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TOPIC:

THE ROLE OF ICT IN THE DISSEMINATION OF INFORMATION TO COCOA FARMERS: THE CASE OF BREMAN KUNTANASI

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THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF ARTS DEGREE IN INFORMATION STUDIES

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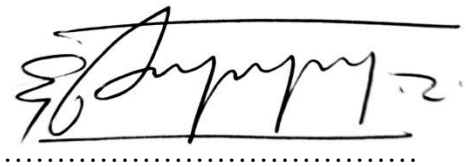
DECLARATION

I hereby declare with sincerity that this dissertation is the result of my own original work under the supervision of Dr. De-Graft Johnson Dei from the Department of Information Studies, University of Ghana, Legon. This work has not been submitted for another degree elsewhere except for references to other works, which have been duly acknowledged.



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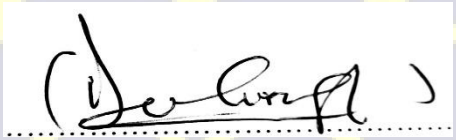

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DEDICATION

This work is dedicated to my parents, Mr. and Mrs. Edwin and all my siblings especially Ransford Edwin for their uncountable support.

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ABSTRACT

The role of Information and Communication Technologies (ICTs) in cocoa farming cannot be over emphasized. The advent of information and communication technology has changed the way farmers carry out their daily activities in recent times, and cocoa farming cannot be left out in the ICTs revolution. For many years in Ghana, cocoa farmers have been heavily reliant on low-tech methods of information dissemination provided by cocoa extension officers through interpersonal communication even though relevant, accurate and timely information has now been made possible by the integration of ICTs into cocoa farming. This study therefore sought to explore the main elements contributing to the low levels of ICTs use in providing the information needs of cocoa farmers in Breman Kuntanasi, Asikuma Odoben Brakwa (AOB) District in the Central Region of Ghana. Survey questionnaires were the primary data-gathering instrument to gather data from cocoa farmers. Data used for the study was collected from a total number of 291 farmers belonging to Cocoa Co-operatives at Breman Kuntanasi Area. Study findings indicated that the primary means of disseminating information to farmers in Breman Kuntanasi was radio and television. Only 1.4% of the 291 respondents used smartphone mobile application systems or software (WhatsApp, Facebook, twitter etc.). The Majority of the farmers had no ICT literacy skills. The study also identified certain barriers to the adoption and use of ICTs, including the cost of ownership, the lack of ICT centers and community information centers, the farmers' socioeconomic situation, their degree of illiteracy, and their limited ICT proficiency. The researcher therefore outlined some recommendations that can be adopted by stakeholders, policy makers and government to enhance smooth adoption and usage of ICTs in cocoa farming business in Breman Kuntanasi Cooperative Area and other cocoa farming communities in Ghana.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The application of Information and Communication Technology (ICT) across different sectors of the global economy has become a game-changer in boosting work efficiency and productivity. One of the industries in the global economy that has seen significant ICT use in all areas of its operations is the agriculture industry. ICTs have recently become one of the major driving tools used by farmers to manage the crucial aspects of production (land, labor, capital, and soil), according to Daum (2020). Numerous issues in the field of agriculture, such as extended droughts, pest and disease outbreaks, seasonality and regional dispersion of farming, high transaction costs, and information asymmetry, can be identified and solved with the help of ICT applications (Anh et al., 2019). ICT application along the agricultural value chain (from farm to fork) could offer opportunities for actors within the chain to obtain accurate, timely, and relevant information; which will not only contribute to profitability but also enhance food security, sustainable and remunerative agriculture (Purnomo & Lee, 2010).

The use of information and communication technology (ICT) in Ghanaian agriculture has advanced significantly in recent years, particularly in the area of farmers' access to information. Various projects have been developed that integrate ICTs into the dissemination of agricultural information to farmers. Farmers Information Services are a promising new area of study and application in the developing field of e-agriculture at the national and regional levels. Although information technology and communication technology were developed independently, according to Boateng (2012), they have considerably converged to create a

new information environment known as ICT. Different people, groups, and organizations have different ideas about how to use new technologies to boost human productivity and quality of life, but if an organization or a community is negatively impacted by the introduction of new technologies, it may be due to how those technologies were used, rather than the technologies themselves. According to Boateng (2012), the ICT revolution in the developed world has had a profound positive impact on people's lives in every aspect. In India, for instance, electronic information exchange has revived the role of extension services in providing agricultural producers with information, education, and assistance with making decisions.

Today, cocoa is the most important agricultural export produce in Ghana (Shahbandeh, 2021). The popular statement that 'Cocoa is Ghana and Ghana is cocoa' clearly shows the importance of cocoa production in Ghana (Ministry of Finance and Economic Planning, 2009). Cocoa remains the backbone of the economy of Ghana, the highest export crop earner and Ghana as the second-largest producer and exporter in the world (Shahbandeh 2021), Its production record for the year 2020/2021 was 850,000 thousand metric tons (Shahbandeh, 2021). Again, about 30 percent of the country's foreign exchange in the year 2019 was from this commodity including export tax. Cocoa is considered to be the most significant crop in Ghana because the sector employs about 800,000 small-scale farmers directly making up 60% of the country's agricultural base (Takyi et al, 2019). It also supports the livelihoods of others in the commerce, service and industrial sectors of the Ghanaian economy. This makes it an important generator of revenue. The regulator of this sector is the Ghana Cocoa Board (COCOBOD). COCOBOD is termed as the 'home' for cocoa farmers, because incentives, subsidies and other beneficiaries are provided to the farmers by COCOBOD.

Studies conducted by Bymolt, Laven and Tyszler (2018) also revealed that cocoa is indeed perceived to be either the first or second most important crop than any other crop both in Ghana and Cote d'Ivoire. The assertion was that the crop generates relatively higher income that takes care of households than any other crop. The study again revealed that cocoa serves as the backbone of the Ghanaian economy, as a tool to secure land rights (thus, once a household plants cocoa trees, the land becomes their long-term property as long as the trees remain on the land) as well as the price security and support government provides through Ghana Cocoa Board (COCOBOD) makes cocoa the most essential commodity in both the two African countries mentioned above.

Cocoa is a cash crop, which is known to be introduced in Gold Coast (former name of Ghana) by a man named Tetteh Quarshie. On his return to Gold Coast in 1879 from Fernando Po, which is located in the northernmost part of Equatorial Guinea, he brought with him the Amelonado cocoa pods. He established a farm at Akwapim Mampong in the Eastern part of Ghana which served as a nursery for all those interested in cocoa farming to follow. Tetteh Quarshie continues to be the forerunner in the development of cocoa farms and to other Ghanaian cocoa growers. In Ghana's many regions, particularly the Eastern, Brong Ahafo, Western, Ashanti, and Central regions, cocoa growing has become widely practiced. A cocoa tree can produce for up to 25 years, yet it typically takes 3 to 5 years for it to produce a crop. First-time harvesting of a tree has no effect on the tree's productive stage. Certain factors, such as adverse weather, maintenance, and the variety of cocoa tree, have an impact on the yield of the cocoa tree over the course of its lifetime as opposed to the first time it is harvested. The ripe pods are cut from the trees and broken so that the cocoa beans can be extracted during harvest. Fermentation occurs within six days with three turnings before the seeds are dried up

in the sun for seven days. In view of this, the use of ICTs could therefore complement the conventional agricultural extension methods in rural areas in Ghana just like other developed countries that have already witnessed the enormous benefits ICT has brought in information dissemination.

There are several ICT-based projects available to satisfy the many informational needs of farmers, including those connected to distribution, supply chain management, agricultural best practices, research, weather forecasts, and finance. Some of these programs are the Farmer Voice Radio (FVR) in Kenya, Malawi, Tanzania, Mali, Ghana, and Zambia, as well as the KenCall Farmers Helpline, Kilimo Salama, M-PESA, and Mali Shambani in Kenya, Cocoalink and Radio Ada in Ghana, and MAKWACHA in Malawi. (Payne et al, 2010). Also in Ghana is Rite FM in Dodowa and Farm Channel International, all these provide agricultural information, advice and support to smallholder farmers over the phone using SMS, voice and voice call to farmers. Experiences from Ghana show that ICTs can be used by farmers to obtain production and marketing information as evidenced in the cocoa sector by the Cocoalink programme. Cocoalink, a programme launched by the Ghana Cocoa Board, provides cocoa farmers with useful information about improved farming practices, farm safety, crop disease prevention, post-harvest production and crop marketing (World Cocoa Foundation, 2014). Here, farmers receive information and specific answers to questions at no charge via voice and SMS messages in their local language or English. It is therefore not surprising that the role of ICT in agriculture is increasingly being recognized in Ghana. The trend towards knowledge and service-based economies is increasingly advancing among emerging markets and institutions whether they are resource-rich or resource-poor. Ghana's economic and political stability combined with its status as a regional standout in information

technology development is showing positive signs that its efforts in the development and promotion of ICT initiatives will pay off.

1.2 Problem Statement

Today a new pattern of agricultural development is fast emerging, in both developing and developed countries, overall development of rural areas. Around the world, traditional societies are evolving into knowledge societies as old methods of providing crucial services to rural residents are challenged. The ability of human and technical resources to create, assimilate, transmit, and safeguard knowledge, as well as to utilize it as a potent tool for social change, must therefore be developed. ICT is therefore the crucial tool for bringing about such a revolution. ICT can revitalize social organizations and profitable agricultural operations when used as a tool to disseminate scientific knowledge to local farming communities. The extension worker in the current scenario of a rapidly changing world has been recognized as an essential means for disseminating knowledge (information) and advice as a component for modern agriculture. The extension service will become more diverse, knowledge-intensive, demand-driven, and efficient in satisfying farmers' information demands if this can be accomplished with the aid of ICT. The extension worker to farmer ratio, which is currently around 1:1500, has been a significant worry (MOFA, 2012). Ghana's current ratio of extension workers to farmers, including cocoa producers, is 1:1850 (MOFA, 2019). This means that using direct, personal contact to reach farmers is ineffective; to close this gap, creative information technologies are required (FARA, 2008). Evidence has shown that Information and Communication Technologies (ICTs) have positively revolutionized every profession in Ghana and farming or agricultural practice is not an exemption, notably in the area of

agricultural information dissemination (Nyarko and Kozári, 2021). However, cocoa farmers in Breman Kuntanasi use and adopt ICTs at a low level because they primarily rely on the one traditional method of disseminating information while grossly underutilizing more efficient ones like computers, multimedia, mobile phones, databases, projectors, scanners, social media, and the Internet. It is based on this background that this study explores some of the underlying factors for the low levels of ICT usage in supporting the information needs of cocoa farmers in Breman Kuntanasi.

1.3 Purpose of the Study

The purpose of the study was to explore the main elements contributing to the low levels of ICTs use in providing the information needs of cocoa farmers at Breman Kuntanasi.

1.4 Objective of the Study

The objectives of the study were as follows:

1. To determine the types of ICT tools or systems used in the dissemination of information.
2. To identify the factors limiting farmers' access to information through ICT facilities
3. To find out the level of computer literacy skills of farmers
4. To make recommendations based on the findings of the study.

