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The Experience of Chamwino Small-Scale Farmers on the use of Smartphone in Farming Business, Tanzania

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Abstract. The pervasive use of smartphones to acquire diverse information among small-scale farmers has received little attention in studies. This study, therefore, explored the experience of Chamwino's small-scale farmers of the usage of smartphone to address ownership pattern, farming practices, information needs, encountered challenges and training needs for future technological alterations. The study employed qualitative design for data collection and thematic analysis was used. The findings revealed that the longer the distance from Dodoma city centre, the fewer the number of smartphones owners. That, less than half of farmers in Mvumi and Makangwa owned smartphones while, less than a quarter in Itiso, Mpwayungu, and Chilonwa Divisions. That youths owned more smartphones than elders, and mostly second-hand that were inadequately used for farming business. This was because, there was no special farming enabled information system to disseminate agricultural information. Accordingly, the frequently used features were SMS and voice calls. Consequently, farmers need information on inputs, weather, market and finance among others. Alternatively, there was no official training on the use of the device thus the new technology was therefore underutilized. Furthermore, challenges identified were farmers' lack of expertise of utilizing the device, uncomfortable large size and the interface of smartphones. Accordingly, farmers were interested in capacity building as many features were not used adequately. Consequently, the study provides deep understanding of farmers' experience and recommends for technological alteration to increase usability of the device.

Keywords: Farmers, experience, information

1 Introduction

Smartphones with a touch screen interface empowered by Global System of Mobile Communication (GSM) protocol are ubiquitous. The adoption and usage of smartphones are prevalent globally, and the majority 63% of the owners uses it at least every thirty minutes in matters such as making voice call, checking time, and accessing the internet [1]. The internet world statistics report that the number of mobile phone subscribers has reached 6.8 billion, which is closer to the world total population of approximately 7.1 billion [2]. The report shows that more than 3.6 billion people, who are nearly half of the humanity globally, are using messaging application in Latin America, the Middle East, and Africa. In Africa, 191 million people use social media and messaging apps, and 90% of these use WhatsApp and Facebook applications which are common worldwide [3]. The internet users in Tanzania who access the worldwide web increased approximately from 18 million in

2016 to 19 million in 2017. Internet penetration increased from 40% in 2016 to 45% in 2017 with more than 40.08 million mobile phone subscribers [4]. Thus, the use of mobile phone particularly smartphone is a promising move towards the creation of a superhighway community. Thus, understanding the portion of the subscriber's experience particularly the small-scale farmers who use smartphone is vital for future technological improvement and innovations.

Small-scale farmers are characterized by family labour and own less than ten hectares of land for cultivation [5]. The Small-scale farmers are referred to farmers throughout this article. These farmers use smartphone to acquire knowledge and skills that support farming decision-making [6]. For example, Karetsos et al. [7] observe that the USA farmers use smartphone as a supplementary working tool to look for information on weather, news, and market that helps in making decisions on their work schedules. Farmers use smartphone sensors such as camera and GPS to explore agricultural related information. A camera is used to take pictures, send and store them on the server or cloud for future reference or inspection whereby, feedback can be displayed and used by respective farmers. The GPS is used for location-aware application to receive essential environmental information for agriculture such as pests, diseases, weather, soil type, texture, quality, and so on, radiation, location of field and farmers [8]. The smartphone is used to collect and disseminate marketing information (product, price, place and promotion), keep information, and balance the supply and demand for commodities [9]. Smartphone help to estimate harvest and forest fuel [10, 11], provide information as a self-reporting on fish catch rates including common snook, spotted seatrout, and red drum [12]. Therefore, with these multiple functions, a smartphone provides a farmer with a resourceful platform that assists in daily decision-making.

Chamwino farmers have not been left behindhand the advancing smartphone technologies that frequently override other digital technologies in the globe. The Chamwino farmers also use smartphones in various farming related activities to access information that add knowledge and skills. Thus, understanding farmers' experience on the use of smartphone to access or acquire information is important. This information is instrumental in making future alteration of the technology to make it consistent with farmers' expectations. Furthermore, increased popularity of smartphone has therefore inspired researchers into exploring the application of the technology in farming business [6, 7, 8]. Several studies on smartphone have been carried out on matters such as awareness [10], assessment of the use of sensor [8], potential evaluation and estimation [10, 11], and on the performance of marketing activities [9]. Thus, smartphone usage has become an integral part of farmers' livelihood for communication.

