UNIVERSITY FOR DEVELOPMENT STUDIES

EFFECTS OF ACCESS AND USE OF AGRICULTURAL INFORMATION ON YIELD OF MAIZE IN TOLON AND KUMBUNGU DISTRICTS OF THE NORTHERN REGION OF GHANA

BY

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DECLARATION

I declare that this thesis titled, **Effects of access and use of agricultural information on yield of maize in Tolon and Kumbungu districts of the Northern region of Ghana,** was composed by myself, that the work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree or professional qualification except as specified.

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Supervisor

I, hereby declare that the preparation and presentation of this thesis was supervised in accordance with the guidelines and supervision of thesis writing laid down of this university

Dr. Hamza Adam. …….. …….

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DEDICATION

I dedicate this thesis to God Almighty my creator, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. He has been the source of my strength throughout this program and on His wings only have I soared. I also dedicate this work to my parents; Mrs. Wilhelmina Kutah and Mr. Peter Kutah for their love, push and finance without which this may never have been possible. To my Spiritual Father, Rev. Appiah Wae Yaw, who encouraged me all the way and whose encouragement has made sure that I give it all it takes to finish that which I have started. My love for you all can never be quantified. God bless you.

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ABSTRACT

This study investigated the effect of farmers' access to and use of agricultural information on the yield of maize in the Tolon and Kumbungu Districts. Thirty-nine respondents were randomly selected from each of the five communities studied in each district for the study. Questionnaires and personal interviews were used in collecting data from 390 maize farmers sampled for this study. Secondary data was also obtained from SARI and IITA offices to compliment the primary data. Descriptive statistics namely percentages and frequencies as well as correlation text and probit regression were used to analyse the data. The study results revealed that, land ownership, timely information, importance of information, understanding of information, utilization of information, access to labour, access to credit and access to extension have significant influence on access to and utilization of agricultural information. The study further established that farmers in the study area mainly access agricultural information through radio, mobile phone, input suppliers and agricultural extension agents. The information farmers considered very important to their maize farming was planting time and proper storage practices of maize. Finally, the study established that farmer's access to and use of agricultural information had influence on the average yield per acre of maize. The research recommends that research institutions should identify and train input dealers in the various communities on improved maize farming methods. Government and other stakeholder responsible for the provision of improved agricultural information should offer training programme for lead farmers in the communities. Since lead farmers always interact with fellow farmers in their various communities.

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ABBREVIATION AND ACRONYM

FFS	Farmer Field School
GDP	Gross Domestic Product
IITA	International Institute of Tropical Agriculture
MDGs	Millennium Development Goals
MOFA	Ministry of Food and Agriculture
NGO	Non-Governmental Organization
RUT	Random Utility Theory
SARI	Savannah Agricultural Research Institute
TPB	Theory of Planned Behavior
UDS	University for Development Studies
UNDP	United Nations Development Programme

CHAPTER ONE

INTRODUCTION

1.1 Background

The agricultural sector of Ghana accounts for one-fifth of the country's Gross Domestic Product (GDP), the sector employs almost half of the workforce and is the main source of livelihood for households in Ghana (MoFA, 2017). The sector is significant to the country's sustainable long-term growth and development agenda. However, the rapid increase in the minerals and the oil and gas sector has affected the relative contribution of the agricultural sector to Ghana's GDP (Oduro & Doss, 2018). Despite the contribution of the minerals and the oil and gas sector to the economy, the agriculture sector still remains important to employment, income generation and livelihood enhancement, particularly among small holder farmers in the rural areas. The Agricultural sector employs about 45 % of the national labour force, exceeding any other sector of the economy (MoFA, 2015). The agricultural sector is essential to the livelihoods of the country's households and as such plays a role in employment and income generation (Dovie & Kasei, 2018).

Ghana's agricultural sector is dominated by smallholder farmers who hold small portion of lands scattered across rural areas in Ghana (Amadou et al., 2018). Majority of these smallholder farmers are into cereal production of which maize cultivation dominates (Deutsch *et al.*, 2018). In Ghana, maize is a major staple crop used as a substitute for other major cereals that are in short supply during the lean season (MoFA, 2016). This has

resulted to an increase in demand of maize for both domestic and industrial purposes (Codjoe, 2007).

The high demand of maize in Ghana for both domestic and industrial purposes have led to a radical approach in increasing production of maize through the development of improved maize farming technologies among farmers (Armar-Klemesu et al., 2018). After the development of these improved maize farming technologies by research institutions such as SARI, IITA and UDS, the innovations are expected to be disseminated to farmers in a coherent manner geared towards increasing adoption and production of maize by farmers. As it is evident that effective utilization of improved maize farming technologies adds to raising productivity leading to improvement in household income and livelihood enhancement of farmers (Simtowe, 2011). Also, utilization of information on improved farming technologies influences the increasing rate of agricultural output and ultimately impacts on the livelihood status of farmers (Meinzen-Dick et al., 2002).

Farmers' access and utilization of information on improved farming technologies is therefore essential in increasing yield of maize. Effective access to and use of information and knowledge are critical factors for rapid economic growth and wealth creation among farmers, and for improving socio-economic well-being of farmers (Benin et al., 2007). There is no doubt that farmer's access to and use of information on improved farming technologies are increasingly becoming the key drivers for socio-economic development world-wide. As noted by Dercon et al. (2007) farmers' access to and use of information on innovation will decrease farmers' likelihood of being poor by 10%. Also, Owens, Hoddinott and Kinsey (2003) observed that farmers access to and use of information on agricultural production increases the value of output by 15%. Generally, farmers access to

and use of information increases their income levels, assets, food and food security (Benin *et al.,* 2007).

Increase in farmers' access to and use of information directly influence farmers' livelihood, which translates into more income for the household, increase in household assets and improvement in the social capital of the farmers (Ojo, Bila & Iheanacho, 2013). In order to achieve agricultural development and enhancement of farmers' livelihoods, an effective information delivery system is needed to disseminate information to farmers (Swanson &Rajalahti, 2010). However, dissemination of information on new technologies and better farming practices to farmers can best be achieved through effective agricultural extension system (Owens *et* al., 2003).

In Ghana, the extension division under the ministry of food and agriculture is the sole unit responsible for information dissemination since independence (MoFA, 2017). However, in recent time's private extension service delivery have taken up the mandate of information dissemination to farmers due to the inadequate number of extension officers in the system and government inability to recruit more extension officers (MoFA, 2015).

The incorporation of private extension service delivery is to offer more cost-effective agricultural extension services to farmers. It is prudent to note that farmers require the services of extension officers on delivering best agricultural practices at the right time of the farming season (Aneani et al., 2011). Agricultural extension and other advisory services are expected to support farmers on agricultural production and facilitate their efforts to solving production problems, link farmers to markets and other players in the agricultural value chain and obtain information, skills, and technologies to improve their livelihoods

(Birner et al., 2009). In order to achieve effective information dissemination and extension services delivery, it will be imperative to understand farmers' access to and use of this agricultural information on improved farming technologies.

1.2 Research Problem

According to Aneani et al. (2011) agricultural extension services delivery are very important entities in the development of the agricultural sector in developing countries because of the role they play through provision of information and other support services to farmers. Agricultural extension services delivery continues to be a key facilitator to achieving food security and to reducing poverty of most of the rural population in most of the developing countries.

Research evidence show that the rural livelihoods are greatly enhanced by access to information on improved agricultural practices, market and weather (Saravanan, 2010). Agricultural information brings credible opportunities and has the potential of enabling the empowerment of farming communities with current happening in the agricultural sector leading towards enhancing livelihood of farmers in general (Saravanan, 2010). Also, research has shown that access to information by farmers at the right time is very essential to increasing agricultural productivity (Mgbada, 2006). Therefore, for farmers to function very well, they need constant information on agronomic practices, disease and pest control, postharvest practices, credit facilities and diversification of livelihoods (Mariano, Villano & Fleming, 2012). When farmers have access to information and effectively utilize it, there will be an improvement in agricultural productivity and ultimately lead to improvement in livelihood outcomes. In recognition of the benefits that agricultural information delivery

offers to farmers, government and some Non-Governmental Organizations (NGOs) have been disseminating information aimed at promoting maize cultivation and marketing.

Some of this information dissemination includes information on improved seeds, access to credit facilities, financial support and subsidies to maize value chain development and market facilitations (Avea et al., 2016, Dogbe et al., 2013).

Despite these efforts, made by government and some Non-Governmental Organizations (NGOs) towards increasing production outcomes and enhancing livelihood of farmers, there have been observed differences in production outcomes resulting in differences in livelihood outcomes because of the level of access to and use of information among farmers (Ojo et al., 2013). Most studies in the area of agricultural information mostly focus on farmers' access to information without considering the actual effects of agricultural information on agricultural production (Tilman et al., 2002; Aker, Ghosh & Burrell, 2016). Creating gap in knowledge on the effects of agricultural information on agricultural production. Thus, this research seeks to fill the knowledge gap in literature on the effects of access to and use of information on yield of maize. Hence, this study seeks to examine the effects of access to and use of agricultural information on maize yield among small holder farmers in Tolon and Kumbungu Districts of the Northern Region of Ghana

1.3 Research Question

1.3.1 Main Research Question

What are the effects of access to and use of agricultural information on the yield of maize among small holder farmers in the Tolon and Kumbungu districts of the Northern of Ghana?

1.3.2 Specific Research Questions

1. To what extent are agricultural information accessed by maize farmers?
2. What are the factors influencing farmers' access to and utilization agricultural information?
3. What are the benefits of use of agricultural information on maize yield in the study area?
4. What challenges are faced by small holder farmers in accessing and utilizing information on maize?

1.4 Objectives of the Study

1.4.1 Main research objectives

To determine the effect of farmers' access to and use of agricultural information on the maize yield among small holder farmers.