1.5 Theoretical Framework

According to Cambridge Advanced Learner's Dictionary, a theory is a formal statement of the rules on which a subject of study is based or ideas which are suggested to explain a fact or event about a phenomenon. For example, economic theory, Charles Darwin's theory of evolution.

Also, a theory is a generalized statement of abstractions or ideas that asserts, explains or predicts relationships or connections between or among phenomena, within the limits of critical bounding assumptions that the theory explicitly makes (Gabriel, 2008, as cited in Kivunja, 2018).

According to Collins and Stockton (2018), defined theoretical framework as the use of a theory in a study that conveys the deepest values of researchers and clearly provides articulated lens on how the study will process new knowledge.

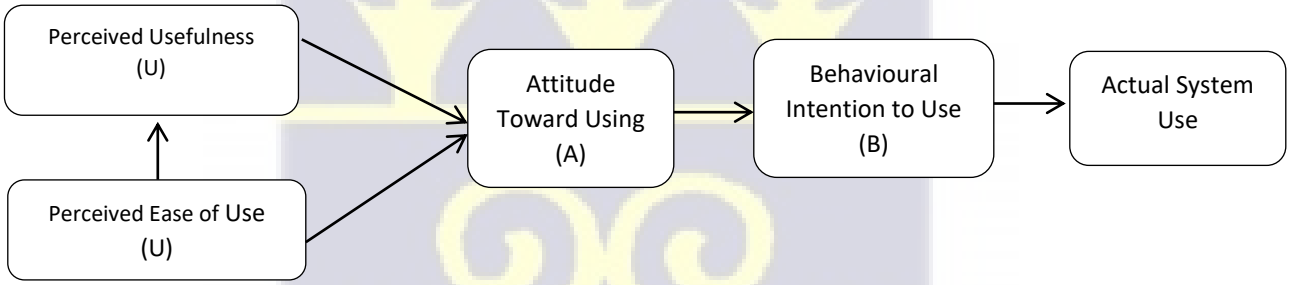
Theoretical framework is the structure that can hold or support a theory of a research study. The theoretical framework introduces and describes the theory that explains why the research problem under study exists.

1.51 Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) created by Davis (1989) is a system theory that models how users come to accept a technology and how they use that technology. Rabaai (2016) argued that amidst the well-developed theories, TAM received extensive empirical documentation on the validations, applications and replications of its power to forecast the behaviour of adoption.

Perceived Usefulness and Perceived Ease of Use determine an individual's intention to use a system with the intention to use serving as a mediator of actual system use according to the determinants of ICT adoption in organizations. The two most important individual beliefs of TAM in using information technology are Perceived usefulness and Perceived ease of use (Brandyberry, Li & Lin, 2010). Perceived usefulness is defined as the degree to which a person believes that using a particular system would enhance his or her job performance (Ghyas & Kondo, 2018). In addition, perceived ease of use is defined as the degree to which a person believes that using a particular system would be free effort. The two behavioural beliefs, perceived usefulness and ease of use, then lead to individual attitude towards the use of ICT tools, individual behaviour intention and actual behaviour.

Figure 1.1: Technology Acceptance Model (TAM)



Source: Technology Acceptance Model (Davis, 1989)

1.6 Scope of the Study

This study focused on registered cocoa farmers in Breman Kuntanasi. The study was centred on cocoa farmers who are registered members of the Cocoa Farmers Union in the community. The reason behind this choice was the fact that these members have been exposed to the cocoa

farming practices for quite some years and have gained much experience and they would be in a better position to give authentic and reliable sources of information that would help the researcher's work.

1.7 Significance of the Study

Central to achieving Ghana's agricultural development agenda is the cross-sectoral promotion of ICT use in Ghana. This is emphasized in Ghana's information and communication technology for Accelerated Development (ICT4AD) initiative with the ultimate goal of transforming Ghana into a middle-income, information-rich, knowledge-based and technologically driven economy and society. The outcome of this study will further contribute to the understanding of the role of ICTs in information dissemination to cocoa farmers. Investing in ICT has the potential of uprooting rural communities from isolation. ICT, therefore, has the potential to inform and empower rural people leading to rural transformation and poverty alleviation. In this era of economic integration and communities having transitioned from industrialization to an information age, there is the need for Ghana's cocoa farming to align itself so as to be competitive on the global market by having access to appropriate, fast and reliable information for increased cocoa productivity. This will enable extension workers and farmers to be in a position to understand the importance of these ICTs in extension services and hence be able to fully utilize their potential to complement other extension and knowledge services. It is also worthy to note that for all these benefits of ICTs to be realized requires that grassroots workers thus the extension workers and farmers to be at the most beneficial use of ICT tools. ICTs help by enabling extension workers to gather, store, retrieve, adapt, localize and disseminate a broad range of information needed by farmers. It is

therefore projected that the study will help policymakers and the district extension system to design policies and programs that use the right mix of ICTs available for agricultural extension service delivery. This will lead to the improvement of agricultural extension service provision for better farm productivity.

1.8 Setting/Research Environment

Breman Kuntanasi

Breman Kuntanasi is one of the larger 4 towns within Asikuma Odoben Brakwa District. It shares common boundaries with Agona Odoben, Breman Ayipey and Breman Asikuma. Breman Kuntanasi is a farming community within Asikuma Odoben Brakwa District in the Central Region of Ghana. It has a population of six thousand eight hundred and eighty-nine (6,889), (2010 Population Census). The town is located on the Breman Asikuma-Kuntanasi-Agona Swedru road. The town is regarded as an agricultural corridor and this is largely attributed to the vast fertile lands which favour the cultivation of major cash crops like cocoa, palm and other agricultural produce such as yams, cassava, maize, plantain and vegetables like tomatoes, garden eggs, etc. It is estimated that about 80% of the population is employed in agriculture, the main crops being cocoa, citrus, fruit, avocado, plantain, corn, cassava, yams and banana. Farmers are confronted with rodents, and diseases, poor planting materials and seedlings, cocoa black pots etc and the use of agrochemicals for agricultural production is sometimes costly or wrongly applied. Fanti is the most important language spoken, and some immigrants speak the Akan dialects of Breman, Agona and Gomoa. The majority of the population professes Christianity, some followers of Islam and traditional religions. The town is mostly covered by tropical rainforests.

1.9 Organization of Chapters

The study was organized into (5) chapters. They are as follows:

Chapter **One** focused on the introduction which included the background of the study, problem statement, the purpose of the study, objective of the study, theoretical framework, scope of the study, significance of the study, research setting or environment and organization of chapters.

Chapter **Two** centered on the Literature Review

Chapter **Three** dealt with the methodology which included the research design, selection of case, population of the study, sample size, sampling technique, instrumentation, data collection procedure, and data analysis and presentation of findings.

Chapter **Four** covered the data analysis and presentation of data as well as the discussion of findings.

Chapter **Five** presented the summary of the findings, conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter will present a critical discussion of the literature relevant to the topic. According to Hart (2018), a literature review plays a critical role as it helps researchers to understand what has been done on a given topic and the findings from previous studies, to identify gaps and build on them. The literature review basically enumerates, describes, summarizes, and objectively evaluates critique and clarifies previous studies (Berg et al, 2019). Within an academic community, a literature review is conceptualized to be both a process and a product (Switzer & Perdue, 2017). Its purpose is to convey to readers or the scientific community of the knowledge and ideas that have been established on the topic, including what their strengths and weaknesses are (Hart, 2018). When conceptualized as a process, a literature review is defined as the systematic process involved in searching for scholarly works within a clearly defined field or discipline of research (Hubbard, 2018, as cited in Randolph, 2009). When conceptualized as a product, a literature review is defined as the final draft report put together after critically reviewing a body of scholarly work (Hart, 2018).

All academic activities no matter the discipline require the researcher to build on the research and relate it to existing knowledge (Snyder, 2019). A literature review is an overview of the available research for a specific scientific topic (Hempel, 2019). The researcher, therefore, summarizes existing research evidence to prove context for new research or to identify important gaps. The researcher again must choose the right strategy to enhance the reliability and validity of conclusions about the research literature.

The literature will be reviewed from the world view, African view, and narrowed down to the Ghanaian perspective under the following themes;

i. Application of ICTs in Agriculture
ii. ICT tools or systems used in information dissemination
iii. Factors Limiting the use of ICT tools and facilities
iv. ICT usage, knowledge and skills of farmers

2.2 Application of ICTs in Agriculture

World Bank's Agriculture and Rural Development division defines ICT as the broad term that encompasses anything ranging from radio to satellite imagery to mobile phones or electronic money transfers (Salampasis & Theodoridis, 2013). In this regard, ICTs are regarded as any device, tool, or application that permits the exchange or collection of data through interaction or transmission. The International ICT Literacy Panel (IILP, 2006) defines 'ICT literacy' as using digital technology, communication tools, and or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society. In recent years, the increase in the use of ICTs in organizations has significantly changed the manner in which organizations operate and communicate. The achievement of agricultural development in the 21st century among others depends on the effective use of ICTs. This includes the use of computers, the internet, geographical information systems, mobile phones, as well as traditional media such as radio or television. ICT application in agriculture has become increasingly important due to its potential in improving agricultural productivity by serving as a pedestal to access vital agricultural information. This is very important due to the growing demand for higher quality products, which also offer opportunities for improving the

livelihoods of rural communities. Realizing these opportunities require compliance with more stringent quality standards and regulations for the production and handling of agricultural produce. New approaches and technical innovations are required to cope with these challenges and to enhance the livelihoods of the rural population. In agriculture, an integrated ICT platform for knowledge and information sharing can help in strengthening the value chain and help the farmer gain by reducing transaction costs. The adoption of ICT tools such as mobile telephony by farmers and agricultural traders in Ghana has helped them reduce both their transportation and transaction costs. Throughout Africa, ICTs have become increasingly integrated into the dissemination of information to farmers. For decades' traditional forms of ICTs have become more prevalent in advisory service provision. Radio and TV programmes feature agricultural information. Rural telecentres provide information on education, agricultural and health issues and equip rural citizens with skills on how to use computers and provide basic literacy. Many Ministries of Agriculture have attempted to integrate ICTs into the delivery of information and have established district information centres to provide agricultural information. NGOs and research organizations such as Agro Minset Organization and Agricultural and Rural Development Association (ARA) have also attempted to facilitate technology transfer in the agricultural sector in Ghana. Mukhebi (2003) as cited by Anyan and Frempong (2018) is of the view that agriculture is also being transformed by ICTs. Increasingly, ICTs spur the development of innovative programmes and research in the agricultural sector. Farmers worldwide are using ICTs to obtain market information, bypass intermediaries and obtain better prices for their products. Timely access to market information via communication networks also helps farmers make judicious decisions about what crops to plant and where to sell their produce and buy inputs. For example, in Ghana, an ICT-based agricultural market information service (MIS) was introduced by the private sector Busy Lab

through its TradeNet (now Esoko) platform. Esoko, a mobile and web-enabled repository of current market prices and a platform through which buyers and sellers interact in Ghana. A study conducted by Halewood and Surya (2012) confirmed that farmers' revenue increased by 10% since they started using the platform in northern Ghana. These real-time market dynamics help farmers deal with external demand directly, hence capturing more of the products' value. Additionally, ICTs empower farmers, rationalize supply chains and improve productivity. ICTs also has facilitated research and development, and information sharing on agricultural farm extension technologies and approaches (such as the development of effective seed technologies), particularly those that can work to enhance food security and subsistence. ICTs can also assist in the utilization of information that warns fisher folk of storms at sea or facilitates the prevention or treatment of crop or animal disease. According to Kaddu (2011; as cited in Anyan & Frempong, 2018), ICTs disseminate generic non-customized information, such as agricultural practices, weather forecasts, and contact information. This type of information enables farmers to get prepared on time. They are able to decide when to plant, the type of crops that do well with which soils and the like.