Unfortunately, few studies have been conducted to understand the experience of farmers who use smartphone to acquire farming information. The study, therefore, sought to investigate the experience of Chamwino farmers that use smartphone to access information to support decision-making. In addition, the study also proposes areas for further improvements. In future, this would be a milestone of improving future mobile technologies and innovations in agricultural domain, and in helping policy practitioners to deal with the existing gaps. Subsequently, other studies can

compare the experience of Chamwino farmers and other areas for technological enhancement.

The study explored the experience of farmers who use the smartphone as a supplementary tool to assist in farming decision-making. The experience focused on ownership level, farming related practices, information needs, challenges, and training needs on the application of smartphone. The idea is to let farmers voice their needs of improving the smartphone quality so that appropriate model can be developed. Thus, farmers who are equipped with diverse knowledge and skills ought to exhibit heuristic character in addressing challenges. To achieve this, the formulated research questions were; 1) *What is the ownership level of smartphones among the Chamwino farming community?* 2) *What have been the farming practices and farmers needs when using the smartphones?* 3) *What challenges do farmers face when using smartphones?* 4) *What type of training do farmers need to help them make better use of smartphone?*

2 Conceptual Framework

The conceptual framework focuses on understanding farmers' experiences of utilizing Apps in Smartphone to acquire farming information. Farming information is obtained from farmers themselves, relatives, friends, neighbors and other stakeholders in the farming business. Likewise, farming information is accessed through agricultural enabled information systems such as e-Wallet [23], and the like that disseminates skills and knowledge to assist farmers in decision-making. Thus, stakeholders in the framework include;

- Farmers through Apps communicate with farming stakeholders to acquire information that add skills and knowledge to support farming decisions.
- The relatives, friends, experts, or farmers are a group of stakeholders that are believed to have farming skills and knowledge which are used by farmers to make decisions.
- The agriculture enabled information system is specific software which was developed to disseminate farming information to farmers through Apps. Thereby, it disseminates timely, clear, accessible and transparent farming information to farmers that support decision-making.

The framework is shown (see Fig. 1) as farmers use Apps in smartphone to seek information from stakeholders and from, agricultural enabled information system. Therefore, farmers need to own smartphones to acquire information for farming purposes, and therefore, are expected to reveal farming practice, their needs, encountered challenges, and ultimately to identify the training needs for better utilization of the tool.

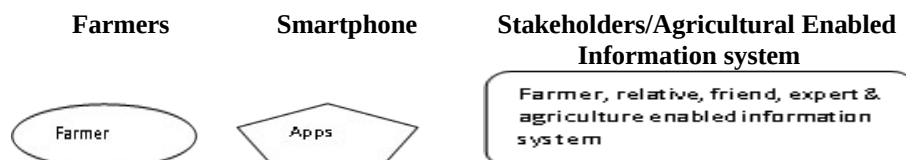


Fig. 1. Framework for understanding farmers experience on smartphone usage

3 Methodology

3.1 Research Design

This study employed qualitative approach because of the characteristics of the farmers in Chamwino [13, 14]. Qualitative data collection and analysis aimed at providing in-depth socio-context and detailed description and interpretations [15]. The approach enabled extensive expression from farmers, and which was healthier in collecting relevant information and the freedom of sharing experience. The data collection was preceded by a survey instrument which was developed and distributed to ten academic members of staff at the College of Business Education to check for relevancy of the questions. Thereafter, all the grey areas, which were raised regarding comprehension, clarity, and relevancy, were addressed before administering the questions to the target population.

An interview guide comprised of open-ended questions and focused on themes such as ownership level, farming practices and needs, challenges, and training needs on the smartphone usage in routine activities (see Table 1). The pilot study for further improvement was undertaken at Mgodole-Mkange village Chalinze District, in the Coastal region. Thereafter, the adjustments were made to questions but retaining their original meaning to make them easily understood by farmers.

Table 1. The interview questions on related themes and their relevance to the survey

Theme	Relevancy
What is the ownership level of smartphones among Chamwino farming community?	Understand the ownership pattern of smartphone in rural settings
What have been the farming practices and farmers needs when using the smartphones?	The farmers use of applications in smartphone for farming related business and their current information needs.
What challenges do farmers face when using smartphone?	To identify the obstacles which farmers face when using smartphone as a supporting tool to acquire information to support decision-making.
What type of training do farmers need to help them make a better use of smartphone?	To understand farmers' motivation of using smartphone and areas which need training.