1.4.2 Specific research objectives

1. To assess the extent to which agricultural information accessed by maize farmers.
2. Determine the factors influencing farmers' access to and utilization agricultural information.
3. Determine the effects of the level of use of agricultural information on maize yield.
4. Establish the challenges faced by small holder farmers in accessing and utilizing information.

1.5 Justification of the Study

Findings of the study will serve as a guide to bringing about sustainable flow of information among all relevant stakeholders in the agricultural sector. Agricultural development requires much more of technology and since having access to agricultural information at the right time and the right time is the surest way to improving inflow, policy recommendations of the study will provide direction in bringing about increased accessibility and utilization of agricultural information among farmers and hence encourage the adoption of improved farming technology in the Northern Region and Ghana as whole.

The study will make suggestions that will serve as a guide for MoFA, research institutions and NGOs on how to target farmers through the use of available information source in the study areas.

Policy recommendations from the study will also serve as a blue print for research institutions to integrate information policies and strategies regarding improved farming technologies in order to enhance agricultural production and improve the standard of living of the people in the Northern Region of Ghana. Finally, the study would also contribute to knowledge since there is lack of knowledge on the study of factors that affect maize farmers' access to and use of agricultural information as well as its implication on their maize yield.

1.6 Definition of Key Concepts

Information: External and internal knowledge that flow among farmers to enable them make decisions on their farming activities.

Innovation: A practice that is perceived as new by farmers.

Access to information: Access to information is when farmers are able to acquire the information from different sources with the motive of improving their farming activities.

Use of information: Using of the information is when a farmer hears information and uses immediately for his/her production purposes.

Smallholder Farmers: These are group of farmers who cultivate between 0.5 to 5 acres of farmland (Agarwal, 2018).

1.7 Organization of the study

The thesis is organized into five chapters. Chapter one deals with the introduction of the study. It focuses on the background of the study, problem statement of the research, objectives and questions of the study, the justification of the study and definitions of key terms used for the study.

The chapter two reviews and discusses literature relevant to the topic to establish a theoretical approach for the research. The areas of literature considered very relevant to the study and provides enough evidence for analytical discussion to support the study.

Chapter three focuses on instruments used to collect needed information for this study, it also presents research design, sampling procedure, data collection and analysis.

Chapter four presents result and discussions of findings of the research within the context of the study objectives. It discussed findings on farmers' socio-demographic characteristics, the factors influencing farmers' access to and utilization agricultural information, the types and source of agricultural information access by maize farmers, the effects of the level of use of agricultural information on maize yield and the challenges faced by small holder farmers in accessing and utilizing information.

Chapter five, the last chapter, focuses on conclusions, implications and recommendations base on the findings of the research.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter reviews related research which are relevant to this study. The chapter is divided into two parts. In the first part, the theoretical concepts that guide the study are discussed. Then in the second part of the chapter, related studies are reviewed. Thus, meaning of agricultural information, Forms of Agricultural Information Farmers Access, Sources of Agricultural Information Used among Farmers, Information sharing and communication network among Farmers, Determinants of farmers' access to agricultural information and Agricultural Information Use and Livelihood outcomes

2.1 Diffusion of Innovation Theory

Diffusion of innovation is a communications theory that suggests an explanation on the processes, the motive and the degree at which new ideas and technology spread through a society (Dearing, 2009). The diffusion of innovation theory developed by Everett Rogers in 1962 is significant to this study because the research is geared towards understanding how farmers access to and use of agricultural information affects their farm yield. There are many theories that deal with the generation of innovations, and their diffusion and adoption or non-adoption by a public. Such theories include the technology acceptance theory, theory of reasoned action, and diffusion of innovations theory (Rogers, 2003). Among the theories, Rogers (2003), claims the diffusion of innovation theory is the theory

that has dominated the understanding and practice of agricultural innovation all over the world for more than half a century.

The theory has been used widely to study the spread of a variety of new ideas, practices, programs, and technologies across several fields. This theory offers insight into approaches for agricultural information sharing and rural community capacity building (Dearing, 2009). From the above, the researcher can conclude that the Diffusion of Innovation Theory is the best fit theory for examining the introduction and spread of information on new agricultural technologies among social groups such as farmers. Hence, this study will use the theory in investigating how farmers access to and use of agricultural information affects their farm yield in the study area.

2.1.1 Elements of Diffusion of Innovation Theory

Diffusion of innovations among individuals is considered important in the life of society because it is relatively difficult to develop useful innovation necessary for the advancement of societies (Rogers, 1995). Developing an innovation usually take more time and require more resources than transferring an already established innovation from one environment to another. Rogers (2006) stated four main elements of diffusion of innovation theory. These are:

A) Innovation

An innovation is an idea or practice that is perceived as new by an individual or unit of adoption (Rice & Atkins, 2009; Roger, 2003). Rogers (2006), noted that, the successful adoption of a particular innovation should score higher in terms of its relative advantage

over existing practices, compatibility to users' needs, trial ability and observability, and lower in its complexity to use.

The relative advantage of one technology over another is a main determinant of the adoption of new technology. The issue of relative advantage has been shown to have a positive relationship with adoption of innovation (Roger, 2003). Users need to be shown that access to agricultural information offers considerable benefit compared to non-access to agricultural information. Compatibility of the innovation needs to align with individual's current values and experiences with regard to access to agricultural information. The more compatible agricultural information will be to farmers the less a change of behavior is required, therefore, allowing for faster usage of agricultural information on maize production. If agricultural information usage requires to adjust their existing behavior or is in contrast to their attitudes the more unlikely not to use the information. In addition, farmers previous experience on access to agricultural information in maize farming, whether this was a positive or negative experience will also influence on farmer's information usage. A negative previous experience can negatively impact the usage of information.

Another dimension of diffusion of innovation theory is trialability, trialability is the extent that the innovation can be tested and experimented before its inclusion. Farmers' access to information on the benefits of agricultural innovation can help farmers experiment usage of agricultural innovation on their farms, before making a decision to either use or not use an innovation on their farms. The complexity (its ease of use) of agricultural innovation will also impact on usage. If the use of agricultural innovation requires considerable practices it is less likely that farmers will persevere with an innovation usage. In addition,

the perceived complexity of the technology can lead to increased uncertainty and perceived risk, and these in turn could lead to a resistance to usage (Ebojei, Ayinde & Akogwu, 2012).

The introduction of agricultural innovation such as row planting, zero tillage and fertilizer application must be visible and the effects that it has on farming must also be visible for other farmers to notice. Overall, for agricultural innovation to be adopted into farming, it needs to show relative advantage, compatibility and lack of complexity. In addition, users, especially farmers need to see agricultural innovation in action and be given a chance to try out this technology themselves. According to Rogers (2006), the higher the observability and communicability of results, the higher would be the rate of adoption.

Once the innovation is disseminated to individuals in a society, a decision is taken on whether to adopt or reject it. An individual's decision to adopt an innovation is not taken immediately, but the process consists of series of actions and choices by the individual over time (Rogers, 2006). The innovation decision process is the process through which an individual or other decision making unit passes from first knowledge of an innovation to forming an attitude towards the innovation, to a decision to adopt or reject an innovation.

Rogers (2003), explained the innovation decision process to consist of five stages:

i) Knowledge stage: This is when the person becomes aware of the existence of an innovation through various communication channels, and gives it some attention.

ii) Persuasion stage: At this stage, a person develops a favorable or unfavorable attitude towards the innovation. Here, the person actively seeks information about the innovation.

iii) Decision stage: This is when a decision is taken whether to adopt or reject the innovation by the person. Adoption means the person has decided to make full use of the innovation while rejection means a decision has been taken not to adopt the innovation.

iv) Implementation stage: Here, the person applies the innovation, leading to behavioral change. But at this stage, the person still keeps some amount of doubts about the expected consequences of the innovation.

v) Confirmation stage: At this stage, the person will seek to strengthen the decision to adopt or reject the innovation, avoiding all forms of conflict.

B) Communication Channels

A communication channel is the means by which message about agricultural innovation is shared among two or more individuals. According to Roger (2003), the two important types of communication channels that would help the communicator in diffusion of innovations are and mass media and interpersonal channels.

i) Mass media includes: radio, video and internet (computer) which enable messages to reach a larger, diverse audience simultaneously within a shorter duration. They are used mainly for awareness creation.

ii) Interpersonal channels include: face-to-face communication between two or more individuals. These channels are the means for persuading individuals to accept a new idea. These channels include neighbors, extension agent and friends.

Rogers' (2003), noted media alone are limited in their effectiveness towards individual or social change. Rather the media's role in spreading new information works perfectly if they complement other means of communication, particularly interpersonal.

Mass media channels are necessary to spread information on awareness of innovation and practices, but, when it is time to decide whether to adopt or not, personal communication is far more effective (Servaes, 2002).

C) Time

Rogers' (2003), noted that, it takes time for an innovation to diffuse throughout the social system. When an agricultural innovation is introduced into a social system, not all farmers within the society adopt it instantly. Some will adopt it immediately, whiles others will adopt it later. Those who adopt the innovation early influence other members of the social system to adopt the innovation, and they in turn influence others and it goes on.

i) Innovators: According to Rogers (2003), innovators are the 'techies', the experimenters who have technology as a central interest in their lives and pursue new technology as soon as it appears, no matter what its function is. Usually, they are the youngest among the population, possessing the highest social class, are fairly well resourced financially, are very social, have close contact to scientific sources and those introducing the innovation.

ii) Early adopters are the 'visionaries' who blend an interest in technology with a concern for significant professional problems and tasks. Among this population, you will find the largest number of opinion leaders compared with the other four categories.

iii) Early majority: They only adopt the innovation after consulting with those who have adopted it earlier. They have above average social status, they are rarely opinion leaders, and tend to spend a lot more time considering when to adopt than innovators and early adopters.

iv) Late majority are the conservatives. They share the attitude of the early majority, though being less comfortable with technology. Those in this category will adopt the innovation, only after average society members have adopted it.

v) Laggards are the final category of people to adopt an innovation. These persons are characteristically always against change in the society, and usually the elderly in society. They are very traditional in their approach to things, most likely of the lowest social status, and are the least worthy persons.