The agricultural sector as noted by Mbagwu, Benson and Onuoha (2017) confronted with the major challenge of increasing production to feed a growing and increasingly prosperous population in a situation of decreasing availability of natural resources. According to Mbagwu, Benson and Onuoha (2017, as cited in FAO, 2017), the world population is expected to surpass the 9 billion Mark by 2050 and agricultural production will need to increase by 60 percent from its 2005/2007 levels to meet this additional food demand, hence, ICT applications is the ideal option to make a significant contribution to meet this future global food needs.

2.3 ICT Tools or Systems Used in the Dissemination of Information

There are quite a number of ICT tools and application software available to aid in disseminating information to farmers across the world including wireless technologies, mobile and smartphones and similar devices, smartphone mobile application systems and even radio/TV (Romani, Magalhães, Bambini & Evangelista, 2015).

Wireless (mobile) technology in a variety of forms is an area of electronics that is developing and growing particularly fast. Wireless LAN (WLAN) technology including Wi-Fi (IEEE 802.11), Bluetooth, Ultra-Wide Band (UWB), WiMax, Zigbee, and more are all growing and finding their own market areas (Romani, Magalhães, Bambini & Evangelista 2015). As a result, wireless technology is being more widely used and found in many new applications. With the widespread expansion of cellular wireless networks and the availability of affordable handsets, several companies started disseminating point information such as market rates, weather, and plant disease alerts (Csoto, 2010). Though the above simple IT systems are of some value to farmers, IT has a much greater potential to create an impact in agriculture (Karetsos, Costopoulou & Sideridis, 2014). In fact, IT could become a core technology in all phases of agriculture; starting from seed research all the way to marketing of produce (Romani, Magalhães, Bambini & Evangelista 2015). Wireless Technologies like Geographical Information Systems (GIS), Wireless Sensor Networks, Data Mediation Software, and Short Message Service (SMS) can be used in crop production pertaining to cereals, pulses, fruits, vegetables, spices, flowers, oilseeds, as well as to seed production systems and planting material, crop production systems, protected cultivation, farm mechanization, farm management, precision farming, pest/disease management, biotic stress management, post-harvesting management and food processing systems, soil, water, and weather understanding

and agriculture education and extension (Karetsos, Costopoulou & Sideridis, 2014). These Wireless Technologies can also be harnessed for soil, water and weather covering issues concerning better management of soil, soil mapping, weather forecasting, abiotic stresses, environment management, disaster management, and natural resources management (Csoto, 2015). At the same time, wireless technologies are important in improving agriculture education and extension knowledge by cultivating the next generation of students', scientists', and professionals' practical and advanced research and warehouse-tracking devices to individual pallet tags, Radio Frequency Identification (RFID) can give fresh produce suppliers detailed visibility into the lifecycle of the produce. They can use this newfound visibility and resulting best practices to reduce shrink and improve profitability. Every fresh produce supplier's dream comes through thanks to all things RFID (Csoto, 2015).

Crops can be tracked at the farm level using observations such as the amount of fertilizer and pesticide application through mobile-based local language applications. The information on location, farm, and the farmer who supplies produce can be captured in the form of bar codes on shipment cartons. The bar codes can be integrated with a tracking and tracing application, and hence, food purchased by a consumer can be tracked and traced to a farm (Romani et al, 2015). IT has the potential to enable the transition of breakthrough science to large-scale adoption. The package of practice (PoP) for new varieties can be embedded into an IT platform and can be disseminated using IVR (Interactive Voice Response) and/or SMS (Short Message Service) technology (Karetsos, Costopoulou & Sideridis, 2014). The IT platform can pass on the names of non-compliant farmers to village workers who can schedule farm visits in a planned way and contact those farmers to ensure proper implementation of PoP.

Bio-technology research for developing pest-resistant and drought-resistant crops could be supported through IT techniques. A combinatorial approach is used to identify novel genes which produce crops with specific traits (Romani et al, 2015). Large-scale trials are conducted to determine the most viable candidates. This process generates huge amounts of data that need to be processed. Various data mining techniques could be used on terabytes of data to come up with an effective option for selecting the gene (Karetsos, Costopoulou & Sideridis, 2014). Many authors in the agriculture and ICT domain have written since 2010 that mobile devices have reached a stage of development that makes them potentially able to support farming at a high level, for example in precision viticulture (Cunha et al., 2010) or in livestock management (Voulodimos et al. 2010). With the recent progress in digital cameras, network bandwidth and information storage capacities, the production (and consumption) of multimedia data has also become an easy task with mobile devices (Joly et al. 2015). Applications that are running on mobile devices became mainstream such that there seemingly is an app for everything and this is also the case in agriculture. Karetsos, Costopoulou & Sideridis (2014) summarized the different groups of agriculture-related applications as follows into categories like Agriculture/Farm Management Information Apps, Agriculture Information Resource Apps Agriculture Calculator Apps, Agriculture News Apps, Weather Apps, etc. The mobile revolution can be observed in the whole world. According to a recent report from the International Telecommunication Union (ITU), by the end of 2015, there are more than 7 billion mobile cellular subscriptions worldwide (up from 738 million in 2000). Even if ICTs are an important factor in the success of farming, exhaustive, timely and comprehensive statistics are hard to find in this topic even though there are some data to start with. One such example is the survey by Float Mobile Learning (2012) which showed that 94% of the farmers owned a mobile phone, and 49% owned a smartphone in North America at the beginning of

this decade. Various data have also shown the use of smartphones and cell phones with the internet by farmers and tablets with many farmers purchasing electronic devices or accessories (Karetsos, Costopoulou & Sideridis, 2014).

Another survey study conducted by Sasu (2020**)** revealed that 99 percent of internet users in Ghana aged 16 to 64 years owned a mobile phone of any type. The same survey also proofed that 98.7 percent had smartphones, while another 5.7 percent owned non-smartphone mobile phones.

The dynamic growth of mobile communications combined with the widespread use of all types of mobile devices (i.e., smartphones and tablets) has changed significantly citizens' daily life and business practice. According to the International Telecommunication Union (International Telecommunications Union, 2016), mobile connections in 2015 reached 7.08 billion. Towards the same direction, in 2015 the smartphone market grew 13% and it is forecasted that in 2017 more than one-third of the world's population will own a smartphone. The increasing penetration of smartphones is due to the fact that it has become the dominant means for communication, entertainment, information, daily life and business. Among the technical advantages that have turned these devices into useful and necessary tools are the wide touch screens, easily readable and adaptable to the needs of each user; the high-resolution cameras that can substitute to a large extent other devices, such as cameras and camcorders; the geographic positioning system (GPS) that supports specialized navigation services; the powerful processors; and file storage capabilities, music player, radio tuner function, video player, etc. These technical characteristics are used by specialized software and mobile applications (apps) (Karetsos, Costopoulou & Sideridis, 2014). Mobile apps are software programs designed to run on smartphones, tablets and other devices (Serrano,

Hernantes & Gallardo, 2013). Initially, mobile apps were developed for undertaking basic tasks of computer programs, such as email, web browsing, calendar, contacts, weather forecast, etc. Today, the growing demand for new mobile products and services puts pressure on both businesses and organizations to develop mobile apps for commerce, banking, health, and tourism in order to meet the specific needs of various business sectors. The agricultural sector in particular comprises an important pillar of the economy and as a business sector covers the food needs of the world population. However, the development of mobile apps for agriculture compared with other business sectors is limited (Karetsos, Ntaliani & Costopoulou, 2014). In the context of this work, the term "mobile agricultural apps" is used to characterize any mobile app targeting the needs of the agricultural sector and its stakeholders, such as farmers, agricultural businesses and co-operations. These apps cover a spectrum of activities from the field (e.g. cultivation techniques) to the agricultural market (e.g. buying and selling products and commodities). More specifically, mobile agricultural apps offer various kinds of services, such as weather forecasting for farmers (Romani, Magalhães, Bambini & Evangelista, 2015), agricultural business news, information for agricultural machinery and equipment, agricultural product market prices, management of the agricultural product, dairy farming (Gichamba & Lukandu, 2012), management of irrigation systems, management of crop sensors (Lomotey & Deters, 2014), yield forecasting and monitoring, registration of soil types, and calculation. Annor-Frempong et al. (2006) found that computer hardware, audiovisual, and telecommunication facilities such as mobile phones were relevant devices for extension delivery in Ghana. Tata and McNamara (2016) analyzed that cellular phones, the internet, radio, and web-based applications are the major tools for sharing and disseminating agricultural information and knowledge among agricultural extension workers in South Africa. Extension officers in India use Digital Green video technologies to train

farmers in rural regions to produce videos among themselves to share good agricultural practices information to boost farm productivity and improve nutrition. The African Farm Radio Research Initiative (AFRRI) also uses radio to educate farmers in rural communities in Africa (FAO, 2017a, FAO, 2017b). ICT tools such as Global Positioning System (GPS) have been a game-changer in extension information transfer. In the United States, crop extension advisors use rugged data collection devices with GPS for accurate positioning to map pests, insects, and weed infestations in farmers' fields (GPS, 2018).

2.4 Challenges Encountered with the Use of ICT Tools/Facilities

Access to ICTs among extension officers is influenced by a myriad of factors with Haghighi et al. (2008) observing that English proficiency skills and educational level were important factors just as Annor-Frempong et al. (2006) found that factors such as low economic status, fear of ICTs, high cost of ICTs, as well as ICT policy influenced ICTs access in the agricultural sector in Ghana. elsewhere, Strong et al (2014) found in their analysis of the factors influencing ICT access among Caribbean farmers that, extension officers' levels of education were the contributing factors influencing their information and communication technology access. They observed that higher levels of educational attainment led to an increase in technology use in agriculture. Michailidis et al (2011), on the other hand, identified age, gender, farm location, and income as the main factors impacting ICT use among farmers and rural dwellers in Greece. Although there are many categories of factors influencing technology adoption, there is no clear distinguishing feature between variables in each category. Categorization is done to suit the current technology being investigated, the location, and the researcher's preference, or even to suit client needs (Bonabana-Wabbi, 2002). The

level of education of a farmer has been classified as a human capital by some researchers while others classify it as a household-specific factor. However, this section discusses the factors under the categories of socio-economic, infrastructural, technology and institutional factors

2.4.1 Socio-Economic Factors

The human capital of the farmer is assumed to have a significant influence on farmers' decision to adopt new technologies. Most adoption studies have attempted to measure human capital through the farmer's education, age, gender, and household size (Fernandez-Cornejo et al., 2007; Keelan, Thorne, Flanagan, Newman, & Mullins, 2010). Education of the farmer has been assumed to have a positive influence on farmers' decision to adopt new technology. The education level of a farmer increases his ability to obtain, process and use information relevant to the adoption of a new technology (Mignouna, Manyong, Rusike, Mutabazi, & Senkondo, 2011; Okunlola, Oludare, & Akinwalere, 2011). A study by Okunlola et al. (2011) on the adoption of new technologies by fish farmers found that the level of education had a positive and significant influence on the adoption of the technology. This is because higher education influences farmers' decision, hence making them more open, rational and able to analyze the benefits of the new technology (Waller, Hoy, Henderson, Stinner, & Welty, 1998). This eases the introduction of a new innovation which ultimately affects the adoption process (Adebiyi & Okunlola, 2013). Other studies that have reported a positive relationship between education and adoption as cited by (Uematsu & Mishra, 2010) include; (Goodwin & Mishra, 2004) on forwarding pricing methods, (Huffman & Mercier, 1991); (Putler & Zilberman, 1988) on the adoption of microcomputers in agriculture, (Mishra & Park, 2005)); (Mishra, Williams, &

Detre, 2009) on use of internet, (Rahm & Huffman, 1984) on reduced tillage,(Roberts et al., 2004) on precision farming and (Traore, Landry, & Amara, 1998) on-farm adoption of conservation tillage.

