farmer stated, “*Electricity bills these days are too high to be afforded. If government could probably provide free power, then that would enable us to use those gadgets such as the smart phones.*” It is well asserted and concurred by [12] that the likelihood of a decrease in use of ICT tools by farmers by 0.9 by a 1% increase in electricity outage. The state of dependence of smallholder farmers on solar systems and batteries restricts them from watching TV or using their phones any time during the day. A good percentage of farmers are normally reluctant to use ICTs due to constant electricity outages.

Lack of ICT Infrastructure

Figure 4 also shows that there was 100% lack of ICT infrastructure. One of the ICT officers at Zukuka bora coffee union said, “*I think ICT is not much in use because of the network challenges. You find that transactions are not completed in the*

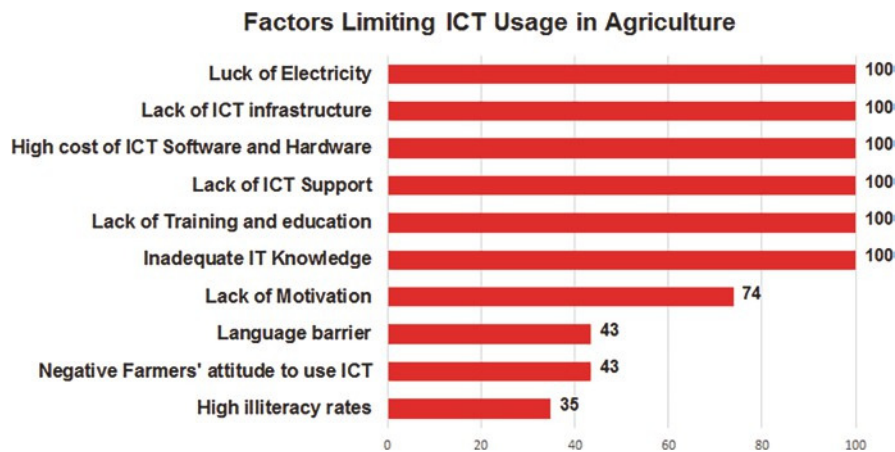


Fig. 4 Factors limiting ICT usage by coffee farmers

expected time frame. For example, sometimes it's so disappointing when I try communicating to some coffee buyers who are out of Uganda, my messages are sometimes seen after a day just because of weak network coverage. So as a result, we as a union sometimes miss out these buyers." One extension worker during the interview stated, *"Most of our farmers don't use electricity because it's expensive for them and us as extension workers, are faced with poor network coverage especially when we are in the field. This means that the farmers too have network challenge."* In most African countries, as concurred and asserted by [13], infrastructure development is still in its young stages. This is, however, common in most rural areas. Most African rural communities are characterized by poor network connectivity, poor road network, and no access to electricity. The absence of these technological infrastructures poses a barrier to ICT adoption as most of the farming population live in rural communities.

High Cost of ICT Software and Hardware

Figure 4 further shows that 100% of the respondents cited high cost of ICT software and hardware as a major limiting factor for the adoption of ICT. During the study, one of the ICT officers stated during a face-to-face interview, *"This hardware you see here are expensive for a low-income earner to purchase. These things require government to support with the purchase since at least am sure there is a budget for it as compared as here in these unions."*

It was realized by [14] that high cost of ICT service includes a barrier to its use on agricultural input information. For example, the cost of mobile services and mobile handsets excluded many poor rural farmers from accessing TigoKilimo in Tanzania. In Mali, 95% of SENEKELA users find that the cost is prohibitive. Yet, the cost was a barrier to the uptake of ICTs on agricultural input by farmers in Tanzania. [14] then concluded that the cost is a barrier to the use of ICTs on agricultural input information by farmers in developing countries. Similarly, the main

limiting factors of ICT adoption are the cost of technology and availability of software as reported by [15].

Lack of ICT Support

Figure 4 further shows that 100% of the respondents received no support from ICT. During one of the FGDs, one of the farmers stated that *“for us here we have not been introduced to ICT. We would wish to best understand what this is and what it does in our coffee.”* In one of the interview sessions, one of the ICT officers also commented, *“The ICT devices are too expensive and surely if government and unions could team up to procure some of these devices then the adoption would be at a high rate.”*

The financial levels of the farmers are not sufficient enough to enable them to purchase the gadgets to be used, such as smart phones and internet. One of the district extension workers stated that *“one thing that I noticed is that our farmers’ income cannot sustain them at the same time enable them to purchase ICT equipment such as GPS and remote sensors.”* The extension worker continued and suggested, *“Government should come in and support with financing to procure these devices.”* Another extension worker officer said that *“equipment such as Printers, Servers and computers are costly to maintain when it comes to repair.”* On interviewing one extension worker, he said that *“government has done very little to bring technology to our farmers. Even the taxes attached to subscription of data to access the internet has scared many from engaging with technology.”*

This is concurred by [12] that lack of financial support to farmers results in many farmers not using ICTs to improve their farm productivity. In addition, a large percentage of farmers in developing countries can’t afford the cost of paying for extension advisory services rendered by ICT innovators and servicing mobile phones because of their low standard of living [13].