D) Social System

A social system is a set of individuals, informal groups or organizations that are engaged in solving a common problem or in accomplishing a common goal. Diffusion of an innovation happens within a social system. Here, the spread of an innovation would obviously be affected by the social system. Two key factors affect the diffusion of innovation within a social system, according to Rogers (2006). First is the complexity of the technology, and secondly the nature of the social system. Diffusion of agricultural innovations at the village level depends upon the structural characteristics of the village or social system, which may be homogenous or heterogeneous. The homogenous village may have population similar in social characteristics like social grouping, religion and culture, whereas a heterogeneous village may have population varied in the characteristics.

2.2 Theory of perceived attributes

The theory of perceived attributes is based on the view that individuals adopt an innovation with perceived attributes (Nutley et al., 2002). Initially, the innovation must have some relative advantage over an existing innovation or the status quo. Secondly, there must be compatibility with existing values and practices. Thirdly, the innovation should not be too complex. Fourthly, the innovation should be trial-able which means the innovation can be tested for a limited time without adoption and finally, there must be observable results in the adoption of the innovation (Rogers, 2006).

Some studies have been conducted using this theory to examine factors that influence farmers' adoption of agricultural innovation. Some include conservation practices, precision technologies and conventional agricultural practices (Floyd *et al.*, 2003; Weir, & Knight, 2004). The results are inconclusive in either fully supporting or rejecting the theory's effectiveness in explaining adoption behavior. Nevertheless, there appear to be a constant association between this theory, economic and social psychology theories. The innovation diffusion theory explains farmer behavior more effectively when used in combination with the economic and social psychology theories (Floyd, 2003). This research explores the channels maize farmers rely on as sources of information for their activities.

2.3 The Theory of Planned Behavior

The Theory of Planned Behavior (TPB) (Ajzen, 1985) builds upon the Theory of Reasoned Action (TORA) which states that, a person's intention is a function of two basic determinants; the first one is a personal factor (an individual's positive or negative evaluation of performing the behaviour) and the second one reflects social influence (the

person's perception of the social pressures put on him to perform or not to perform the behavior in question) (Azjen, 1985). For instance, if people evaluate the suggested behavior as positive (attitude), and if they think their significant others want them to perform the behavior (subjective norm), this results in a higher intention (motivation) and they are more likely to do so.

Burton (2004) asserts that, the theory of planned behavior (TPB) was created in order to include socioeconomic, socio-cultural, psychological and economic approaches into the behavioral analysis. According to Ajzen (1991), behavioral intentions are a function of three components: attitude toward a behavior, subjective norms (social pressure), and perceived behavioral control (self-confidence) which is a measure of a person's perceived ability to perform a behavior and ability is intended to incorporate a person's consideration of resources and opportunities that are recognized as conditional for the performance of some behavior. The TPB proposes that behavior is predicted by the strength of an individual's intention to behave the way they do.

Attitudes, subjective norms and perceived behavioral control are assumed to be predictable from an individual's beliefs about the behavior. Behavioral intentions have been defined as the subjective probability that an individual will engage in a specified behavior (Fishbein & Ajzen, 1975).

Intentions encompass all the motivation factors that affect behavior and indicate how much effort an individual will exert to perform behavior. According to Ajzen (1991) intentions are considerably accurate in predicting behavior. Thus, the theory predicts that the stronger an individual's intention to perform behavior, the more likely the individual will engage in that behavior.

Attitude towards the behavior refers to the individual's positive or negative assessment of engaging in the behavior. An individual's attitude is a multiplicative component consisting of the individual's strength of belief associated with the behavior and the individual's subjective evaluation or weighted importance of the beliefs attribute.

The theory predicts that as the individual perceive the behavior as favorable, he or she will more likely intend to perform the behavior (Fishbein & Ajzen, 1975). A subjective norm (SN) refers to the individual's perception of the social pressures to engage or not to engage in the behavior. To be precise, it encompasses an individual's perception of whether or not to engage in the behavior as seen from his or her significant others.

Perceived behavioral control (PBC) refers to the individual's perceptions of the ease or difficulty of performing the behavior. It predicts that the more an individual perceives that he or she has control, the more likely the individual will intend to engage in the behavior (Fishbein & Ajzen, 1975). An assumption underlying TPB is that most human behavior is rational. TPB help us to explore the rationality that underlies the individual's decision to engage, or not engage, in behavior.

Attitudes, subjective norms and perceived behavioral control are shown to be related to a set of salient behavioral, normative and control beliefs about the behavior (Azjen, 1991). The behavioral belief refers to an individual's positive or negative evaluation of self-performance of the particular behavior. That is the degree to which performance of the behavior is positively or negatively valued (perceived benefits or consequences of taking the desired action). The normative belief refers to an individual's perception about the particular behavior, which is influenced by the judgment of significant others e.g., other

farmers', input dealers, friends and family members (perceived opinions of others regarding one's performance of the behavior).

Control belief refers to an individual's beliefs about the presence of factors that may facilitate or hinder performance of the behavior (Ajzen, 2001). The behavioral, normative, and control beliefs are influenced by a variety of socio-demographic factors, such as social, cultural, personal and situational factors are stated as the main reasons for the introduction of TPB (Burton, 2004). Thus, the theory of planned behavior is important to this study in the sense that there could be other external factors that may prevent a maize farmer from using agricultural information on he/she farm.

2.4 Theory of Motivation

Motivation has been measured to be consisting of three psychological variables. First, energizing or triggering behavior, which is a cognitive process that gets individuals engaged in or turned off toward doing something. Secondly, guiding behavior, which describes why one course of action is chosen over another. Thirdly, regulating persistence of behavior, which describes why individuals persist towards goals (Alderman, 2004). Armstrong (2006) likewise discussed three constituents of motivation that are direction, effort and persistence.

Valence, Instrumentality and Expectancy (VIE) looks at the role of motivation in the overall work environment (Vrooms, 1964). The theory, claims that people are motivated to work when they believe that their efforts in the workplace will result in a desired outcome which was assumed by Vrooms in three folds (Robbins & Judge, 2008).

Expectancy: Expectancy can be described as the belief that higher or increased effort will yield better performance. This can be explained by the thinking of 'If I work harder by doing things that will help boost my yield, I will make something better'.

Conditions that enhance expectancy include having the correct resources available, having the required skill set for the job at hand, and having the necessary support to get the job done correctly.

Instrumentality: Instrumentality can be described as the thought that if an individual performs well, then a valued outcome will come to that individual. Some things that help instrumentality are having a clear understanding of the relationship between performance and the outcomes Valence means "value" and refers to beliefs about outcome desirability. There are individual differences in the level of value associated with any specific outcome. For example, the yield from a maize farm will not be what will motivate a maize farmer but rather what other farmers will say about his farm when they see it doing well. Valence can be thought of as the pressure or importance that a person puts on an expected outcome. The VIE theory stipulates that causal relationships exist between motivational process, levels of expended efforts, achieved performances and allocated awards. In the context of this study, motivation theory helps understands the motives that drives farmers to accessing agricultural information for their farming activities in the study area.

2.5 Meaning of agricultural information

According to Adereti, Fapojuwo and Onasanya (2006) information is defined as data that have been put into a meaningful and useful context which is communicated to a recipient who uses it to make decisions. In order words, agricultural information was categorized into two broad groups by Umali (1994). He categorized it into pure agricultural information

and agricultural information inherently tied to new physical inventions. Pure agricultural information can be used without the compliment of any specific physical technology. It includes practices like production techniques, farm management, marketing and processing and community development. In order words, agricultural inventions or technologies are those that come in the form of agricultural inputs, management technologies facilitating farm management, and marketing and processing equipment.

2.6 Types of Agricultural Information Farmers Access

According to Drahos and Braithwaite (2017) though knowledge is produced through agricultural research, it is not the only means for knowledge generation. Learning from experience, interaction and farmers' experimentation are other sources. Cook, Lacoste, Evans, Ridout, Gibberd and Oberthür (2018) indicated that farmers have been innovators for centuries, based on their own on-farm experimentation. Information needs of farmers should be organized to meet their conditions and priorities (Kiplagat & Ochola, 2005). This is important as farming practices change over time due to factors like population pressure, availability of markets, climate change, change in production technologies and channels of transferring information. In addition, farmers have priorities on the enterprises that they consider more useful than others. Their priorities are also dictated by other factors like the resources available, weather patterns, soil types, social set up, markets and information sources available to them.

Farmers need information that is specific to their production activities and as stated in the study of Kiplagat and Ochola (2005) these include information on climate and weather patterns, agricultural inputs, agronomic practices, water harvesting, pests and diseases

management, post-harvest and value addition technologies. In addition, farmers require to be updated on the agricultural policies and how they will affect their production activities. According to Evanson and Mwabu (2001) information is needed to improve production techniques of crops and livestock that include land preparation, crops spacing, appropriate varieties, pest management, livestock production, acquisition of credit facilities and marketing of agricultural products, farm record keeping and basic accounting procedures including calculations of profits and losses.

A study commissioned by the World Bank (2006) notes that, in the absence of information, smallholder producers face problems of poor information selection that limit the performance of agricultural commodities and input markets and in turn the participation of small producers in these markets.

2.7 Sources of Agricultural Information Used among Farmers

Townsend (2017) defines information source as an institution or individual that creates or brings about a message. Thus, some effective and efficient information source offer farmers the ability to increase the amount of information they (farmers) need for their farming activities. An effective information source helps to facilitate knowledge awareness, acquisition, understanding, and information flow within and among a variety of agriculture networks including researchers, extension services, and farmers.