On the other hand, some authors have reported an insignificant or negative effect of education on the rate of technology adoption (Khanna, 2001; Samiee, Rezvanfar, & Faham, 2009). Studying the effect of education on technology adoption, (Uematsu & Mishra, 2010) reported a negative influence of formal education towards adopting genetically modified crops. Since the above empirical evidence has shown mixed results on the influence of education and the adoption of new technology, more study needs to be done in order to come up with a more consistent result. Age is also assumed to be a determinant of the adoption of new technology. Older farmers are assumed to have gained knowledge and experience over time and are better able to evaluate technology and technical information than younger farmers (Kariyasa & Dewi, 2013; Mignouna et al., 2011).

It is believed that access to credit promotes the adoption of risky technologies through relaxation of the liquidity constraint as well as through the boosting of a household's risk-bearing ability (Simtowe & Zeller, 2006). This is because, with an option of borrowing, a household can do away with risk-reducing but inefficient income diversification strategies and concentrate on more risky but efficient investments (Simtowe & Zeller, 2006). However, access to credit has been found to be gender-biased in some countries where female-headed households are discriminated against by credit institutions, and as such they are unable to finance yield-raising technologies, leading to low adoption rates (Muzari, Gatsi, & Muvhunzi, 2012). There is, therefore, a need for policymakers to improve current smallholder credit systems to ensure that a wider spectrum of smallholders are able to have access to credit, more

especially female-headed households (Muzari, W., Gatsi, W., & Muvhunzi, S. 2012). This may, in certain cases, necessitate designing credit packages that are tailored to meet the needs of specific target groups (Muzari, W., Gatsi, W., & Muvhunzi, S. 2012).

A key determinant of the adoption of a new technology is the net gain to the farmer from adoption, inclusive of all costs of using the new technology (Foster & Rosenzweig, 1995). The cost of adopting agricultural technology is a constraint to technology adoption. For instance, the elimination of subsidies on prices of seed and fertilizers since the 1990s due to the World Bank-sponsored structural adjustment programs in sub-Saharan Africa has widened this constraint (Muzari, W., Gatsi, W., & Muvhunzi, S. 2012). Previous studies on determinants of technology adoption have also reported the high cost of technology as a hindrance to adoption. The study done by (Makokha, Kimani, Mwangi, Verkuijl & Musembi, 2001) on determinants of fertilizer and manure use in maize production in Kiambu County, Kenya reported high cost of labor and other inputs, unavailability of demanded packages and untimely delivery as the main constraints to fertilizer adoption. The cost of hired labor was also reported by (Ouma et al., 2002) as one among other factors constraining the adoption of fertilizer and hybrid seed in Embu county Kenya. (Wekesa, Mwangi, Verkuijl, Danda, & De Groote, 2003) when analyzing determinants of adoption of improved maize variety in coastal lowlands of Kenya found high cost and unavailability of seeds as one of the factors responsible for the low rate of adoption.

Off-farm income has also been reported to have a positive impact on technology adoption. This is because off-farm income acts as an important strategy for overcoming credit constraints faced by rural households in many developing countries (Reardon, Stamoulis, &

Pingali, 2007). Off-farm income is reported to act as a substitute for borrowed capital in rural economies where credit markets are either missing or dysfunctional (Ellis & Freeman, 2004). According to (Diiro, 2009) off-farm income is expected to provide farmers an alternative source of liquid capital for purchasing productivity-enhancing inputs such as improved seed and fertilizers. However, not all technologies have shown a positive relationship between off-farm income and their adoption. Some studies on technologies that are labor-intensive have shown a negative relationship between off-farm income and adoption. According to Goodwin and Mishra and Park (2005), the pursuit of off-farm income by farmers may undermine their adoption of modern technology by reducing the amount of household labor allocated to farming enterprises. This will not limit itself to any category of factors but consider them in a holistic manner.

2.4.2 Infrastructural Factors

Farm size plays a critical role in the adoption process of a new technology. Many authors have analyzed farm size as one of the important determinants of technology adoption. The adoption of technology by farmers is affected farm size and other factors influencing adoption affect farm size. Some technologies are termed as scale-dependent because of the great importance of farm size in their adoption (Bonabana-Wabbi, 2002). Many studies have reported a positive relationship between farm size and the adoption of agricultural technology (Uaiene et al., 2009; Wiggins, 2009). Farmers with large farm sizes are likely to adopt a new technology as they can afford to devote part of their land to try new technology unlike those with less farm size (Uaiene et al., 2009). In addition, lumpy technologies such as mechanized equipment or animal traction require economies of size to ensure. profitability (Feder et al., 1985). Some

studies have shown a negative influence of farm size on the adoption of new agricultural technology.

Small farm size may provide an incentive to adopt a technology especially in the case of an input-intensive innovation such as a labor-intensive or land-saving technology. Farmers with small land may adopt land-saving technologies such as greenhouse technology, zero-grazing among others as an alternative to increased agricultural production (Yaron et al., 1992). A study by (Grieshop, Zalom, & Miyao, 1988; Samiee et al., 2009) concluded that the size of the farm did not affect Integrated Pest Management (IPM) adoption implying that IPM dissemination may take place regardless of farmers' scale of operation. A study by (Kariyasa & Dewi, 2013) also found that extensive landholdings had no significant effect on the degree of Integrated Crop Management Farmer Field School (ICM-FFS) adoption probability

The characteristic of technology is a precondition of adopting it. The degree to which a probable adopter can give a trial on a small scale first before accepting it from beginning to the end is a major determinant of technology adoption (Doss, 2003). Mignouna et al. (2011) revealed that the features of the technology are the reasons for adopting Imazapyr-Resistant maize (IRM) technology in Western Kenya, which plays a critical role in the adoption decision process. They argued that farmers who identify the technology as being consistent with their needs, as well as suitable, are likely to adopt technology since they find it as a positive investment to their environment. The technique's performance is significantly influenced the farmers' perception to adopt them. The farmers' perception of a characteristic of modern rice variety significantly affected their decision to adopt it (Adesina and Zinnah 1993). According to Wandji et al. (2012) who concluded that the more farmers accept

technology costs to establish fish farming, the more they are convinced that fish farming is the most lucrative agricultural activity. They gave an account of this when studying the perception of farmers towards the adoption of Aquaculture technology in Cameroon. This farmers' perception of the performance of the technologies as a factor influencing the adoption of agricultural technology needs to be in the future study as recent research on this factor is very shallow.

2.4.3 Institutional Factors

Technology adoption among farmers is higher when extension services are made available. Through extension services, farmers get to know the benefits of new technology through extension agents. Extension agent acts as a link between the innovators (Researchers) of the technology and users of that technology. This helps to reduce transaction costs incurred when passing the information on the new technology to a large heterogeneous population of farmers (Genius, Koundouri, Nauges, & Tzouvelekas, 2013). Extension agents usually target specific farmers (farmers with whom a particular farmer interacts) exerting a direct or indirect influence overall population of farmers in their respective areas(Genius et al., 2013). Many authors have reported a positive relationship between extension services and technology adoption. A good example includes the Adoption of Imazapyr-Resistant Maize Technologies (IRM) by (Mignouna et al., 2011). Factors determining technology adoption among Nepalese (Karki & Bauer, 2004) adoption of improved maize and land management in Uganda by (Sserunkuuma, 2005); adoption of modern agricultural technologies in Ghana (Akudugu et al., 2012) just to mention a few. This is because exposing farmers to information based upon innovation-diffusion theory is expected to stimulate adoption (Uaiene et al., 2009). In fact, the

influence of extension agents can counterbalance the negative effect of lack of years of formal education in the overall decision to adopt some technologies (Yaron, Voet, & Dinar, 1992).

2.5 ICT Usage, Knowledge and Skills of Farmers

With the exponential growth of digital technologies occurring within agricultural systems, smart farming (also referred to as digital agriculture, digital farming, and precision agriculture) has captured the attention of numerous scholars, from the technical to the social sciences (Sonka, 2016; Bronson and Knezevic, 2016). Farmers are embracing new digital and robotic technologies that are transforming the way they farm, and digitalization, more generally, is fundamentally changing the way agricultural technology and input suppliers interact with farmers, processors, manufacturers, retailers and the broader agro-food sector (Wolfert et al., 2017). However, Carolan (2017) determined that there are mixed feelings over the use of such technologies among conventional farmers.

According to Bronson and Knezevic (2016), various explanations exist for the 'mixed feelings' farmers show towards farming technologies. Some of the challenges relate to the moral and ethical questions about access, cost, scale and support, which will determine whether it will ever be possible, or indeed desirable, for all farms to be 'big data enabled', or whether it is an inevitable progression of modernization in agriculture (Fleming et al., 2018). Other challenges relate to farm data ownership, privacy, cybersecurity and the equitable sharing of the benefits of digitization and data collection (Wolfert et al., 2017; Fleming et al., 2018; Kosior, 2018).

Importantly, farmers have much in common with the broader community when it comes to the concerns they have about data collection, sharing and use (Janzen, 2018). While there are currently no legal or regulatory frameworks that are aimed at agricultural data specifically, the existing broader legal and regulatory frameworks around data collection both inform and are informed by concerns over data ownership, access and use (Jakku et al., 2018). A number of studies (Chikaire et al., 2017; Nzonzo and Mogambi, 2016) reveal inadequate ICT literacy skills among farmers to integrate ICT into their farming practices. This was confirmed in Botswana (Lekopanye and Sundaram, 2017); Nigeria (Chikaire et al., 2017); Tanzania (Angello, 2015); and the Eastern Cape in South Africa (Chisango and Lesame, 2014) even though there is a lack of specificity on how to develop ICT literacy levels (Chikaire et al., 2017). The low levels of ICT literacy skills invariably result in a digital divide and poverty among the rural communities and is a possible barrier to the adoption of ICT in their agricultural practices.

It has also been established in literature that the level of ICT literacy among rural farmers, especially in developing countries is abysmally low. This is a major limitation as far as meeting the information needs of rural farmers is concerned. Lamptey, Sambo and Hassan (2016) revealed that lack of technological expertise is one of the major challenges of dissemination of information among farmers.