3.2 Study Area

Chamwino is one of the seven districts in Dodoma region with approximately a total population of 340,000. The District is dominated by Gogo followed by other small ethnic groups such as the Barbaigs, the Maasai, the Mbuwi, the Rangi, the Sandawe and the Nguu. Chamwino comprises five divisions namely; *Itiso, Makangwa, Mvumi, Chilonwa and Mpwayungu*. The main economic activities include crop farming, livestock keeping, beekeeping, and seasonal petty businesses [5, 13]. Chamwino was chosen because it is one of the districts affected with food insecurity [5].

3.3 Selection of the Participants

A non-probabilistic convenience sampling which involved the population that was enthusiastic in the study was employed. Convenience sampling was chosen because the targeted population met certain practical criteria such as being easily accessible, geographical proximity and availability [16, 17]. The selection was conducted through Village Chairman and Ward Executive Officer. The inclusion criteria involved being a farmer for at least three years, should have participated in any of the community development projects, ability to use mobile phone for communication, and being the head of a household (see Table 2).

Table 2: Selected Participants by division, village and gender

Division	Village	Participants by gender		Total participants
		Female	Male	
Mvumi	Muongano	2	3	5
	Mvumi Ilolo	1	2	3
Mpwayungu	Chiberela	3	1	4
	Isang'ha	1	1	2
Makangwa	Mlowa barabarani	2	1	3
	Mlowa bwawani	1	2	3
Chilonwa	Nzasa	2	1	3
	Membe	1	2	3
Itiso	Haneti	3	1	4
	Itiso	1	2	3
Total		17	16	33

Source. Field report

3.4 Data Collection Method

An in-depth interview, which lasted for between 50 and 70 minutes was administered in Swahili language from 08th June to 23rd July 2018. Simultaneously, the researcher took notes and audio-recorded the conversations after getting the consent from the respondents. However, the data saturation was reached at 24th respondent, after which additional interviews did not add any new information. The concept of saturation level has been used in previous qualitative studies [18, 19].

3.5 Data Analysis

The qualitative thematic analysis was presented systematically in a table format following the pattern reflected in the research questions. Data from audio-recording were transcribed into units that were categorized into themes [20]. Thematic analysis offered a stretchy and useful tool of presenting important detailed information as suggested by Braun and Clarke, [21]. Also, as suggested by Creswell [22], thematic analysis involves organizing and preparing the data, doing the initial reading of the information, coding the data, making descriptions from the codes, doing thematic analysis, presenting the finding in tables, and interpreting the findings.

4 The Study Findings

The findings are presented based on the analysis performed and the quotes were translated from Swahili to English language.

4.1 Ownership of Smartphones

Smartphones were commonly known as “*Touch*” or “*Simu ya kupaata*” (that means a slippery mobile phone). That, less than half of the respondents in Mvumi and Makangwa Divisions owned smartphones. While less than a quarter in Itiso, Mpwayungu, and Chilonwa owned smartphone. Furthermore, the commonly owned smartphones were TECNO, Itel and Samsung models. However, more than three quarter of the smartphone owned were second-hand, meaning that they had already been extensively used by people other than the current owner. Accordingly, there were limited chances of sharing the smartphones among farmers for use on transactions such as money transfer. Ownership of smartphones was more pronounced among the youth aged between 23 to 45 years than old people of 50 years and above.

4.2 Farming Practice and Farmers’ Needs

Participants used smartphones to communicate with relatives, friends, businessmen and women, consultants (public and private) in areas of farming related business, social and political purposes. The farming related information focused on transportation, pesticides, input, finance, market; Social inquiries focused on family matters, while political inquiries were based on vote seeking during the election. Mode of communications was dominated by SMS and voice calls. In addition, a limited number of youths in Mvumi and Makangwa used smartphone for chatting on Facebook, WhatsApp, in-built camera, games and the internet. Few farmers were using smartphones for checking date, checking time and for doing simple arithmetic using in built calculator. Furthermore, farmers needed to get more information on inputs, weather, finance, transport, market, health, and agricultural research reports.