Inadequate IT Knowledge and Lack of Training and Education

According to Fig. 4, 100% of the respondents had either inadequate IT knowledge or had never undergone any form of ICT training or education. One farmer during the focus group discussion hinted that *“I can’t even operate this smart phone. With only this problem, am sure when a law is passed out that ICT is a must in our coffee business, then I might require some serious training.”* Most farmers during the focus discussion groups stated that using ICT in agriculture is completely a new concept that they had never thought of adopting. One farmer continued, *“Am actually just hearing for the first time from you that it’s possible to look for coffee market using my smart phone.”*

One identified important aspect in the studies is the illiteracy rate among farmers. According to a study by [13], the rates of illiteracy are normally very high among smallholder rural farmers, which affects their ability to effectively manage and understand the use of ICT tools [13]. There is need to have a diverse range of agricultural skills by making more investment in life-long learning, education, and skills development [16]. Higher education and advanced skills in this knowledge revolution play a complementary role in technological advances. Without sufficient education and trained workforce, new technologies cannot be adopted in

agricultural production. The smallholder farmers should be equipped with the necessary skills and knowledge for them to be able to impart the acquired knowledge and skills to the masses especially if it involves the less educated in the rural areas.

Lack of Motivation

From the findings as shown in Fig. 4, lack of motivation was also identified as a limiting factor, with 74% lacking motivation. These farmers attitude was negative and, as a result, they didn't know the importance of using ICT.

One farmer reported, *"I have never been exposed to these things because in my area, I rarely see this technology you are talking about, and I don't see any reason as to why I would use it because right now am able to grow my coffee and take to the coffee union without this technology."* On interviewing one of the extension workers, she clearly stated, *"the type of farmers we are dealing with are those primitive farmers who are never and easily persuaded to adopt and use ICT because they are more contented to their ways of operation. Most of them even can't use the electronic system that was introduced mainly to help them redeem their inputs, yet they received training."*

It has been stressed by [17] that frequent exposure to ICT and usage must be considered if someone wants to form a positive attitude toward ICT. When people frequently get exposed to ICT and use it, they will realize that ICT is helpful and beneficial to them, which creates a positive attitude toward ICT usage.

Language Barrier and High Illiteracy Rates

It is also revealed in Fig. 2 that 35% and 43% had a problem of language barrier and high illiteracy rates, which means that they would not be able to read and write. One of the farmers during the focus group discussions stated, *"honestly, I didn't go far with books. That's why you see me not using those big phones because it needs someone who knows English to read the things in it."* While at BCU, one farmer said that *"technology needs to be used by those people who went to school. In fact, I fear those things because I can't read or even write."* One of the extension workers noted, *"The farmers who have attained education are so few and most of these few are school dropouts who are half baked, causing a delay in the adoption of ICT usage."* To adopt ICT usage, reading and writing were required. According to [18], the farmers' lack of ICT knowledge limits them from using ICT frequently. The leading languages of the internet are generally not those used in the rural areas by the smallholder farmers rather English which requires a literate to use.

Farmer's Negative Attitude Toward ICT Usage

From the finding as shown in Fig. 5, 43% of the sampled respondents showed a negative attitude toward the employment of M-Agric. One said, *"honestly, am not in support of the use of the existing tech in Agriculture because one thing I know is that our sales are effected by Technology."* Similar to the finding of Dhaka (2010), a positive significant relationship was found between the level of education of farmers and their attitude on ICT-based farming. This may be due to the fact that education changes the human behavior, and using different ICT tools is difficult for illiterate people. Finally, a significant positive relationship was found between farmers'