Determining the ICT literacy levels of farmers was therefore considered necessary for the future construction of an innovative intervention aimed at their development. The gamut of everyday life skills and revolutionary advantages of ICT expertise span the ability to access information that deals with the knowledge of and about how to gather and/or retrieve

information; the aptitude to handle and manipulate information, which is associated with implementing an existing organizational or classification scheme; the know-how to link information, which includes adequately analyzing and characterizing information; the competence to assess information, which involves determining the worth, significance, value, or efficacy of information; and also the capacity to generate, as in producing information by acclimatizing, implementing, designing, devising, or authoring information (Kosior, 2018).

CHAPTER THREE

METHODOLOGY

3.1 Introduction

A methodology is a systematic way of finding a solution to a research problem under study (Kothari & Garg, 2014). Silverman (2013) defines it as the choices made about cases to study, methods of data gathering, and forms of data analysis in planning and executing a study. Research methodology is therefore the procedures and techniques used to gather and analyze data in a systematic manner (Ngulube, 2015). The methodology chapter of the study covers sub-sections such as research design, selection of cases, selection of subjects, population, sample size, sample techniques, data collection instruments, data collection procedure and analysis of data and presentation of findings.

3.2 Research Design

A research design is defined as the specific methods that are used in gathering and analyzing data based on the research approach chosen (Dawson, 2019). Rahi (2017) stated that a research design is a plan or blueprint, which shows how data relating to a given problem should be collected and analyzed. In like Manner, Onwuegbuzie and Combs (2011) explained that a research design is the overall strategy that is chosen to integrate different parts of a study in a coherent manner to address a research question. The survey method was chosen for this study. The method enables generalization of the study's findings to the full population from the viewpoint of the sample. The survey approach was used to assist in the collection of quantitative data for analysis because the intended population was so big, and the results obtained also provide a high level of reliability. Survey research was adopted because it does

not involve a significant financial investment and allows data to be collected quickly as well as allowing for the generalization of results from a sample to the entire population.

According to Leedy (2001), the survey has a wider utility because it enables data to be gathered quickly on a big population. Comparison of results from surveys enables the drawing of conclusions (Creswell, 2003). For this study's objectives, a cross-sectional survey was used. This is the method where information is gathered in this way at a single point in time.

There are different research approaches that can be used in a study. They include the quantitative research approach, qualitative research approach and the mixed method approach. This study adopted the quantitative research approach. Quantitative research was the favored over both qualitative or mixed methods because this study sought to build knowledge and develop an understanding about the low levels of ICT usage among cocoa farmers at Breman Kuntanasi. It is applied by researchers to observe phenomena or occurrences affecting individuals and social groups and learn about them, in line with what this study sought to do. Quantitative method was also the best method identified to guide this study to gather data that are measured to examine questions about the sample population. This study sought to determine ‘what is’, with respect to the levels of ICT usage in supporting the information needs of cocoa farmers Breman Kuntanasi (Sekaran &Bougie, 2016). The quantitative research approach is linked to the positivist paradigm. It usually involves collecting and converting data into numerical form so that statistical calculations can be made, and conclusions are drawn.

3.3 Selection of Case

The study focused on Breman Kuntanasi Community. This was because Breman Kuntanasi is one of the larger four (4) towns among; Asikuma, Brakwa & Odoben) within the Asikuma Odoben Brakwa District that produced a cocoa yield of 3,993 tons (63,890 bags) , thus, 20% out of the total cocoa yield of 19,015 tons (304,246 bags) realized in the year 2020/2021 for whole District (Breman Asikuma Cocoabod; Quality Control Report, 2020/2021). The other three (3) larger towns had 3,042 tons, 2,282 tons and 1,902 tons respectively (Asikuma, Brakwa & Odoben)

3.4 Selection of Subjects

The people chosen for a particular study are called subjects. This section shows how subjects are selected for the study. This section describes the population of the study, sample size and the techniques used in selecting the respondents for the study.

3.4.1 Population

A population of a study refers to the objects that are of interest to the study and which the researcher wants to investigate (Singh & Masuku, 2014). It is the total number of people that is of interest to a researcher and as such, the researcher wants to sample to make generalizations and this saves the researcher's time, effort and resources (Metler & Charles, 2011). A population can be considered as a group of people or objects with common attributes characteristics from which data can be gathered and analyzed (Shafique & Mahmood, 2010). Creswell (2014) also defined a population as the collection of all individuals who share

similar characteristics based on what a researcher is interested in and therefore qualify to be included in the study.

For this study, the target population was the registered Cocoa Farmers in Breman Kuntanasi Area who have been divided into seventeen (17) Cocoa Cooperatives as placed on record on file from the Cocoa Health and Extension Division (CHED) – COCOBOD, Breman Asikuma District with a population of 1,445. The reason behind this choice was because these members have been exposed to the cocoa farming practices for quite some years and have gained much experience and therefore were in a better position to give authentic and reliable sources of information that would help the researcher's work.

Table 3.1 shows the population distribution of the cocoa farmers in the Breman Kuntanasi community.

Table 3.1: Study population

Cocoa Cooperatives	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	**Total**
	100	85	71	75	82	100	72	103	80	79	92	70	89	88	87	94	88	**1,455**

Source: ***Record on file (Breman Kuntanasi Cocoa Cooperatives, 2021)***

3.4.2 Sample Size

A sample size is defined as the proportion of the population of interest that is selected for a research study (Patten & Newhart, 2017). It is a subset of the population under investigation. The sample must be representative of the target population from which it was drawn and it must be of good size. According to Creswell (2014), a sample size is a small unit of a

population that is carefully selected to study in order to help extend knowledge gained from the study of a portion of the entire population. The ideal target is to get a fair representation of the entire population by choosing a small collection of units to study and construct accurate generalizations about the larger group (Creswell 2014). Usually, the entire population is not studied due to limited time, expensive nature and difficult to study a huge number of subjects at a time.

The sample size normally assists in saving the researcher's time financial and human resources. It facilitates the processes, gives accurate measurements when done properly and aids in estimating sampling errors (Kothari, 2004).

For this study, Alreck and Settle's (1985) proposition for selecting sample size was used. They proposed that for different population sizes, a sampling ratio of 30% is adequate for a population of less than 1,000, a sampling ratio of 20% is adequate for a population between 1,000 and 10,000, and a sampling ratio of 10% is adequate for a population greater than 10,000". In view of this, 20% of the total population was used for the study. Therefore, the researcher used 20% of the population (1,445) and arrived at 291.

Hence, the sample size for this study was 291.

Sample size = $\frac{20}{100} \times 1{,}455 = 291$ (The total sample size)

Where PS is equal to Proportionate sample size

The following statistics show the population and proportionate sample size of each group

Group One P. S $\frac{100}{1455} \times 291 = 20$

Group Two P. S $\frac{85}{1455} \times 291 = 17$

Group Three P. S $\frac{71}{1455} \times 291 = 14.2 \cong 14$

Group Four P. S $\frac{75}{1455} \times 291 = 15$

Table 3.2: Distribution of Sample Size

No. Group	Members	P.S
Group 1	100	20
Group 2	85	17
Group 3	71	14
Group 4	75	15
Group 5	82	16
Group 6	100	20
Group 7	72	14
Group 8	103	21
Group 9	80	16
Group 10	79	16
Group 11	92	18
Group 12	70	14
Group 13	89	18
Group 14	88	18
Group 15	87	17
Group 16	94	19
Group 17	88	18
TOTAL	**1455**	**291**

Source: Field Data (2021)

3.4.3 Sampling Technique

A Sampling technique denotes the processes utilized in the selection of research participants from a larger group of the population so that conclusions can be drawn as a representation of how the larger group of people act or what they believe (Plonsky, 2017, p.51). Therefore, the techniques by which the sample is chosen are vital to the validity of the research findings. The sampling technique shows the process through which the subjects (sample size) will be selected from the target population. There are different sampling techniques. However, they can be grouped into probability and non-probability sampling. For this study, non-probability sampling particularly convenience sampling was used. Convenience sampling helped the researcher to select subjects who were available and willing to participate in the study for the research.

3.5 Data Collection Instrument

Hsu and Sandford (2012) define instrumentation as the tools or means by which investigators attempt to measure variables or items of interest in the data-collection process. It is a tool that helps the researcher to collect data from a given population or respondents (Kumar, 2021). The research instrument that was adopted for this study is a questionnaire. A questionnaire is made up of a list of questions, clear instructions and space for answers or administrative details. According to Kumekpor (2002), a questionnaire is a document containing a number of questions on a particular theme, problem, issue or opinion to be examined.

The researcher adopted a close-ended questionnaire for the study. Fraenkel at el (2015) stated that an open-ended questionnaire requires respondents to answer by writing their opinions on

the answer sheet while in a close-ended questionnaire; respondents only answer by checking, circling, or marking the options that best suit them. The questionnaire was divided into five parts (parts A, B, C, and D) based on the objectives of the study. Part A gathered data on the demographic characteristics of the participants. Part B collected data on the ICT tools or systems used in the dissemination of information by the participants. Part C gathered data on the factors limiting farmers' access to information through ICT facilities. Part D gathered data on the level of ICT literacy skills of farmers. A questionnaire was chosen for the study because it enables researchers to collect a large amount of data within the shortest possible time. Also, it is very economical as compared to interviews, which will later require for transcribing of data.

3.6 Data Collection Procedure

According to Fraenkel et al (2015), data collection requires contact with the respondents, and this can be achieved through personal interviewing, direct administration of questionnaire to a group, engaging the service of research assistant, and the like. The researcher obtained an introductory letter from the Department of Information Studies and sought permission to conduct the study from the authorities of the community and the cocoa cooperatives. After that, the researcher met with the respondents and explained the purpose of the study to them. The researcher administered the questionnaire himself.

3.7 Data Analysis and Presentation of Findings

Data analysis is usually conducted to organize and give meaning to the data. The data that was gathered for this study were analyzed using the Statistical Package for Social Sciences

(SPSS), version 25. SPSS is software that is used in the statistical analysis of data. The data was coded and keyed into the SPSS software by the researcher. Also, the data was cleaned in order to detect and correct errors so as to ensure consistency. In addition, frequencies, percentages, tables, and charts were used to present the results for easy interpretation.

3.8 Ethical Consideration

The importance of ethical consideration in research cannot be overstated. Ethics are the principles or standards for performing a study or research. To enable the researcher to collect data from the participants, an introductory letter was obtained from the Department of Information Studies of the University of Ghana. Before administering the questionnaire, the participants were informed about the study's purpose and objectives. The participants' permission was asked, and their contributions were kept confidential. The participants were given the opportunity to ask any questions that they had in order to clear up any doubts they had and they were free to decide whether or not to take part in the study. The participants were also given ample time to complete the questionnaire. All of the participants' identities were kept confidential and were not revealed. The data gathered was provided as it was. The information provided by the participants was kept in great regard, and the participants were assured that participating in the study would not expose them to any threat or risk. Furthermore, all sources of information used in this study were properly acknowledged. As a result, the study was carefully conducted and guided by the University of Ghana's code of ethics.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION OF FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the analysis of the quantitative data gathered and the presentation of the findings derived as a result of the analysis as well as the discussion of the findings of the study. Tables, charts (figures), percentages and frequencies were used to support the analysis and aided with the presentation of the findings. The data collected with the aid of a questionnaire were analysed and the findings obtained were presented in this chapter. Data was collected from the cocoa farmers of Breman Kuntanasi in the Central region of Ghana. The data collection was done by the researcher himself with the assistance of 3 other people from the cocoa farmers' association of the Breman Kuntanasi community.