4.3 Challenges Encountered when using Smartphone

The encountered obstacles include; lack of expertise of operating the device, bulkiness of smartphones, weak networks in Mpwayungu, Itiso and a few areas in Chilonwa as opposed to Mvumi and Makangwa divisions which paired with other studies [23, 24]. Furthermore, the prices of smartphones are too high for many farmers; the existing unfriendly interface disturbs and limits the users. The crowded and the existing unused features in the interface such as; Boomplay, Theme, video player, service, palmstore, micro intelligent, Aha, Asphalt nitro, carlcare, Phone master, assistant, google go cause inconvenience to farmers. Finally, the use of unfamiliar language is a demotivating particularly to the elderly farmers.

4.4 The Training Needs on the use of Smartphone

Most of the old aged farmers have difficulties of utilizing the smartphone features. Receiving a call was a challenge to old aged farmers and whose fingers were not as agile as those of the younger users. Difficulties in writing and sending messages as the letters are too close to each other on the screen leading to several typographical errors. The participants were able to use voice mail and a clock to check time with ease relative to other features. The respondents had limited use of some of the available features such as SMS, calculator, Bluetooth, camera, and radio. Other features were not used such as; Boomplay, Theme, video player, service, palmstore, micro intelligent, Aha, Asphalt nitro, carlcare, Phone master, assistant and google go. Due to these difficulties, participants expressed interest of attending training on the use of the available applications in smartphones together with those that support crop farming business if available but were reluctant to pay for training charges.

5 Limitation

The study is a qualitative that provides an insight on what is unknown about farmers' experiences in using smartphones to acquire knowledge and skills. Farmers' experience in smartphones usage is wide and therefore, more research in this area is required for future technological alterations.

6 Discussion

6.1 What is the ownership level of smartphones among the Chamwino farming community? Ownership of smartphone was diverse across the divisions depending on the proximity to Dodoma central business district. Divisions such as Mvumi and Makangwa closer to city centre had higher ownership of smartphones relative to Itiso, Mpwayungu and Chilonwa because of being located farther away from Dodoma central business. The difference in ownership was attributed by frequency of business transactions between the divisions and the Dodoma city centre. For example, many farmers in Mvumi and Makangwa owned smartphones because of their engagement in such businesses as hides and skin, cereal crops, grapes, and cattle. In addition, Mvumi had a referral hospital and a daily open-market that attract people from various places.

The respondents believed that ownership of a smartphone was associated with status and prestige. Thus, these perceptions encouraged the farmers to own smartphones and the mostly owned were TECNO, ITEL and Samsung models; implying that these devices are in abundant supply. Most of the smartphones owned were second-hand which were often obtained as gifts or presents from relatives or friends. Other farmers buy own smartphones from the shops that sell used items or from friends. However, most of the second-hand smartphones thus acquired had some defects such as a broken touch screen, short battery lifespan, and faulty buttons.

Furthermore, sharing of smartphones was uncommon for fear of damaging the device or lack of skills to operate the devices. The non-sharing was confirmed through experimenting money transfer (M-Pesa, Tigo-pesa and Airtel money) whereby, each participant's name was automatically matched with the names in the researcher's registration list of attendance. The sharing was limited in cases of unanticipated circumstances such as death, injuries, or when someone runs out of airtime while in an emergency. As participants noted "*no one should use another person's smartphones for whatever reason because, if it is destroyed, it costs a lot of money to repair, in addition to transport costs to Dodoma city centre*". Besides, there were more young people owning smartphones aged between 23 to 45 years than was the case with the elderly people This is because, the elderly was not as mobile as the young who travel to various places on business transactions and engaging in temporary employment such as security guards. The elderly believed that smartphones are meant for the young, because the phones have slippery interface with several unfamiliar applications.

This finding is in contrast with the results reported in a study by Karetso et al. [7] who revealed that smartphones have penetrated in almost all the environments where people carry out their everyday activities. However, the findings of the current study paired with a study by Sarraf et al. [25], who reveal that not all Americans have equal access to smartphones and that ownership is stratified according to income levels.

Thus, smartphone ownership needs an in-depth study to establish a true status of proprietorship.