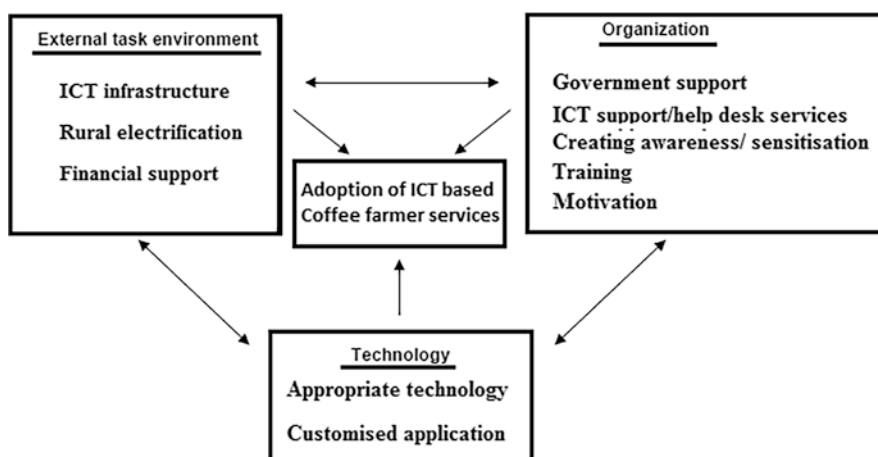


Fig. 5 A TOE framework for successful adoption of ICT among coffee farmers in Bugisu sub-region in Bugisu

knowledge on ICT and their attitude on ICT-based farming. Ajayi (2013) also found the same result in his study. This is to say that farmers attitude on ICT-based farming is most likely to be positive if their level of knowledge is found satisfactory and relevant to their need.

4.6 Factors for Increasing the Adoption of ICT by Coffee Farmers and Extension

Training Farmers on How to Use ICT

One of the most identified challenges in adopting ICT was lack of skills among the farmers. Farmers need to be trained and be followed up with different refresher trainings specifically on how to use ICT.

One farmer during the focus group discussion said, “*We would have tried using this ICT that you are talking about but the only problem we have is that we even don’t know how to operate it.*”

One farmer further asked, “*How soon could the education program for the elderly be introduced in our villages to equip us with the skills of using ICT without any fear?*”

There is need for the government to demystify ICT training at all levels of education to improve local content development. In the current scenario of a rapidly changing world and agriculture extension, has been recognized as an essential mechanism for delivering advice and information or knowledge as an input for modern farming [19]

Sensitizing Coffee Farmers About the Importance of Using ICT

This sensitization is needed not only for bringing up awareness but also for creating a trust for using ICT among the farmers and different coffee unions and between the farmers and the extension workers.

One of the farmers stated, *“I really don’t see the reason of me using ICT because first, I am able to bring my coffee here at the union and even receive my payments. To me, it’s risky to use ICT because am not sure where my details will be taken and who will use it.”* Government should popularize technological changes to the coffee farmers, coffee unions, and the extension workers such that all parties are moving at the same pace of adoption.

Agriculture is an information-intensive industry which generally draws upon infinite sources of a wide considerable body of research materials and locally contextualized knowledge. It relies upon continuous flow of information from world, local, and regional markets [20]. To optimize production, coffee farmers need information. Different kinds of information are being made available to those interested, particularly on how to start farming, what to do when one is at a cross road, and management of coffee farming.

Government Support

On interviewing a union leader, she proposed that government together with the existing coffee unions should come up with a proper strategy of ICT adoption. The extension worker suggests that government should be top of the game by accelerating ICT usage through refresher trainings and follow-ups. One of the extension workers noted, *“we have been having an electronic reporting system which was actively used for 3 months and later most people stopped reporting through the system. After the first training we had, no follow-ups were made. I for one would suggest that our government should be on top of the game by accelerating ICT usage through refresher trainings and follow-ups to be sure that the system is used as expected.”*

A study conducted in Malaysia by [21] established that supposed benefits of ICT and conducive government policies positively influence decisions on adoption and use of ICT. Lack of stakeholders’ support such as support from government as a key stakeholder to usage and adoption of ICT will lead to inadequate planning. Stakeholders’ support plays a crucial role in accelerating usage and adoption of ICT. This relates to what [22] found out in his study that customers and sellers of the firm exert pressure on it to use ICT in its transactions with them; that in my study, the Stakeholders’ support motivates farmers towards adoption and usage of ICT and vital in creating awareness and need for training program, focused on adoption and usage of ICT.

Financial Support for Farmers

“Some of us do not have that capital to finance all of our coffee project activities until harvest time arrives. One of our main sources of capital is the yield of last year’s harvest,” one of the farmers during the focus group discussion stated.

On interviewing one union leader, he stated, *“In most cases to earn cash, our farmers have to sell the crops as soon as possible. So often the coffee must be sold*

at a low price.” Furthermore, enough money is not earned by farmers for increasing either the amount of agriculture production or household consumption [23]. Government together with banks facilitates farmers in producing various agricultural products in order to maintain national food security. Banks should be encouraged by the government to provide special financing products for agricultural entrepreneurs and farmers. It has been proven that lending to farmers can increase farmers’ living standards and income [23].