According to Boz and Ozcatalbas (2010) family members, neighbor farmer, extension services, input providers and mass media were key sources of information for farmers. Also, Majeed, Farooq, Shah and Zaman (2017) revealed that farmers mostly prefer to source for information through fellow farmers, printed material, television and private sector. Furthermore, Benard, Dulle and Ngalapa (2014) identified interpersonal sources

such as family/parents, personal experience, neighbors or friends and agricultural extension officers' as the major sources of information probably because of their readily availability and accessibility. The print media, fellow farmers and television were identified by Rehman *et al.* (2013) as the most common sources of information while sources, like extension field staff, private sector, radio, and NGOs were the least common.

Kajogbola (2004) revealed that the most common information methods preferred and used by farmers are video show, radio programme and mobile phones. Another research conducted by Ndaghu *et al.* (2013) identified radio, a mass information tool as the most popular source of method among respondents surveyed. Majority of the farmers indicated that their information needs were satisfied through the radio channels. This was attributed to various factors including the high level of literacy of farmers, availability and accessibility of the radio channels and easy language comprehension. The study showed the use of radio in spreading agricultural information among farmers is increasing at a faster rate than personal contacts by extension workers.

An analysis of the Malawian government's agricultural policy launched in year 2000 revealed the policy made vast use of mass media particularly radio in disseminating information to farmers (Farm Radio International, 2010). Radio was one of the key components under the policy to provide relevant and appropriate information to farmers in Malawi through a number of channels. The study by Farm Radio International revealed that new techniques such as phone-in programme, live community forums, and radio diaries are making radio a more interactive medium and providing farmers with a real voice and information. However, farmers' reliance on interpersonal media for agricultural information instead of mass media was evident in another study by Oto and Dauda (2011)

in the Benue State in Nigeria, which assessed farmers' use and preference of agricultural extension communication channels. Majority of the respondents indicated use of radio in obtaining agricultural information but only 10.44 percent of them indicated they regularly apply what they hear in their work, while 56.33 percent indicated that they used it only some times. The study found that interpersonal communication channels of disseminating agricultural information were generally more available and accessible for use by farmers than the mass media.

Specifically, the study found that relatives, friends and neighbors of farmers, as well as extension agents were the main sources of farmers' information, although a government runs programme had been ongoing in the community to encourage the use of radio to educate farmers.

A study by Tadesse (2008) examined the participation of farmers themselves in the spread and used of agricultural information in Ethiopia. The respondents were asked to explain their involvement in the dissemination of the agricultural information they had obtained to other farmers and neighbors. The result showed that, most of the respondents participated in local information exchange during community meetings, social gathering time, religious sessions and when they met in places like markets. These results confirm that local information exchange network plays important role in the dissemination of simple and easily understandable agricultural information like the need to use government-approved chemicals on one's farm.

The results of a study by Ndilow (2013) that investigated how ideas of new agricultural practices are disseminated to farmers under the Malawian Agriculture Development

Program Support Project showed both personal and non-personal means of information dissemination are necessary to properly impact farmers with agricultural information. The research established that farmers receive messages through a variety of interpersonal information means. These include accessing information through extension agents, using the lead farmer concept, accessing information through village meetings and accessing information through field days. Farmers also receive messages through electronic media (radio), although it has not been so much utilized under the project. Print dissemination through the use of leaflets is also common under the project.

The study thus recommends that agricultural information methods including print, electronic and interpersonal need to be taken into great consideration if interventions for developing agriculture are to be successful. It recommended that the Ministry of Agriculture streamline the management of all stakeholders involved in the dissemination process on the project so as to achieve harmony and consistency in message development and dissemination.

O'Sullivan and Carr, (2018) divides the sources of information into two main groups interpersonal and impersonal. Face-to-face exchange of information between individuals is regarded as interpersonal, whereas mass media sources are known as impersonal methods enabling one or a few persons to reach many addressees at a time

The review of the above literatures informed the researcher about the several available sources of accessing information. It also showed regular sources of agricultural information for farmers are usually influenced by a number of factors including literacy, availability of technological tool among many.

2.8 Information sharing and communication network among Farmers

Communication can be defined as "the exchange of messages" between two or more partners, or establishing "commonness" between two or more parties through a particular medium, or an active, dynamic process in which ideas and information are exchanged leading to modification of people's knowledge, attitudes and practices (Tadesse, 2008). To boost the productivity of farmers there is the need for information exchange, though gaps exist between the knowledge of the people in a system and not all people will have the kind of knowledge and information to produce efficiently.

In order to close this gap Mai (2016) suggested that governments should facilitate the sharing of information through training, media publications, leaflets, and the opening of educational institutions and secondary the sharing of the information through individuals. To strengthen these information exchanges, extension can serve as information source and information exchange facilitator. The learning opportunities among farmers are the main (informal) means for information dissemination across a community. Thus, agricultural extension service is expected to contribute to the well-functioning of the existing local information exchange, taking into account the diverse sources of information.

2.9 Determinants of farmers' access to agricultural information

The accessing and use of agricultural information by farmers are influenced by behavioral and socio-economic factors, behavioral factors includes reliability, relevance, accuracy, usability, timeliness of the information and the information dissemination process (Glendenning, Babu & Asenso-Okyere, 2010; Acheampong et al., 2017). The other factors include sex, age, marital status, educational level, household size, farming experience, farm

size, type of farm ownership, labour availability, engagement in off-farm work, and the cultivation of additional crops (Mosha et al., 2018).

2.9.1 Gender

Gender of the household head is a factor that limits access to agricultural information and its use. Women are traditionally occupied by household chores whiles the men have the liberty of mobility, participate in different meetings and trainings consequently have greater access to extension services. Male-headed households tend to build and maintain larger network ties with relatives and friends than female-headed households (Bedeke, Vanhove, Gezahegn, Natarajan & Van Damme, 2018).

Nambiro, Omiti & Mugunieri (2006) in assessing access to agricultural extension in Sub Sahara Africa found out that sex is an important determinant in the seeking of agricultural information. Male farmers sought for agricultural information than their female counterpart. A positively significant relationship was established between sex of household head and adoption of improved agricultural technologies in the cultivation of Irish potatoes (Namwata, Lwelamira & Mzirai, 2010). In order words, Akudugu, Guo and Dadzie, (2012) found out that there was no significant relationship between sex and access to agricultural information.

2.9.2 Age

Age describes how long a person has been in existence. Young farmers are enthusiastic to get knowledge and information than older farmers. It might also be that older farmers want to avoid risk and are not likely to be flexible than younger farmers and thus have a lesser likelihood of information utilization. But some studies report different results; Dunn and Holtz-Eakin (2000) noted that older farmers being more experience and have accumulated

more capital as a result they are more likely to invest in innovation. Likewise, Yenealem (2006) reported positive relationship between age and adoption behavior of farmers. However, Haba (2005) suggests that older people were unwilling to pay for agricultural information delivery technologies such as print, radio, farmer-to-farmer, expert visit, and television. He revealed that, as age increased, the willingness to pay for these agricultural information delivery technologies decreased, meaning that older farmers were less willing to get information than younger ones. Old age also increases with conservativeness and negatively impact on adoption while young farmers tend to be more innovative and risk adverse (Zhang, Li, Xiong & Xia, 2012; Adesina, Mbila, Nkamleu & Endamana, 2000). According to Deribe (2007) on diary women farmers proved that age has a negative influence on agricultural information network of farm women. The study is that older women do not seek many new ideas, since they try to conform to practices they have followed for a long time in their life. Ayele & Bosire (2011) also found out that both younger and old tried new things introduced to them thus there was no significant relationship between age and the use of improved inputs and practices.

2.9.3 Marital Status

Marriage is considered as an important social institution in the Ghanaian society can be found in every human culture. Nambiro, Omiti and Mugunieri (2006) working on the topic "Decentralization and access to Agricultural Extension services in Kenya" established that the marital status of farmers significantly influenced their access to extension services. Opara (2008, 2010) also suggested that there was a positive association between marital status and agricultural information access and use.

Though, marital status of the farmer was found by Koskei, Langat, Koskei and Oyugi (2013) to negatively affects the probability of access to information, signifying that the unmarried farmers had access to agricultural information more than married farmers which could be attributed to the fact that un-married farmers take part in more social activities due to limited responsibilities, while married farmers stay in house to attend to family issues.

2.9.4 Education

Education for farmers is generally associated with receiving and absorbing of agricultural information and use of the information. Education is believed to increase farmers' ability to obtain, process and analyze information disseminated by different sources and helps him/her to make appropriate decision to utilize agricultural information through reading and analyzing in a better way (Huggins & Valverde, 2018).

The ability to read and understand sophisticated information that may be contained in a technological package is an important aspect of access to agricultural information (Zuta, 2009). Rehman *et al.* (2013) found out that education of respondent had a significant relationship with their access to agricultural information; an increase in the educational level of the respondents increased their access to agricultural information.

Better education according to Okoye *et al.* (2008) would lead to improved access to knowledge and tools that enhance productivity. However, Maumbe and Okello (2013) established that irrespective of farmers' educational level it had no influence on their access to agricultural extension services.

With regards to the use of agricultural information, Ofuoku *et al.* (2008) posit a positive significant relationship between level of formal education of fish farmers and information

use. According to Gatew, Zewde, Kassa, Chanyalew and Gazu (2018) education is expected to create a favorable mental attitude for the acceptance of new practices especially of information-intensive and management intensive practices.

2.9.5 Household Size

The household is the number of individuals eating from the same pot of the family. It is usually agreed that increase in household size comes with extra hands to work on the farm thus more use of agricultural innovations. On the other hand, increase in household size also put extra burden on the family as not being able to invest in the farm. Koskei et al. (2013) asserts that an increase in size of household increases the probability of access to information.

The increases in household size put pressure on the demand for household needs and hence the need to produce more for family and earn more to cater for the household which could lead to agricultural information seeking and use. Techane (2002) has also found family labour as positively related to intensity of fertilizer use which is determined by the family size. However, Christiaensen and Demery (2007) established no significant between household size and agricultural extension services access.