6.2 What are the farming practices and farmers' needs when using the smartphones?

The farmers were using the smartphone for farming related business, particularly in seeking for information on transportation, pesticides, inputs, weather, finance, and markets in normal communication system. Transport related information includes availability of trucks, fair charges, mileage charge on transportation of goods, and these are done through contacting a relative or a friend. A smartphone is used to inquire from a relative or a friend to seek for assistance, provide or receive suggestion on any pesticides to use for controlling pests or insects damaging a crop. Furthermore, smartphone is used to inquire various farming inputs (i.e. better seeds, hoe, axe, among others), to seek for clarification on weather forecast from relatives, friends and others whom they are related to, farmers also use smartphones to communicate to other people who are familiar with financial institutions to seek for clarification on loan or credit acquisition. Financial information which is required includes interest rates on borrowing and timeframe for repaying the loan, and market information includes daily market prices of commodities or the quantities demanded and supplied of specific goods and the ongoing auction market in different places. Thus, communication is carried out between the two related people who are located far apart and is presumed that the other is informed about the issues under the inquiry.

On the other hand, the use of smartphones for social inquiries on family matters was highest and low on political inquiries that happens in a cycle of four- or five-years during the elections. The frequently used features are sending and receiving messages, and voice mails. Few youths use Facebook, camera, WhatsApp and play games. The youths were hardly using the internet for farming activities and were unable to retrieve or store information in a smartphone. Thus, smartphone was underutilized because farmers had low skills and knowledge that limit them from utilising the device.

The Chamwino farmers' lack crop farming enabled information system that supports timely access to the required farming information. Smartphones developed to user's specifications that provide required information is more useful. For example, a smartphone with a sensor is used to detect and diagnose plant disease, calculate fertilizer amounts, study soil texture, estimate the water which is needed by the crops, study water supply and do readiness analysis of the crop [8]. In Bangladesh, farmers use smartphone to obtain latest market prices, negotiate with traders and build trust, access weather data, carry out market research, and coordinate freight transport [9]. Thus, farmers need information about weather, the amount of rainfall, degree of hotness and the like; information on the inputs such as, good seeds, the type of cattle-driven plough, the type of axes and hoe, fertilizer and the like. Differences in the needs make it necessary for the development of smartphone that suit specific groups with few commonly used features such as SMS and voice mail suitable to all the groups across the social and age divide.

6.3 What challenges do farmers face when using the smartphones?

Lack of expertise among farmers of operating the device was a more severe with the elderly than was the young farmers, which is supported in [14, 24, 26]. Receiving a call by swiping the receipt-icon in a wrong direction was a common among the

respondents. There was no prior training on the use of smartphone making it difficult for farmers to operate the device effectively. Smartphones are perceived by the elderly as designed for youths who have nimble fingers to operate slippery screen. Similar findings are reported in a study by Pongnumkul et al. [8]. As noted by elderly participants *“The white people are canny; they have brought a smartphone, when touched, it displays many complicated items that elderly people cannot appreciate and operate the tool”*. However, less than a quarter of the youths could operate ten features implying urgent need of training. Interestingly, the youths who had mastered some functionalities, volunteered to teach others that implied a need for training.

The respondents reported on bulkiness of smartphone as follows, *“Look at how large the size is, we cannot keep it in our trousers pockets when undertaking daily routines. It means if we hold the phone, we should stop doing other economic activities”*. Thus, farmers were uncomfortable with the different brands of smartphone due to large sizes that can be solved by supplying different sizes. Furthermore, weak network signals are the results of inadequate and poor infrastructure which are also cited in other studies [23, 24]. The network challenge is a phenomenon that cuts across most of the emerging economies as noted by Nwalieji, [24] and needs a joint solution.

The high smartphone price is associated with low income earned by farmers who are heavily dependent on selling farm produce as noted, *“We depend on selling our farm produce at low market price to earn income and buy various needs. The low-income is also reported by Sarraf et al. [25] in USA and Amadu et al. [27]. A smartphone costs at least Tanzania shillings (Tshs.) 200,000.00 (equivalent to 88 USD) which is equal to foregoing 8.3 bags of maize of one hundred kilograms each. The 8.3 bags are equivalent to approximately an output from two hectares of maize farm. Comparatively, farmers cultivate on average of two hectares, which means, buying smartphone may lead to one-year household starvation. However, a contrastive finding is reported in Pongnumkul et al. [8] who reveal that smartphones are affordable. The probable solution is an intervention that facilitates the transportation of farm produce to distant markets with higher prices, the formation of corporative societies that allow bulk sales from big traders and software developers should manufacture affordable smartphone to farmers.*