Babbie (2015) opined that a response rate of at least 50% is adequate for analysis and reporting. According to Lindeman (2019), a response rate is calculated as the number of people who partakes in a data collection by answering a survey divided by the total number of respondents a researcher sent the survey to (sample) expressed as a percentage. Babbie (2015) indicated that a rate of 60% is good while 70% is very good and above is excellent. The researcher distributed 291 questionnaires and they were all answered and returned. This, therefore, gives a response rate of 100%, hence the response rate can be pointed to be excellent and ideal for the study.

This chapter was organized based on the following themes:

1. Demographic Characteristics
2. ICT Tools Used
3. Factors Limiting the Use of ICT Tools
4. Level of Literacy Skills
5. Discussion of Findings

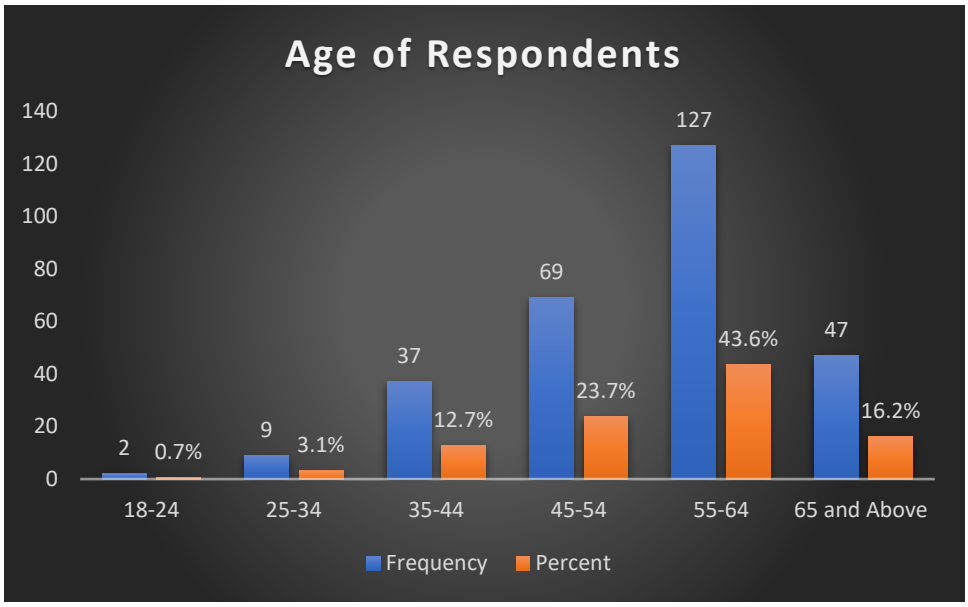
4.2 Demographic Characteristics

Demographic can be defined as the attributes of a population that helps the researcher to assess whether a respondent should be included in a survey and also helps to break down gathered data into meaningful groups of respondents (Morosan & DeFranco, 2014). For this study, the demographic data obtained from respondents were age, gender, education qualification and period of farming.

4.2.1 Age of Respondents

Age is one of the determinants of once maturity (Dango, 2018). The researcher sought to find out the age distribution of the respondents. Figure 4.1 shows the age distribution of the respondents.

Figure 4.1: Age of Respondents



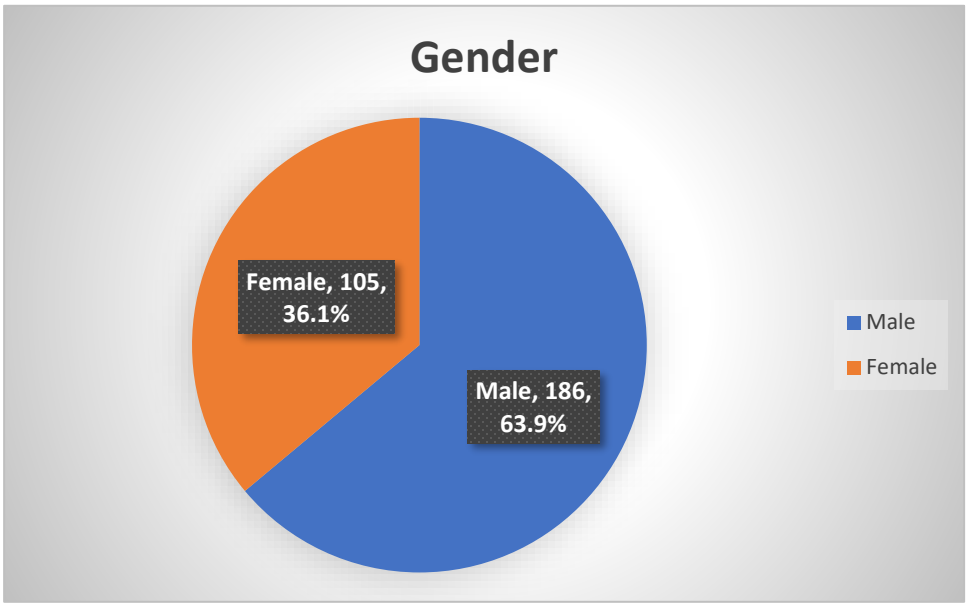
Source: Field Data (2021)

The respondents were asked to select the age category they belong to. These were grouped into six (6) category which were; 18 – 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64 and above 65 years. Data obtained shown that, the age between 18 to 24 years were 2(0.7%) respondents, 9 (3.1%) respondents were between the age group of 25 to 34 years, 37(12.7%) respondents were between the age group of 35 to 44 years, 69 (23.7%) were between the age range of 45 to 54 years, 127 (43.6%) were between age group of 55 to 64 and 47 (16.2%) respondents were 65 years and above.

4.2.2 Gender of Respondents

The respondents were asked to select their either male or female. Figure 4.2 displays the responses obtained from the respondents.

Figure 4.2: Gender



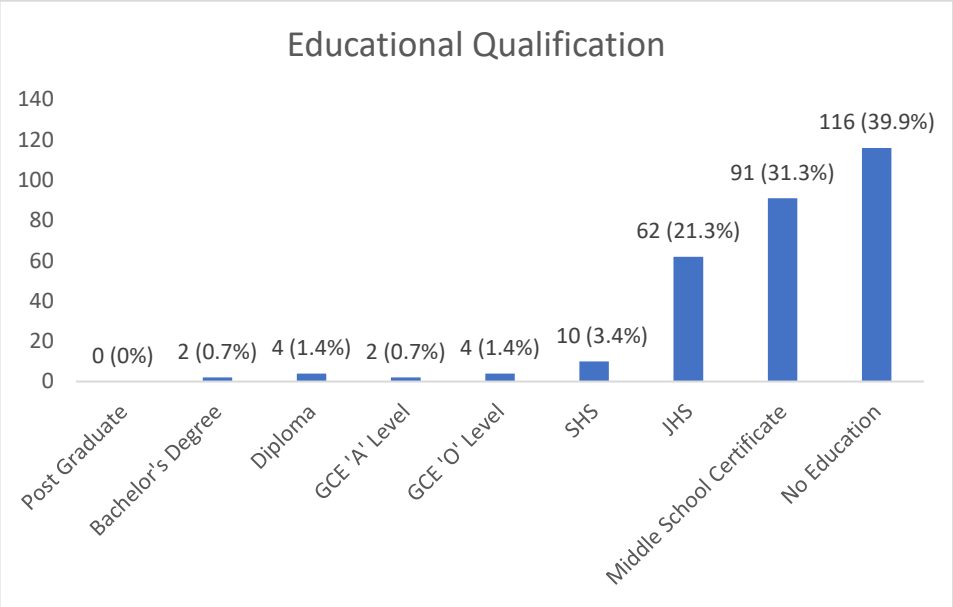
Source: Field Data (2021)

The responses obtained showed that out of the 291 total respondents, 186 representing 63.9% constituted males whereas 105 representing 36.1% were females. This therefore, shows that majority of the respondents were males.

4.2.3 Educational Qualification

Education is an enlightening and insightful experience a person involving the acquisition and usage of knowledge, skills, habits, values and beliefs (Agyei, 2020). Being it formal, informal or semi-formal helps the individual to read and write and it also contributes to the attainment of knowledge (Dango, 2018). Figure 4.3 shows the distribution of the educational qualification of the respondents.

Figure 4.3: Educational Qualification



Source: Field Data (2021)

The results presented in fig shows that majority of respondents had no education which represents 116 (39.9%), 91 respondents representing 31.3% had middle school education, 62 respondents representing 21.3% had junior high school education, 10 respondents representing 3.4% had SHS education, 4(1.4%) respondents had GCE 'O' Level education, 2(0.7%) had GCE 'A' Level, 4 respondents representing 1.4% had diploma education, 2 respondents representing 0.7% had bachelor's degree as educational qualification, meanwhile no respondents had post graduate qualification.

4.2.4 Period of Occupation

Period of occupation denotes the number of years and experience a person has acquired in a particular profession, work, job or business. Table 4.1 depicts the responses obtained from the respondents on their period of work.

Table 4.1: Period of Occupation

	Frequency	Percentage
0-5 years	12	4.1
6-10 years	26	8.9
11-15 years	54	18.6
16-20 years	69	23.7
21-25 years	86	29.6
26 and above	44	15.1

Source: Field Data (2021)

The above table shows that, farmers who had worked in cocoa farming business for 21 to 25 years with 86(29.6%) were the majority and those who have been in the business 0 to 5 years the minority with 12(4.1%) respondents.

4.3 ICT Tools Used

ICT tools are set of technological tools used to store, manage or communicate information. Some examples of ICT tools are; mobile and smartphones, iPad, desktop/laptop computers etc. Table 4.2 shows the ICT tools used by farmers.

Table 4.2: ICT Tools Used by Farmers

ICT Tools Used	Response Categories				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Wireless technologies (WiFi, broadband, internet)	291 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mobile and smartphones and similar devices (iPad/Tablet, etc)	291 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Desktop/laptop computers projectors	291 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Computer-controlled automated systems such as agricultural drones	291 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Smartphone mobile application (software such as WhatsApp, Facebook, Twitter, etc)	287 (98.6%)	0 (0%)	0 (0%)	4 (1.4%)	0 (0%)
Television (TV)	154 (52.9%)	0 (0%)	1 (0.3%)	128 (44.0%)	8 (2.7%)
Radio	90 (30.9%)	0 (0%)	1 (0.3%)	190 (65.3%)	10 (3.4%)

Source: Field Data (2021)

Among the ICT tools used, the results showed that 190 respondents representing 65.3% used radio frequently as against 90 respondents representing 30.9.0% who did not use radio, with the television set use, 154 out of the 291 representing 52.9% did not use television however, 128 respondents representing (44.0%) indicated the usage of TV set to access information for farming business. Only 4 respondents representing 1.4% used smartphone and mobile application systems/software such as WhatsApp, Facebook, Twitter etc whereas 287 respondents representing 98.6% did not used such ICT tools. Again, all the 291 respondents representing 100% indicated that none of them had ever used wireless technologies (such as WiFi, broadband), iPad/tablets, desktop/laptop computers or computer-controlled automated systems in their farming business.