2.9.6 Farming experience

Farming experience is the number of years the household has spent with that particular crop. The number of years spent in farming is a very important household related variable that has a relationship with the production process. Longer farming years comes with accumulated farming knowledge and skill which contributes to the use of agricultural information (Namwata, Lwelamira & Mzirai, 2010).

Siddiqui & Rahman (2007) also claims that experience in a particular activity equips the individual and makes the person more matured to take right decision. Bekele and Drake (2003) also assert that number of years the farmer has being farming on his/her owned his farm is assumed to influence the investment behavior. However, Glover and Kusterer (2016) posit that farming experience has no relationship with access to extension services. Rehman et al. (2013) also establish a non-significant relationship between agricultural information access and farmers years in farming in Pakistan.

2.9.7 Farm Size

Farm size is the measure of the total land area under cultivation. Rehman et al. (2013) in studying effects of farmers' socio-economic characteristics found a highly significant relationship between size of land holding and farmers access to agricultural information. Likewise, Samian, Mahdei, Saadi and Movahedi (2015) who also found a highly significant relationship between land holdings of the respondents and their access to information.

Farmers with large farm sizes are usually wealthy and there is more likelihood that they would readily use any high inputs innovation. Large farm size facilitates easy realization of the benefits due to economy of scale (Zhang et al., 2012).

Mwangi & Kariuki (2015) found a significant positive relationship between farm size and farmers' usage of modern agricultural production technologies, the bigger the size of a farm, the higher the probability for adoption of current ideas by farmers.

2.9.8 Off-farm work engagement

Off-farm activities, defined as the participation of individuals in remunerative work away from a "home plot" of land, is seen as an important tool in sustainable development and poverty reduction, especially in rural areas (Newton, Miller, Byenkya & Agrawal, 2016).

Since farming is a seasonal activity, off-farm occupation comes in with extra income to support the household needs and investment on the farm. Davis (2003) states that off-farm employment is an alternative source of income for farmers, thus a way to boost rural economic activity and employment in many developing countries. Off-farm income was noted to have a positive relationship with access to agricultural information by Koskei et al. (2013) in their study Determinants of Agricultural Information Access by Small Holder Tea Farmers in Bureti District in Kenya". This implies that the more a farmer earned from off-farm work they are likely to look for information to invest in their tea farms. Income from non-farm activities has been found to increase the farmers' probability to invest in new technologies (Diiro & Sam, 2015). However, Akudugu et al. (2012) found out that off-farm activities had a negative relationship with adoption of technologies, because they are likely to interfere in the other activities that the farmer is carrying out.

2.9.9 Farm ownership type

Ownership of one's own farm normally comes with an enthusiasm to invest in it since all the benefits would accrue to you than doing a shared cropping. In agreement with this assumption, Tenaw, Zahidul and Parviainen (2009) noted that, farmers naturally do not feel sound emotionally when they are not cultivating on their own land and as such do not invest in land development and will not use inputs efficiently.

Kyomugisha (2008) also found land ownership as a major factor influencing investment into land to boost productivity. He states that, land owners invest in soil management practices than tenant farmers and other occupants.

Akinola & Adeyemo (2013) also revealed that land use and ownership affected yam output implying that farmers that owned land are able to adopt technologies that will enhance their yields than sharecroppers.

2.9.10 Labour availability

Studies such as Adelaja and Hailu (2008) state that improved practices require lots of labour and hence the household with relatively high labour force uses the technologies on their farm lands more than those with low labour force. Also, Nandi, Haruna and Abudu (2012) inferred from the positively significant relationship between labour availability and adoption of Agricultural innovation and concluded that labour availability is a requirement for technology adoption which increases the yield of farmers. Beshir (2014) also found a positive relationship between labour availability and intensity of use of improved forages as improved practices are labour intensive.

2.9.11 Additional crops cultivation

Crop diversification is one of the coping mechanisms of food security, production and market risks. Growing of other crops such as cassava, vegetables among others helps farmers feed their families, thus the little income from the major crop on the farm. Crop diversification also serves as additional source of income apart from the main crop maize. For example, diversification was the single most important source of poverty reduction for small farmers in South and Southeast Asia (FAO & World Bank, 2001).

Aneani, Anchirinah, Owusu-Ansah, and Asamoah (2011) argues that diversified maize cultivation into growing other crops to earn additional income apart from maize and also ensure food security and income stability (MASDAR, 1998)

2.9.12 Group membership

A farmer's association with other farmers is a means of sharing knowledge, information and other resources. Farmers who belong to a group are exposed to the resources of their colleague farmers such as their experience in farming, successful practices on their farms and many more. Belonging to a group serves as a contact for services provided for groups such as extension services, loans and agro-inputs. Rogers (1995) concludes that: the heart of the diffusion process consists of interpersonal network exchanges between those individuals who have already adopted an innovation and those who have not are then influenced to do so. In agreement with this assumption, Conley and Udry (2010); Bandiera and Rasul (2003) stated that group membership increases the capacity of an individual to access information about current innovation and its benefit from other members. It also increases individual farmer's awareness and as a result increases the likelihood for adoption of new technology. Group participation was found to stimulate information exchange among members as a result of each other's experience and knowledge (Katungi, 2006).

Ofuoku et al. (2008) identified group membership as significantly related to information usage because farmers influence each other in a group as a result of experience shared.

2.9.13 Distance to market

Distance to market is a factor that influences access and use of agricultural information and inputs. Longer distances to inputs shops tend to make prices high thus constraining poor farmers from purchase. Regular visits to the market make farmers aware of new technologies and serves as a platform to share information with other farmers from other localities. The closeness of the market to farmers is a great catalyst for farmers to receive information (Negash, 2007).

Distance to market was found by Bulale (2000) to have had a significant effect on the adoption of crossbred dairy. Yenealem (2006) also show that market distance is negatively and significantly related to adoption decision. Ayele & bosire (2011) also opines that, distance to nearby markets negatively influenced farmers' access and use of inputs as it adds cost to purchasing inputs implying that longer distances come with higher prices of inputs hence reducing the use of agricultural information by farmers.

2.9.14 Access to credit

Smallholder farmers are often financially constrained, thus access to credit in the form of money or farming inputs will go a long way in the search and use of agricultural information by farmers. Availability of credit is important if improved technology in the form of purchased inputs is to be available to farmers, especially small-scale producers. Inputs such as improved seed, agrochemicals and fertiliser require capital in the form of short-term production credit. Access to credit can relax the financial constraints of maize farmers. There are different reports of significant positive influence on the adoption behavior of farmers regarding improved technologies (Tesfaye, Tadesse & Tesfaye, 2001). Ayele and Bosire (2011) found out that access to credit had a positive impact on the use of improved agricultural inputs as it helped farmers to access seeds, fertilizers and other inputs.

Akudugu et al. (2012), established a significant relationship between adoption and credit. The study argues that credit helps farmers to purchase most modern technologies, which are expensive, thus, difficult for many rural farmers, who are normally poor to acquire and utilise them without assistance in the form of supply of affordable credit and other financial services (Benin, Mogues, Cudjoe & Randriamamonjy, 2009). For instance, it has been

reported that most small-scale farmers in the country are unable to afford basic production technologies such as fertilizers and other agrochemicals resulting in low crop yields due to poverty and limited access to credit (MoFA, 2010).

2.9.15 Access to agricultural information and its use

Access to agricultural information and its use could be highly influenced by farmers' orientation towards improved farming. It included farmers' attitude towards improved farming practices, farmers' innovation proneness, farmers' achievement motivation and their information seeking behavior. According to Toma el al. (2018) farmers accessing agricultural information at the right time stand and using it the chance of increasing their farm productivity.

2.9.16 Information seeking behavior

This variable reflects the degree at which the respondent was eager to get information from various sources on different agricultural activities. Owolade (2008) explains that information-seeking behavior as the totality of human behavior in relation to sources and channels of information sought. Kathuri and Shivoga (2010) advocates for the need for farmers to possess good information search behavior in order to enable them to adopt improved production technology.

Owolade (2008) mentions that vast information available for use by farmers who are interested in increasing their productivity, but they exhibit diverse information seeking behavior, some having a high seeking behavior whiles others do not and the difference in their attitude thus affect the information sought after and their productivity. Sharing

problems, asking and weighing options exposed people to a variety of hygiene and sanitation information than people with no such behavior (Regassa, Sundaraa & Ketsela, 2011). Tadeg, Mohammed, Asres and Gebre-Mariam (2005), established that as information seeking behavior of farmers' increases, their utilization of accessed information also increases.

2.9.17 Attitude towards improved farming practices

According to Kearsley (2008) attitude is a "disposition or tendency to respond positively or negatively towards a certain thing (idea, object, person, and situation). They are closely related to our opinions, beliefs and are based upon our experiences". Attitude simply refers to "a person's evaluation of any psychological object". These evaluations are represented as items of knowledge, which are based on three general classes of information: cognitive information, emotional information, and information about past behaviors (Allen, Machleit, Kleine & Notani, 2003). This study looks at attitude towards improved farming as the degree of positive or negative opinion of respondent farmers towards improved farming practices. Attitude is a requirement for behavioral change to occur. Positive attitude towards improved farming practice is supposed to enhance the use of such practices and recommendation to other farmers. Attitude towards improved farming was found by Tadesse (2008) to have a significant relationship with agricultural information access and use as farmers seek for information, it exposes them to new information for their activities and influences it use.

Ebrahim (2006) in his study of adoption of dairy innovations, its income and gender implications, reported that attitude towards change had a statistically significant relationship with dairy adoption. Farmers' had an unfavorable attitude towards the use of

fertilizer as they complained of fertilizer promoting weed growth and decreasing the shelf life of produce (Okoedo-Okojie & Aphunu, 2011).