Improvement and Maintenance of the Existing Infrastructure

One of the ICT officers when interviewed said, “*According to me, I think improving on the adoption of ICT calls for development and maintenance of infrastructures that will support network communication system.*” Farmers during the focus group discussions suggested that electricity has to be accessible and affordable for them. This is because the ICT devices use electricity and therefore government should play an upper hand in this. Government should think of providing free internet for the farmers. An example was given by a union leader that *Soroti market was given free internet by their Member of Parliament.* From this fact, he suggested that government is in capacity of providing free internet to the coffee farmers.

Among the modern modes of ICT, mobile telephony has been the most widely and recently accepted mode of delivering information not only in India but also in other African and south Asian countries. Increasing mobile phone-based services enhances the availability of information and knowledge and will further help in improving education, better health and efficiency, awareness, better adoption of technology, better market efficiency, reduced transaction costs, etc. The economic growth and development of the rural sector will in turn be catalyzed. It was emphasized by [24] that ICT has great potential and should be offered the same importance as biotechnology revolution.

4.7 TOE Framework for Successful Adoption of ICT Among Coffee Farmers in Bugisu Subregion in Bugisu

Technological Factors

As stated earlier, technology refers to the characteristics of the technology itself, including the appropriate type of technology, its functionality, complexity, compatibility with existing systems, and ease of use. The following forms of technology would greatly facilitate the activities of the coffee union and coffee farmers in Bugisu subregion:

- *Appropriate technology.* This is the introduction of efficient and effective technology that can best be used by the farmers and unions to facilitate their day to day coffee farming activities such as market information system, GPS technology, mobile phone-based farmer applications, and TDRS (soil moisture tester).

- *Customised application.* Most illiterate group of farmers would easily embrace and use technology if only the available systems had features that would be enabled to translate in the local languages.

Organisational Factors

Organization refers to the internal context in which the technology is used, including factors such as the organization's size, organizational structure, support, culture, and resources, etc.

- *Government support.* There is a need for government to extent ICT-based services to the rural coffee farmer and provide all the necessary support needed for a successful adoption and use of ICT base services.
- *ICT support/help desk services.* This helps the farmers to call whenever they encounter a challenge with any of the technologies provided.
- *Sensitisation and creating awareness.* Technology is not well embraced by some cultures who believe that their property would indirectly be grabbed as a result of using it. Different communities need to be educated about the advantages of using technology. Transforming the mindset of farmers one at a time in preparation for the introduction of ICT to them is really needed.
- *Training farmers, extension workers, and cooperative leaders.* Basic skills especially on how to navigate different ICT devices such as phones, tablets, and computers should be offered to both farmers and cooperative leaders. Also they should be trained on how to use the available coffee farming applications.
- *Motivation to use ICTs.* This is a form of lowering the prices of ICT devices to enable farmers buy them. Also provide free internet for applications used by farmers. Cooperative unions should motivate farmers by gifting those who consistently use ICT to access different services such as loan requests, communication, and awareness.

Environmental Factors

Environment refers to the external context in which the organization operates, including factors such as market conditions, technology support infrastructure, regulatory requirements, and social and cultural norms.

- *Provision of the necessary ICT infrastructure.* There is a need to provide or improve on the necessary ICT infrastructure such as extending telephone masks to the rural areas.
- *Rural electrification.* Government needs to strategize to prioritize electrification of these areas that farmers come from. This will enable the low income earner access electricity that will enable them to charge their phones.
- *Financial support to farmers.* The cooperative unions can offer some credits to farmers purchase different ICTs and software.

5 Conclusion

Bugisu region in Eastern Uganda is the third most successful coffee-growing regions in Uganda after central and western regions. Bugisu region produces about 675,850 bags of Arabica coffee. However, while Bugisu region is the third most successful coffee-growing region in Uganda, coffee farmer face numerous challenges that have significantly reduced the production of coffee. Coffee farmers in the region are grappling with pests which destroy large parts of farms leading to about 50% loss. Therefore, there is a need to improve coffee production in the region, and one of the ways to improve coffee production is by using ICT innovations to curb some of these challenges. ICT provides services such as online market access, online weather information systems, diseases and pests control systems, farm management systems, and many others. ICT has demonstrated incredible potential for improving agriculture productivity in developing countries through innovations specifically that use ICT. However, while ICT would help address most of the challenges faced by the coffee farmers in Bugisu region, there is a need to provide a framework for ICT adoption. This chapter, therefore, presents a TOE framework for successful adoption of ICT among coffee farmers in Bugisu subregion in Bugisu.

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