4.4 Factors Limiting the Use of ICT Tools

Factors limiting the use of ICT can be described as barriers to the successful integration of ICT in cocoa farming business. It can also be seen as the factors that reduce, prevent or restrict one's ability or willingness to access information when using ICT facilities. The results obtained from the factors limiting the use of ICT tools by the cocoa farmers are illustrated in Table 4.3

Table 4.3: Factors Limiting ICT Use by Cocoa Farmers

Factors Limiting ICT Use	Response Categories				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Availability of ICT centers/ Community information centers and overall infrastructure	1 (0.3%)	0 (0%)	0(0%)	0 (0%)	290(99.7%)
Compatibility of available ICT tools to farmers' work in general	1 (0.3%)	0 (0%)	0(0%)	0 (0%)	290(99.7%)
Simplicity/complexity of accessing and understanding ICT	1 (0.3%)	0 (0%)	0(0%)	0 (0%)	290(99.7%)
Relative Advantage (perceived benefits of using ICT in their work over traditional methods)	1 (0.3%)	0 (0%)	0(0%)	0 (0%)	290(99.7%)
Educational level of farmers	2 (0.7%)	17(5.8%)	1(0.3%)	0 (0%)	271(93.1%)
Age of farmers	2 (0.7%)	19(6.5%)	1(0.3%)	0 (0%)	269(92.4%)
Socio-economic status of farmers	1 (0.3%)	0(0%)	0(0%)	0 (0%)	290(99.7%)
Cost of accessing ICT tools	1 (0.3%)	0(0%)	0(0%)	0 (0%)	290(99.7%)
ICT literacy level of farmers	1 (0.3%)	0(0%)	0(0%)	0 (0%)	290(99.7%)
ICT policy (contribution of Agric extension services)	1 (0.3%)	0(0%)	0(0%)	0 (0%)	290(99.7%)
Information quality (accessed by farmers via ICT)	1 (0.3%)	0 (0%)	0(0%)	0 (0%)	290(99.7%)

Source: Field Data (2021)

The study considered factors limiting farmer' access to information when using ICT facilities and the following were responses. The responses depicted that 290 (99.7%) out of the total respondents of 291strongly agreed that, unavailability of ICT centers/Community information centers, compatibility, simplicity/complexity, relative advantage, socio-economic status of farmers, cost of accessing ICT tools, ICT literacy level, ICT policy as well as information quality were the major contributing factors restricting farmers ability to use ICT in accessing information.

Educational qualifications and the age of farmers were equally identified as limiting factors based on responses obtained from the respondents which were represented by 271(93.1%) and 269(92.4%) respondents respectively.

4.5 Level of ICT Literacy Skills

ICT literacy skills can be referred to as the ability for someone to produce, process, store and disseminate information using a variety of ICT devices or equipment. Again, it is the ability to use digital technology. The results in Table 4.4 shows the level of ICT literacy skills of the cocoa farmers.

Table 4.4: Level of ICT Literacy Skills of Cocoa Farmers

Level of ICT Literacy Skills	Response Categories				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Collecting and managing information	291(100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Practical knowledge and understanding of computer use	291(100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Accessing and evaluating information	291(100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Managing information	291(100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Transforming information					
Producing and exchanging information	291(100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Creating information Sharing information	291(100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Using information safely and securely	291(100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Source: Field Data (2021)

Responses from the respondents indicated that, the total respondents which was 291 representing 100% could not use ICT to collect and manage information, had no practical knowledge and understanding of computer use, could not access and evaluate information, had no ICT know-how to use ICT to produce and exchange information, neither they could create, share nor safely store information. This is clear on the above table where respondents strongly disagreed to the assertion that they had some ICT skills and knowledge to carry out some information activities.

Hence, inadequate ICT literacy skills among farmers is a threat to integrate ICT into their farming practices and this findings has supported a number of studies conducted in other African countries such as Botswana, Nigeria, Tanzania and Eastern Cape in South Africa

which came out with similar findings. The following were the scholars, who carried out these studies in the various African countries, namely; Chikaire et al (2017), Nzonzo and Mogambi (2016) (Lekopanye and Sundaram, 2017), (Chikaire et al., 2017); (Angello, 2015); (Chisango and Lesame, 2014). The same literature also established that the level of ICT literacy among rural farmers, especially in developing countries is abysmally low and this serves as a major limitation as far as meeting the information needs of rural farmers is concerned.

4.6 Discussion of Findings

This section discusses the major findings of the study. The discussion is structured based on the objectives of the study. This study examined the role of ICT in the dissemination of information to cocoa farmers. The discussion was carried out by situating the major findings of the major findings within the context of theoretical and empirical literature. The discussion was structured under the following headings:

i. Demographic Characteristics
ii. ICT Tools Used
iii. Factors Limiting the Use of ICT Tools
iv. Level of Literacy Skills

4.6.1 Demographic Characteristics

The age bracket of 55 to 64 years who were older and weak constitutes the greater labour force of cocoa farmers with 127 respondents representing 43%, followed by 69(23.7%) respondents representing the age group between 35 to 44 years. The oldest age group that was 65 years and above had 47(16.2) respondents beating the age group between 25 to 34 years

with 37(12.7%) and that of 18 to 24 years with only 2(0.7%) respondents. The findings from figure 4.1 is a clear indication that, those who were younger and energetic (age between 18 to 24) rather formed the minority labour force whereas the older and weak age groups (55-64, 45-54 and 65years and above) representing 127(43.6%), 69(23.7%) and 47(16.2%) respectively were the majority labour force. This shows that the youth in Breman Kuntanasi Area either have less or no interest in cocoa farming business as compared to the elderly who have a high interest and heavily engage in it.

The findings also showed that the males dominate when it comes to cocoa farming business with 186(63.9%) respondents as against 105(36.1%) respondents who were women and formed the minority workforce. It is not quite surprising to see the male dominance in the cocoa farming business since the male in general dominates the labour force. Men still dominate the labor force, according to the International Labour Organization, despite decades of effort in boosting women's participation in the workforce (ILO, 2020).

The findings from table 4.1 shows that the highest educational qualification among the farmers was bachelor's degree with 2(0.7%) respondents and middle school education being the lowest educational qualification also had 91 respondents representing 31.3%. However, the highest respondents of 116 representing 39.9% had no education. The finding clearly shows that a high number of people working in the cocoa farming business are illiterates. This can also be attributed to the fact that the young, energetic and educated people especially the youth are attracted more to the formal sector and office-based jobs as compared to cocoa farming.

It is therefore clear from the findings that, those who had worked for 16-120 and 21-25 years had the highest responses with 69(23.7%) and 86(29.6) respondents respectively. The findings on the period of works corroborates the findings of the age of the respondents as it is obvious that the elderly group took cocoa farming as their main occupation for their livelihood and also as a means to cater for their families.

4.6.2 ICT Tools Used

The first objective was to find out the types of ICT tools used by the cocoa farmers especially in the dissemination of information. ICT tools have varied forms of advantages for the individual. The findings revealed that the least used of ICT tool by the farmers was the smartphone mobile application and the most used tools were the radio and television. In other words, the findings also showed that the farmers had no know idea about the use of other ICT tools such as iPad/tablets, desktop/laptop computers, wireless technologies and controlled automated system which are more sophisticated than the radio and the television. Although studies from Annor-Frempong et al (2006), Romani, Magalhães, Bambini & Evangelista, (2015) and Tata & McNamara (2016) have shown that mobile phones, the internet, television, radio and web-based applications, wireless technologies and smartphone mobile application systems were the major tools for sharing and disseminating agricultural information and knowledge among agricultural extension workers in both Ghana and South Africa respectively, the findings from Breman Kuntanasi proved otherwise with respect to the ICT tools used by the farmers with the exception of radio and television set that stood out to be the most frequent ICT tools used by the farmers in Breman Kuntanasi for their farming business.

4.6.3 Factors Limiting the Use of ICT Tools

With regards to the factors limiting the use of ICT tools by the cocoa farmers, the findings revealed that socio-economic status, high cost of ICT tools or systems as well as ICT policy were contributing factors accounting for less usage of ICT by the farmers and this has confirmed a study conducted by Annor-Frempong et al. (2006) which found that factors such as low economic status, fear of ICTs, high cost of ICTs, as well as ICT policy influenced ICTs acceess in the agricultural sector in Ghana. Also, the findings from this work have also provided high validity to support the assertion that educational level of farmers pose challenge to the use of ICT. A research work conducted by Strong et al (2014) found in their analysis that factors influencing ICT access among Caribbean farmers that, extension officers' levels of education were the contributing factors influencing their information and communication technology access. They further observed that higher levels of educational attainment led to increase in technology use in agriculture. A study by Okunlola et al., (2011) on the adoption of new technologies by fish farmers also found that the level of education of farmers had a positive and significant influence on adoption of the technology. According to Udimal et al. (2017), higher education influences farmers' decision, hence helps them to be more open, rational and able to analyze the benefits of the new technology.

4.6.4 Level of ICT Literacy Skills

In terms of the level of ICT literacy skills of the cocoa farmers, the findings revealed that the cocoa farmers in Breman Kuntunase community had no ICT literacy skills. The findings indicated that the respondents strongly disagreed to the assertion that they had some ICT skills and knowledge to carry out some information activities. Hence, inadequate ICT literacy skills

among farmers is a threat to integrate ICT into their farming practices and this finding has supported a number of studies conducted in other African countries such as Botswana, Nigeria, Tanzania and Eastern Cape in South Africa which came out with similar findings. The following were the scholars, who carried out these studies in the various African countries, namely; Chikaire et al (2017), Nzonzo and Mogambi (2016) (Lekopanye and Sundaram, 2017), (Chikaire et al., 2017); (Angello, 2015); (Chisango and Lesame, 2014). Chikaire et al (2017) established that the level of ICT literacy among rural farmers, especially in developing countries is abysmally low and this serves as a major limitation as far as meeting the information needs of rural farmers is concerned. In like manner, Nzonzo and Mogambi (2016) also opined that one of the main limitation of farmers especially those in the rural areas is their knowledge level in terms of ICT literacy.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the major finding that emerged from the study based on the objectives. It also provides conclusion based on the findings. In addition, recommendations were also identified based on the findings of the study. Areas for further studies have also been suggested.

5.2 Summary of Findings

The purpose or aim of the study was to investigate the role of ICT in the dissemination of information to cocoa farmers in Breman Kuntanasi with the view to identifying possible problems and making recommendations as to how ICT tools can be fully utilized by these farmers. The specific objectives were to determine the types of ICT tools or systems used in the dissemination of information, to identify the factors limiting farmers' access to information through ICT facilities and to find out the level of computer literacy skills of farmers. The findings of the study were summarized in line with the objectives of the study as presented below.

5.2.1 ICT Tools Used

The study sought to find out the ICT tools used by the cocoa farmers. The findings revealed that the least used of ICT tool by the farmers was the smartphone mobile application and the most used tools were the radio and television. In other words, the findings also showed that

the farmers had no know idea about the use of other ICT tools such as iPad/tablets, desktop/laptop computers, wireless technologies and controlled automated system which are more sophisticated than the radio and the television.

5.2.2 Factors Limiting the Use of ICT Tools

The study sought to find the factors that limits the cocoa farmers use of ICT tools. The findings revealed that the findings revealed that socio-economic status, high cost of ICT tools or systems as well as ICT policy were contributing factors accounting for less usage of ICT by the farmers.