2.9.18 Innovation proneness

Innovation proneness was operationally defined as the rate of acceptance of an innovation by an individual for his/her agricultural activities. Studies conducted to assess the influence of innovation proneness on access to and use of agricultural information. For instance, Asres (2005) report of a statistically significant relationship between innovation proneness and access to productive role information and utilization of women. Singha and Baruah (2011) in studying farmers' adoption behavior in rice technology found out that innovation proneness of respondents significantly affected adoption of selected rice cultivation practices. Likewise, Singha and Baruah (2012) in their study of adoption behavior of dairy innovations by small farmers under different farming systems established that innovation proneness was very significant in the adoption of dairy farming practices.

2.10 Agricultural Information Use and Livelihood outcomes

In the development of human societies, information had played an important role and had been a facilitating factor in the shaping of the way we act and think (Card, 2017). Information is very important in the improvement of agricultural production, marketing and distribution strategies (Oladele, 2006). It is a central issue in farming and it is the basis for extension service delivery (Ofuoko et al., 2008). Kalusopa (2005) states that agricultural extension service delivery, the agent is only a source of new information, effectively disseminating research results or necessary information for farmers survival thus there exists a direct relationship between provision of effective information and agricultural development.

2.10.1 Livelihood outcomes

Livelihoods are set of capabilities, assets, and activities that are required to make a living (Chambers & Conway, 1992). The strategies that make living encompass the range and combination of activities and choices that people undertake in order to achieve their livelihood goals (Kollmair & Gamper, 2002). Livelihood outcomes are achievements and benefits that households anticipate to obtain through the implementation of specific activities and strategies. The outcomes can also be interpreted as the aspirations of the household. Potential outcomes include conventional indicators like more income, improved food security, reduced vulnerability and more sustainable use of the natural resources (DFID, 2001).

For the purpose of this study, the following were employed from DFID (2001): assets possession, income and household basic needs such as daily food needs, clothing, water, shelter, education and health care serve as the livelihood outcomes.

According to Anderson (2007) farmers' exposure to agricultural information plays an important role in agricultural development and contribute to improving the welfare of farmers and other rural dwellers, which can manifest in many ways including increase in yield, income, improved standard of living and many more. Some studies have reported on the impact of agricultural information on farmers' livelihood which include: Farm radio messages in Malawi were found to have affected positively on farmers' behavioral changes in diversification of crops to reduce overdependence on rice.

The study suggests that practices like engaging in soil improvement, use of compost manure, rotation systems, micro enterprises, small-scale irrigation, better environmental

conservation, nutrition, and home economics are more effective when linked to new information and information communication technologies (FRI, 2008).

The change in the attitude, behavior and practices of farmers in the above review resulted in the increase of yield and income of farmers as reported by Rizvi (2011) in India who found that information to farmers via the mobile phone led to an increase in productivity and incomes of farmers. However, Raj, Poo Murugesan, Aditya, Olaganathan and Sasikumar (2011) also established an improvement in the livelihoods of farmers who benefitted from agricultural information on crop cultivation and nutrient management.

The intervention led to changes in the practices of farmers, reduction in cost of production and increase in net farm income. A study in China on the livelihoods of farmers, it was found out that there had been an improvement in the quality of life of farmers and an improvement in the local economy and society. It also brought improvement in the rural farmers' livelihood by the strengthening their human capital to increase financial capital through improved access to information on better agricultural practices and market information (Fengying, Jieying, Fujiang & Xiaochao, 2011).

According to Barua and Rahman (2017), higher profits aid in minimization of problems of vulnerability, food insecurity, limited access to resources, information and knowledge as well as shocks of the rural people. Bhasin and Akpaulu (2001) established that not only did their meals and clothing improved but also their savings and children's education as a result of higher incomes from the farm.

2.11 Conceptual Framework

Conceptual framework abstracting the researcher is view of linkages of concepts and variables explored in this study is illustrated in Figure 2.1 below. To ensure effective access to and use of agricultural information by maize farmers in the study area. This study assumes that for maize farmers to be able to access and use agricultural information. Certain factors must influence farmers' access to information. These factors are sex, age, timely information, relevance of information, educational level, land ownership, cultivation of other crops, utilization of information, educational level, farming experience, farm size, access to credit, access to market, FBO membership and access to extension service (Mwangi & Kariuki, 2015). All these factors are affected by the sources of information accessed by maize farmers, these sources include interpersonal media, mass media, extension agent and colleague farmers. This study assumes that, when a maize farmer has access to information on production activities, he/she stands the chance of enhancing their farm yield.

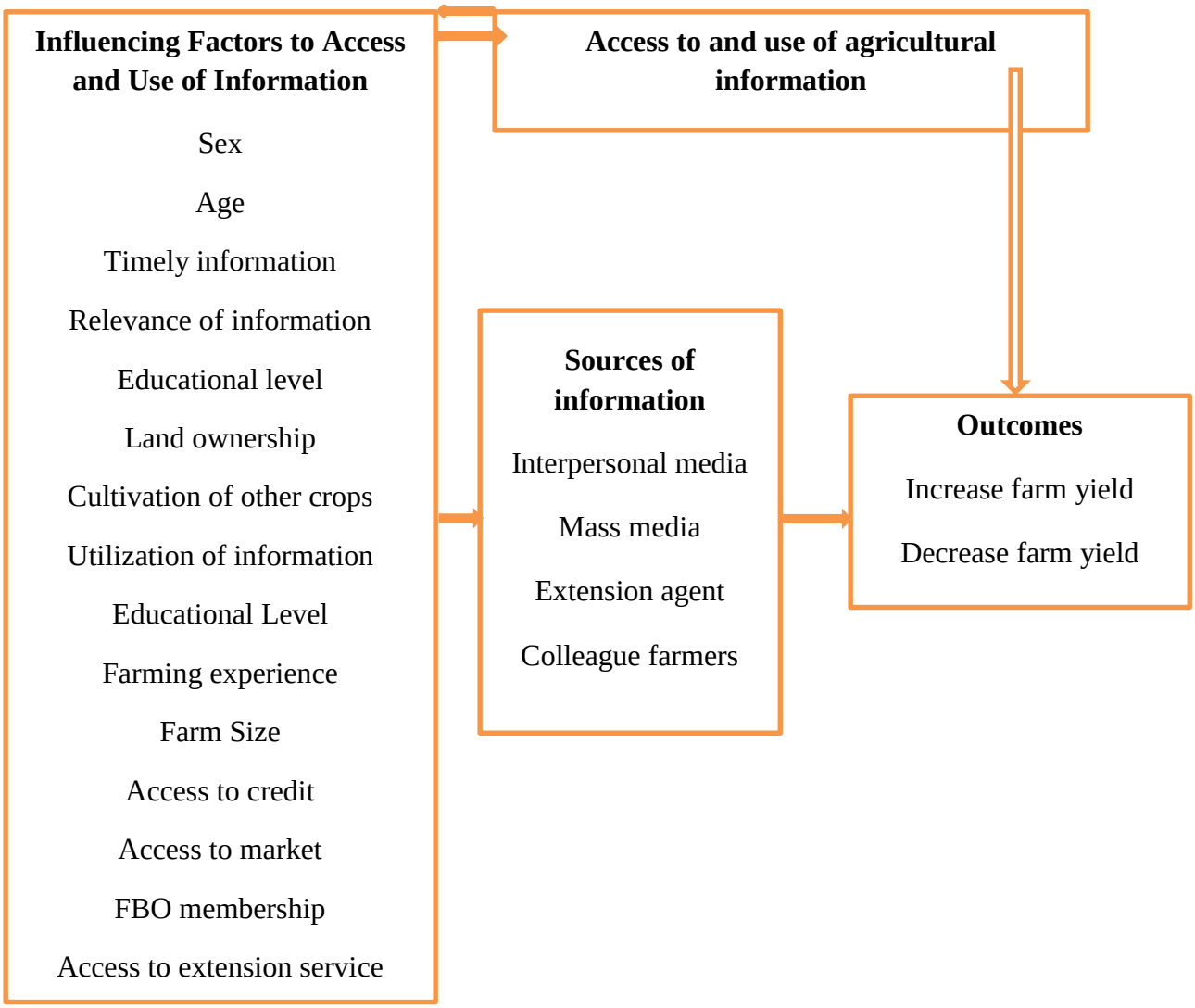


Figure 2.1: Conceptual Framework

Source: Author's own construct, 2018

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

This chapter focuses on brief description of the study area, the instruments used to collect needed information for this study and it also presents the research design, sampling procedure, data collection and data analysis procedure.

3.1 The Study Area

The research looks at maize farmers' level of access to and use of agricultural information on the livelihood outcomes in the Tolon district and Kumbungu district. To achieve this, Tolon and Kumbungu districts of the Northern region were selected for the study due to being part of high maize producing areas.