The unfriendly interface design of smartphone which is so delicate to handle in rural settings particularly to the elderly. The elderly participants noted *“Smartphone do not need rough handling which happens when preparing charcoal furnace for business, chopping big trees, carrying, arranging, and building furnace; these are tedious activities. Sometimes, there are cattle rustling organized by dishonest groups, whereby all people in the village must participate to rescue the stolen cattle. All these are shuddering and rough activities to handle while holding a touch phone”*. Similar findings are reported in Wyche and Steinfield, [28] that there is a mismatch between management information system design and the handling skills of farmers. The respondents cited faster deterioration of the touch screen as causing inconvenience, which is supported by Pongnumkul et al. [8]. Thus, the developers need to redesign smartphone that endure in shuddering activities, and touch screens that accommodate rough hands and wetness.

The overcrowded and unused applications might be associated with different needs of end users. Different societies have diverse needs that might not always be the

same. Thus, there are farmers' needs, health needs (orthodontist, pathologist, psychiatrist etc.), sport's needs (footballers, athletes, table or low tennis, netballers, basketballers etc.), and the needs of economists. The applications that do not support users' needs are likely considered as overcrowded and unused features.

The unfamiliar language to users of the technology is unconceivable as it leads to communication breakdown. The language challenge was more severe among the elderly people who were mostly operating the smartphone by memorizing some few procedures. Unfamiliar language is reported in a study by Anjum, [14] who proposed the use of clear language, an argument which is also supported by the current study.

6.4 What type of training do farmers need to help them make better use of smartphone? Farmers need training on receiving voice calls among the elderly groups that swipe receipt-icon on the wrong direction, thus, disconnecting the calls instead of receiving them; farmers need training on the use of smartphones to manage SMS such as typing and forwarding SMS particularly elders. The letters on the screen need enough space to avoid typing errors. The use of Facebook, WhatsApp and internet was limited to farmers due to technical know-how; thus, training is important so that users can be able to exploit the available opportunities in smartphones. The unused features were not familiar to farmers thus training on Boomplay, Theme, video player, service, palmstore, micro intelligent, Aha, among others, may increase the utility. Furthermore, the inclusion of farmers information needs such as weather, inputs and market among others may motivate farmers into adopting the technology.

Thus, willingness to attend training on various applications indicates motivation of using smartphones in farming and in non-farming activities. Capacity building would enable the adoption of the technology which is also recommended by Wyche and Steinfield, [28]. Furthermore, inability to pay for training charges might be solved if farmers realize the benefits of using the smartphone for farming business, the relevant authorities should intervene in balancing the local market prices of farm produce and improve infrastructure to fast-track farmers' transportation of the produce to distant market (see Table 3).

Table 3: Summary of Experience of Chamwino Farmers Using Smartphone

Theme	Main Issues found
Ownership of smartphone	There was inadequate ownership of smartphone, second-hand and limited sharing. The youths owning more smartphones than the elder group.
Farming practices and farmers information need areas	Smartphones were inefficiently used for farming related business but more on social and less on politics. Farmers need information on input, weather, finance, transport, market, health and agriculture research reports.
Challenges	Incompetency, smartphone size, weak network, high prices, unfriendly interface design of the smartphones, crowded features and use of unfamiliar language.
Training needs	Respondents need training on SMS, voice call and on unused features in smartphones. Farmers were positive to attend training on the use of features in smartphone but not ready to pay charges.

7 Conclusion

Farmers' experience on the use of smartphone provides an opportunity to software developers and policy practitioners to undertake future technological alteration. Smartphone ownership level is minimal though increasing, which is contrary to what the researcher envisaged at the beginning. The ownership of the second-hand smartphone dominates the study area and there is a need for rigorous arrangements to ensure that farmers own and use new smartphones.

However, the use of smartphone for farming business is inadequate and there are no apps for agricultural related activities. Thus, limited utilization is associated with lack of relevant apps; the current apps of smartphone usage were developed without considering farmers' requirements. The study, therefore, recommends for strategies to

mitigate the cited limitations and technological alterations to suit farmer's needs. Enhanced technologies and innovations are crucial to support an increased productivity in crop farming value chain. Thus, the provision of training on the application of smartphones is crucial, and there is need for the establishment of mobile-enabled farming information services, which will in the long run, support farmers in improving their knowledge and skills.

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