5.2.3 Level of Literacy Skills

The study sought to find the level of literacy skills of the cocoa farmers. The findings revealed that the respondents strongly disagreed to the assertion that they had some ICT skills and knowledge to carry out some information activities. Hence, inadequate ICT literacy skills among farmers is a threat to integrate ICT into their farming practices.

5.3 Conclusion

This study sought to assess the role of information and communication technologies (ICT) in the dissemination of information among Cocoa farmers in Breman Kuntanasi. The findings from this study revealed that the use of Information and Communication Technologies (ICTs) among the farmers was extremely lower. The findings also showed that the commonly used ICT tools among the farmers were radio and television devices. The farmers based on the

findings did not show any interest in the use of other sophisticated ICT tools such as iPad or tablet, mobile or smartphone, laptop, computer-controlled automated systems (agricultural drones) and desktop computers for their farming business. Again, the majority of the farmers were not using social media platforms such as WhatsApp, Facebook and Twitter and the internet to either disseminate or receive cocoa information. The aged constituted the majority workforce and the males were dominant in the cocoa farming business. The study noted that the most critical factors affecting farmers' access to information using ICTs in Breman Kuntanasi were inadequate ICT literacy level, socio-economic factors, unavailability of ICT facilities, lack of ICT training opportunities, lack of ICT infrastructure as well as high illiteracy level of the farmers.

5.4 Recommendations

The following recommendations were made based on the findings of the study.

5.4.1 Subsidizing Customized Android Phones for Cocoa Farmers

The integration of ICT into cocoa farming in Ghana has shifted the focus of farmers towards the usage of ICT in enhancing rapid performance in the cocoa farming activities and this has become a necessity for cocoa farmers to acquire android or smartphones to help them meet the technical requirements needed to use ICT in cocoa farming. The COCOBOD in collaboration with the telecommunication agencies can initiate this project as was recently done for the teacher unions through the ministry of education when the new syllabus was introduced. These phones should have a customized animation app on all information about cocoa farming practices in local languages so that the larger population of farmers who cannot read or write

would also benefit from this project in discharging their farming activities. This animation concept usually provides simple, accurate, precise and clear information for the understanding of the user.

5.4.2 Introducing ICT and Cocoa Information Centres

This paper recommends that ICT and cocoa information centres that provide relevant information on farming should be introduced in cocoa farming areas (in addition to public/community libraries). These information centres can help the farmers to easily get all the relevant information that they need. The presence of these information centres can enable the farmers to access a lot of information with the assistance of an information/library worker.

5.4.3 ICT Literacy Education for Adults

The report revealed that about 95% of the farmers had no idea about ICT and its usage. This therefore, requires the need for the Ghana COCOABOD in collaboration with the cocoa co-operatives in the community in the short-run improve the level of information technology literacy of cocoa farmers through seminars/training in the use of ICTs, such as mobile phone devices, computers, internet cameras, among others in cocoa related activities, and in the long run introduce ICTs into adult education programmes during Sundays evening and taboo days to equip farmers with the basic knowledge and skills needed in the use of ICTs. COCOABOD again, in collaboration with a national electronic media house such as Ghana Television (GTV) that has the largest coverage area can equally run adult ICT literacy education in local languages every week on their network to enable cocoa farmers with the ICT usage.

5.4.4 Training of Farmers in the Use of ICTs

Training in the areas of ICT is very essential for cocoa farmers to aid them in their work. It is therefore important for COCOBOD to organize training and development sessions for all cocoa farmers across the country. The training sessions can be held at district levels quarterly for all cocoa farmers as it will make them aware and highly equipped them with the skills needed in the area of ICT so as to utilize them effectively in the area of cocoa farming.

5.4.5 Improve the Level of ICT Adoption and Use by Cocoa Farmers

The use of ICT has reshaped the activities of cocoa farming and it is, therefore, essential for farmers to know its importance to their work. In view of this, the government of Ghana through her agencies, such as the Ghana Cocoa Research Institute, Public/Community Libraries and the District Cocoa Extension Divisions should collaborate to deploy the use of ICTs such as radios and mobile phones in services delivery to the farmers especially in the areas of information dissemination, training, product promotion and the application of farm inputs. Again, considering the diffusion of mobile phones with the attendant benefits such as ease of use and relatively cost-benefit. Government and Extension Officers should leverage the advantage of mobile phones as a tool for information dissemination to farmers. This will go a long way to boost Cocoa farming in the country

5.4.6 Improve the Use of Radio and Television in Accessing Cocoa Information

Since ICTs are important tools for accessing cocoa information, it is recommended that the broadcasting media should increase the frequency of broadcasting relevant cocoa programmes. These radio and television programmes should be advertised frequently to

increase the awareness of the cocoa farmers on the existence of the programmes. The programmes should be improved in order to include simple and affordable techniques that are relevant to our environment so that the knowledge obtained from the programmes is applied by all the farmers. The programmes should also be repackaged in the local content (language) of the farmers since the majority of them could not read or write to enable the farmers to continue learning and benefitting from the programmes. If it could be, community radio and television that are specifically for cocoa farmers should be introduced. These will be very useful for the farmers who will learn and benefit from the programmes.

5.4.7 Enhancing the Use of Mobile Phones and Internet to Access Cocoa Information

Relevant government bodies (e.g. NCA and COCOBOD) in collaboration with internet service providers in Ghana (e.g. AirtelTigo Vodafone, and MTN) should take into consideration the possibility of starting up ICT projects in cocoa farming communities to help them gain easy access to information. This can be done through sending relevant short messages to the farmers especially on the weather and the application of fertilizer, price of cocoa as well as the use of chemicals in fighting pests. These projects will enable the farmers to access relevant information through their mobile phones at cheaper prices. These websites should be in local languages to enable many farmers to benefit from them. The ICT projects can also provide computer and Internet skills to the farmers and extension officers; this will promote the use of the Internet to access cocoa information.

5.5 Areas for Further Study

The following areas can be considered by future researchers.

- ICT literacy education for adult as a determinant of ICT adoption among cocoa farmers
- The introduction of ICT training and cocoa information centres as key enablers of ICT usage

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APPENDIX A: QUESTIONNAIRE FOR FARMERS

UNIVERSITY OF GHANA

SCHOOL OF INFORMATION AND COMMUNICATION STUDIES

DEPARTMENT OF INFORMATION STUDIES

THE ROLE OF ICT IN THE DISSEMINATION OF INFORMATION TO COCOA FARMERS – QUESTIONNAIRE

Dear Participant,

My name is Boadi Agyeman Edwin, a post-graduate student at the University of Ghana, Legon. For my final dissertation, I am examining the role of ICT in the dissemination of information to cocoa farmers. I am inviting you to participate in this research study by completing the attached surveys. Your participation in this study – including all information you provide is strictly confidential and under strict privacy and non-disclosure policy. Please understand that your participation is entirely on a voluntary basis and you have the right to withdraw your consent or discontinue your participation at any time without any consequences to you. Participation in this study involves no risk whatsoever, physically or emotionally.

Thank you!

PART A: DEMOGRAPHIC INFORMATION

Please tick as appropriate, or provide short written responses as required

1. Indicate your age

Age 18 – 24 ☐ 25 – 34 ☐ 35 – 44 ☐ 45 – 54 ☐ 55 – 64 ☐ 65 and above ☐

2. Select your gender

Male ☐ Female ☐

3. Please state your highest level of qualification

Post graduate ☐ Degree ☐ Diploma ☐ GCE 'A' Level ☐ GCE 'O' Level ☐ SHS ☐

JHS ☐ Middle School Certificate ☐ No Education ☐

4. How long (in years) have you been in cocoa farming?

0 - 5 ☐ 6 – 10 ☐ 11 – 15 ☐ 16 – 20 ☐ 21 – 25 ☐ Above 26 ☐

Instructions: The next sections (part B, C and D) have responses to each statement rated on a Likert scale of 1, 2, 3, 4, and 5. Five (5) represents the strongest agreement with a statement whilst 1 represents the least agreement OR the strongest disagreement, as demonstrated in the following table**:**

1	2	3	4	5
Strongly Disagree	**Disagree**	**Neutral (not sure/cannot tell)**	**Agree**	**Strongly Agree**

PART B: ICT TOOLS OR SYSTEMS USED IN THE DISSEMINATION OF INFORMATION

ICT tools or systems refer to devices used in information and communication technology

1. The following tools or systems are readily available for me to access information that I require for my farming business

		1	2	3	4	5
	ICT tools or systems					
1.	Wireless technologies (WiFi, broadband, internet)					
2.	Mobile and smartphones and similar devices (iPad/Tablet, etc.,)					
3.	Desktop/laptop computers, projectors					
4.	Computer-controlled automated systems such as (agricultural) drones					
5.	Smartphone mobile application systems/software (WhatsApp, Facebook, Twitter, and so forth)					
6.	TV					
7.	Radio					

PART C: FACTORS LIMITING FARMERS' ACCESS TO INFORMATION WHEN USING ICT FACILITIES

Limiting factors refer to factors that reduce or restrict farmers' ability or willingness to access information when using ICT facilities.

2. The following are factors limiting farmers' access to information when using ICT facilities

		1	2	3	4	5
	Factors limiting farmers' access to information when using ICT facilities					
1.	Availability of ICT centers/ Community information centers and overall infrastructure					
2.	Compatibility (of available ICT tools to farmers' work in general)					
3.	Simplicity/complexity (of accessing and understanding ICT)					
4.	Relative Advantage (perceived benefits of using ICT in their work over traditional methods)					
5.	Educational level (of farmers)					
6.	Age (of farmers)					
7.	Socio-economic status (of farmers)					
8.	Cost (of accessing ICT tools)					
9.	ICT literacy level (of farmers)					
10.	ICT policy (contribution of Agric extension services)					
11.	Information quality (accessed by farmers via ICT)					

PART D: LEVEL OF ICT LITERACY SKILLS OF FARMERS

ICT literacy skills refer to knowledge and competencies required to take advantage of ICTs for farming purposes

3. The following statements examine the level of ICT literacy skills of farmers

STATEMENT		RESPONSE (PLEASE TICK)				
		1	**2**	**3**	**4**	**5**
1.	Collecting and managing information					
2.	Practical knowledge and understanding of computer use					
3.	Accessing and evaluating information					
4.	Managing information					
5.	Transforming information					
6.	Producing and exchanging information					
7.	Creating information					
8.	Sharing information					
9.	Using information safely and securely					

THANK YOU FOR YOUR PARTICIPATION!

APPENDIX B: INTRODUCTORY LETTER

UNIVERSITY OF GHANA
DEPARTMENT OF INFORMATION STUDIES
SCHOOL OF INFORMATION AND COMMUNICATION STUDIES

Ref. No.:.....

November 4, 2021

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

INTRODUCTORY LETTER

I write to introduce to you Mr. Edwin Agyeman Boadi, an M. A student of the Department of Information Studies, University of Ghana, Legon.

He is researching on the topic **"The role of ICT in the Dissemination of Information to Cocoa Farmers: Case of Breman Kuntanasi".**

Please assist him with the necessary information that he will need to undertake the research.

Thank you.

Yours faithfully,

Dr. Ebenezer Ankrah
Head of Department

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