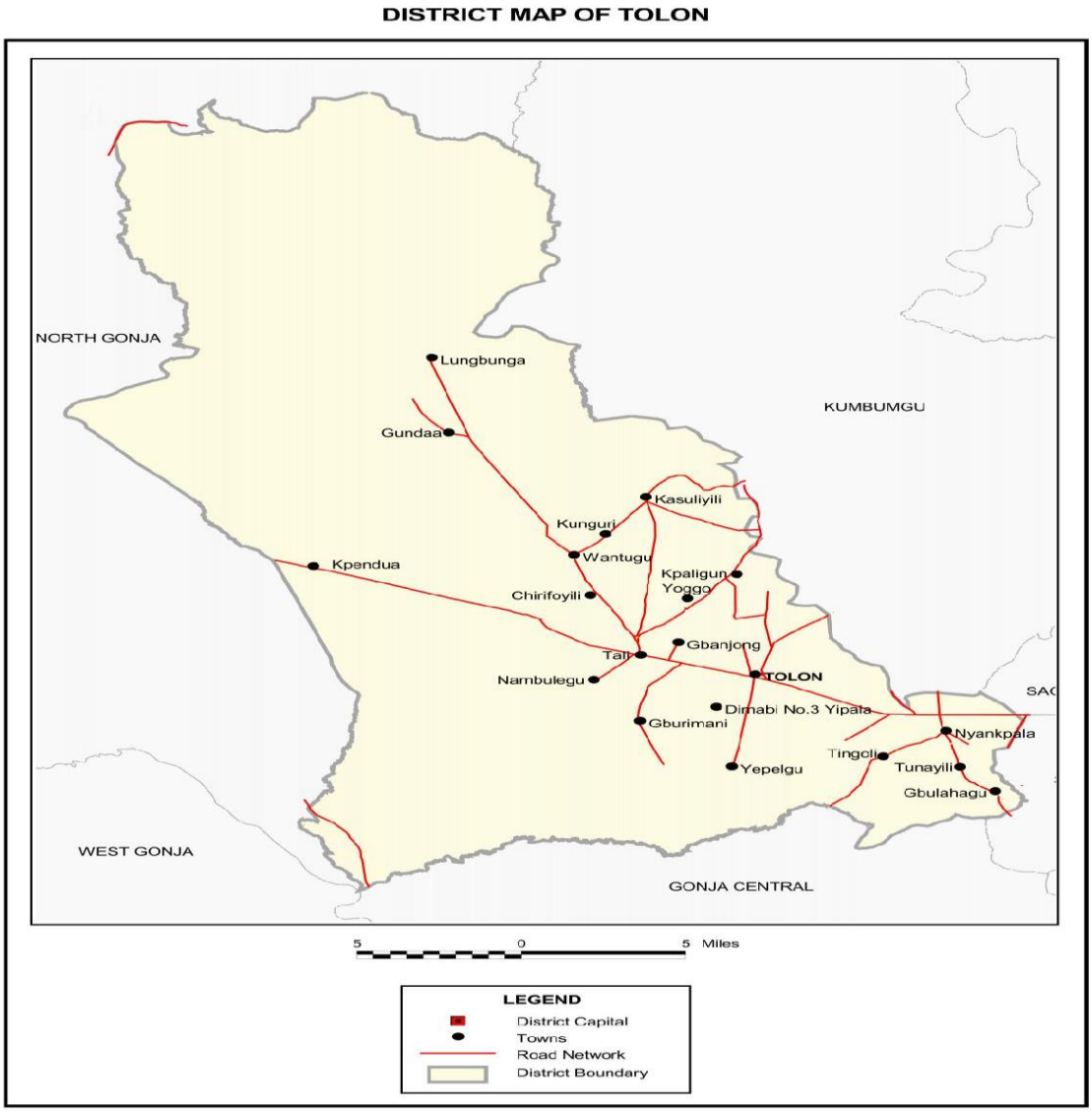
3.1.1 Profile of Tolon District

The Tolon district assembly came into existence in 2011 by Legislative Instrument, 2142 with Tolon as the district capital. Hitherto, the district was part of the Tolon/Kumbungu district; one of the 45 districts created by the then Provisional National Defense Council (PNDC) law 207 in 1988. To enhance participation and development especially at the grass-root, the district was among the 42 inaugurated districts in 2012. The district was carved out from the then Tolon/Kumbungu district. According to the 2010 Population and Housing Census, the district has about 72,990 people.

The district lies between latitudes 9° 15′` and 10° 02` North and Longitudes 0° 53′and 1° 25′ west. It shares boundaries to the north with Kumbungu district, North Gonja district to the west, Central Gonja to the south, and Sagnarigu districts to the east. The district is

characterized by a single rainy season, which starts in late April with little rainfall, rising to its peak in July-August and declining sharply and coming to a complete halt in October-November. The dry season starts from November to March with day temperatures ranging from 33°C to 39°C, while mean night temperature range from 20°C to 26°C. The Mean annual rainfall ranges between 950mm - 1,200m (Ghana Statistical Service, 2010).

Figure 3.1: Map of Tolon District



Source: Ghana Statistical Service, (2014)

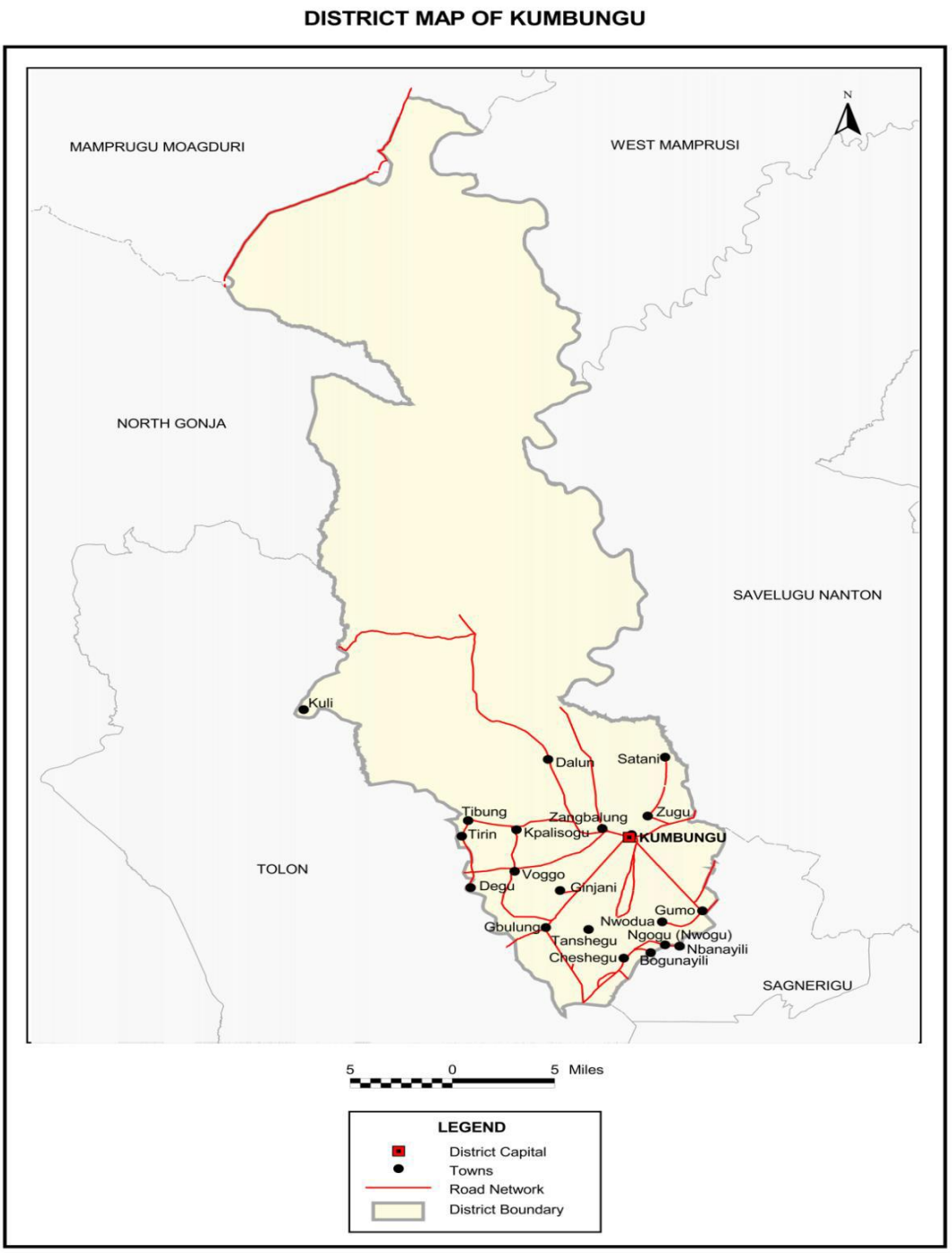
3.1.2 Profile of Kumbungu District

The Kumbungu district was carved out of the then Tolon/Kumbungu district with L. I. 2062 in the year 2011. However, it was later inaugurated on the 28th of June in the year 2012 with Kumbungu as its district capital. The district shares boundaries to the north with Mamprugu/Moagduri district, Tolon and North Gonja districts to the west, Sagnerigu district to the south and Savelugu/Nanton Municipal to the east. The district has the smallest land mass of 1,599 sq km are in the Northern region (Ghana Statistical Service, 2010).

The district experiences rains between May to October, with average annual rainfall is 1000mm. The district temperature is warm, dry and hazy around February to April. It is cool, moist and rainy around May to September. Harmattan is experienced in the period from November to February. The vegetative cover is basically Guinea Savanna interspersed with short drought resistant trees and grassland. The land is generally undulating with several scattered depressions. The soil is generally of the sandy loam type except in the low lands where alluvial deposits are found. Major trees species include the shea trees, dawadawa, mango, which are economic trees and form an integral part of livelihood of the people (Ghana Statistical Service, 2010).

The district is blessed with good drained with several rivers and streams, most prominent being the White Volta that are very good for irrigation purposes. The soils in the district are sandy loam type, where alluvial deposits are found. The district has as high as 95.4 percent of households engage in agriculture production, of which majority 97.9 percent are involved in crop farming (Ghana Statistical Service, 2010).

Figure 3.2: Map of Kumbungu District



Source: Ghana Statistical Service, (2014)

3.2 Research design

According to Babbie (2011) research design serves as a blue print for conducting research work, by considering which questions to answer, which data is relevant, what data to collect and how to analyze the results. In the context of this study, descriptive survey design was employed in carrying this research. Kelley, Clark, Brown and Sitzia (2003) are of the view that, descriptive research is a most basic type of enquiry that aims to observe (gather information on) certain phenomena, often at a single point in time using cross-sectional survey to examine a situation by describing important factors such as demographic and socio-economic, behaviors, attitudes, experiences, and knowledge. The main emphasis of this study is to examine maize farmers' level of access to and use of agricultural information as well as its implications on maize yield in the Tolon and Kumbungu Districts and as such descriptive survey design was considered most appropriate in achieving the research objectives. The importance of descriptive survey is firmly grounded on Cooper and Schindler (2001), ideology that descriptive survey design discovers and measure cause and effect relationships among variables in a research. In line of this, descriptive survey design was employed to guide the content of this research, due the relationship of agricultural information and yield.

Generally, both qualitative and quantitative approaches of gathering data were employed to holistically explore the study concepts. Thus, this approach provided systematic way of gathering and analyzing both qualitative and quantitative data for this research (Creswell, 2010). The use of different methods is referred to as triangulation or multiple strategies is a method that is used to overcome the problems associated with researches that rely on only single method and single data set (Mikkelsen, 1995).

3.3 Population

According to Babbie (2011), population is any precisely defined set of people or collection of items which are being studied. In the context of this study, the target population for this study were all farmers engaged in maize cultivation in the Tolon and Kumbungu districts. According to GSS (2010) population and housing census, Tolon district had about 7,304 households engaged in crop farming, whiles Kumbungu district had about 3,860 households engaged in crop farming. Thus, the sample frame for the study was a total of 11,164 farm households.

3.4 Sampling Procedure and Sample Size

Neuman (2003) is of the view that, choosing the appropriate sample depends on the kind of data analysis the researcher intends to use. A sampling technique mostly involves the way a researcher selects sample size, type and representativeness of the sample (Bailey, 1987). This involves the selection of units of interest to make a just generalization on the population from which the sample was chosen (Trochim, 2006). Thus, this makes it possible to make observations, measurements of these units and conclusions drawn regarding the total population. The accuracy of the sample depends largely on the researchers' purpose and the populations' characteristics (Sarstedt et al., 2018). Thus, the practical limitation like cost and time played a critical role in choosing a sample size for the study. Generally, the larger the sample size, the smaller the sample error. Also, the greater the homogeneity (the less the diversity) in a sample, the smaller it's sampling error. Thus, this study makes use of large sample size of 390 respondents comprising of 195 from Tolon District and 195 from Kumbungu District using Cochran, 1997 determination formula.

A total of 11,164 maize farmers constitute the sampling frame for this study (GSS, 2010). Cochran's (1977) sample size determination formula was used in calculating the sample size. Applying Cochran (1977), sample size (n) computation formula as:

$$n = \frac{N}{1+Ne^2} \quad \ldots\ldots (1)$$

Where n = sample size

N = target population of maize farmers

e = marginal error (5%)

Thus N = 11,164

$$n = \frac{11{,}164}{1 + 11{,}164\ (0.05)^2} = 386$$

Adjusting for correction factor and unforeseen circumstances, the target sampled size was increased to 390 maize farmers.

Since it is sometimes impossible to study the entire population, sampling is therefore that part of statistical work concerned with the selection of individual observations intended to yield some knowledge about a population of concern. The study employed a multi-stage sampling technique. Due to the special interest in farmers' access to and use of agricultural information. Thus, Tolon and Kumbungu districts were purposively selected due to their proximity with the research institutions; SARI and UDS, and the role these institutions plays in information dissemination on agricultural innovation

At the second stage five (5) communities each were randomly selected from Tolon and Kumbungu district. The sampled communities from the Tolon district are; Nyankpala, Gbulahagu, Chirifoyil, Tolon and Tali. From the Kumbungu district Dalun, Voggu, Degu, Gumo and Kumbungu were selected.

The final stage thirty-nine (39) maize farmers were randomly selected from each selected community, making a total of 390 maize farmers from Tolon District and Kumbungu District.

3.5 Types and Sources of Data

Quantitative data from primary and secondary sources were employed in the study. Primary data were obtained from maize farmers in the Tolon and Kumbungu districts. Secondary data were obtained from records of the department of agriculture, records of SARI as well as published and unpublished sources.

3.6 Methods of Data Collection

According to McMillan and Schumacher (2006) data collection may be done with measurement methods, extensive, interviews and observations. In the context of this study, a combination of data collection tools was employed to collect both qualitative and quantitative data from maize farmers in the study area. These included administration of structured and semi-structured questionnaires to respondents to collect primary data.

Questionnaires

The questionnaire for maize farmers (see Appendix A) features a mixture of questions that are related to the study concepts. The questionnaire comprises of background questions

such as farmers' access to and use of information and its implication on maize yield in the study area.

Questions were very specific on the factors influencing farmers' access to and utilization of agricultural information, the types and source of agricultural information accessed by maize farmers, the effects of the level of use of agricultural information on maize yield and the challenges faced by small holder farmers in accessing and utilizing information.

The questionnaires were administered to maize farmers in the Tolon District and Kumbungu District. There were developed for the sampled farmers in the study area, the questionnaires were written in simple language that minimized rather subjectively and judgment, rather than in broad quality terms. The questionnaire was also designed to be as brief as possible while still covering the necessary range of subject matter required in the study.

3.7 Data Analysis

Data processing involves the transformation of data into information by collating, sorting, classifying, retrieving, disseminating information manually or using computer software (Bourque, 2006). The goal is to highlight useful information, suggest conclusions and supporting decision making. Data were checked for completeness and accuracy the responses after the data collection, coded and entered into the Statistical Package for Social Sciences (SPSS) and processed using appropriate descriptive and inferential statistics included chi square test and multiple linear regression. The results were presented using percentages and frequencies and displayed as tables and charts.

3.7.1 The extent to which agricultural information is accessed by maize farmers

Farmers were asked to indicate the various information they usually receive on farming activities. On the extend of agricultural information, the various information channels thus radio, video, colleague farmer, demonstration plot, extension agent (MoFA) and input dealers were given to farmers to rate their level of agreement on a Likert scale of 1-5 with a scale rating of strongly agree, agree, undecided, disagree or strongly disagree on their extend of accessibility.

3.7.2 Factors Influencing Farmers' Access to and Utilization Agricultural Information

The study adopted the Random Utility Theory (RUT) based on farmers' decision to access and use agricultural information. The underlying economic theory of factors that influence the decision to access and use agricultural information is based on the assumption that farmers are motivated by utility maximization (Shakya and Flinn, 1985; Adesina and Zinnah, 1993). Farmers form expectations of the cost and benefit through analysis of information they access. In line with Marenya and Barrett (2007) and Nkamleu and Adesina (2000), it is assumed that farmers behave consistently with utility maximization and that farmer's access and use agricultural information when the expected utility from accessing exceeds that of not-accessing agricultural information. The utility a smallholder maize farmer can derive from a product can be represented as having two components; a utility function of observed characteristics known as the deterministic component of utility and the unobserved component known as the random component.

The deterministic component is exogenous and includes farmers' characteristics and product characteristics and a set of linearly related parameters and the random component

may result from missing data/variables (omitted variable), measurement errors and misspecification of the utility function.

This function is specified below:

$ASij = X\beta + e$ …… (1)

Where,

$X\beta = \nu$ …… (2)

where AS*ij* is the maximum utility attainable when alternative j is chosen by farmer i; $X\beta$ is the deterministic component of the utility function, *X* is a vector of observable socio-demographic and economic characteristics, product-specific factors that influence utility, β is the unknown parameter vector to be estimated and e is the error term.

For empirical purposes, the expected utility of participation Y can be construed from a farmer's observed binary choice of access and use of agricultural information, which implies a probit regression model is preferred (Anley et al., 2007; Thuo et al., 2012).

The explicit probit regression model is expressed thus:

$Y = F(\omega + \alpha Xi) = F(Zi)$ …… (3)

where *Y* is the discrete choice variable of access and use agricultural information, *F* is a cumulative probability distribution function, is a vector of unknown parameters, X is a vector of explanatory variables as in (1) and *Z* is the *Z*-score of the *aZ* area under the normal curve. The expected value of the discrete dependent variable in equation 2 is conditional on the explanatory variables, and also given as:

$$E\,[Y/X] = 0\,[1\text{-}F\,(a'X)] + [\,F(a'X)] = F9\,a'X) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

With the marginal effect of each explanatory variable on the probability of access and use agricultural information is given by:

$$\frac{\partial E[Y/X]}{\partial x} = \acute{\varnothing}\,(a'X)a \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

Where Ǿ (.) is the standard normal density function (Fufa and Hassan, 2006; Thuo et al., 2012).

Following the above, the empirical model can be specified as:

Information $_{access/use} = \beta_0 + \beta_1$ Age $+ \beta_2$ Sex $+ \beta_3$Edu+ …….. $+ \beta_n + \mu$

Table 3.1 Description, Measurement and hypothesized sign of variables used in the probit regression model

Variable	Description	Measurement	Hypothesized sign
Dependent Variable			
	Access to agricultural information	Yes =1, no = 0	+
	Use of agricultural information	Yes =1, no = 0	+
Independent Variables			
X_1	Age of respondent	Years	+
X_2	Sex of respondent	1= Male, 0= Female	+/-
X_3	Education	Years in school	+
X_4	Farm size	Acres	+
X_5	Experience in farming	Years in farming	+
X_6	Credit access	Yes =1, no = 0	-
X_7	Farm ownership	Yes =1, no = 0	+/-
X_8	Labour availability,	Yes =1, no = 0	+
X_9	Household size,	Number of people	+
X_{10}	Other work,	Yes =1, no = 0	+
X_{11}	Cultivation of other crops	Yes =1, no = 0	+/-
X_{12}	Access to market	Yes =1, no = 0	+
X_{13}	Access to extension service	Yes =1, no = 0	+
X_{14}	Group membership	Yes =1, no = 0	+/-
X_{15}	Frequency of information access	Yes =1, no = 0	+
X_{16}	Timeliness of information access	Yes =1, no = 0	+
X_{17}	Understanding of language used for dissemination,	Yes =1, no = 0	+
X_{18}	Importance of information disseminated	Yes =1, no = 0	+

3.7.3 Perceived Effects of Agricultural Information Access and Use on Maize Yield

The influence of agricultural information on maize yield in the study area were addressed using descriptive statistics such as frequency counts and percentages whiles Chi-square test and Pearson correlation were used to test the relationship between information access and maize yield.

3.7.4 Challenges Faced by Small Holder Farmers in Accessing and Utilizing Information

The challenges faced by small holder farmers in accessing and utilizing agricultural information was achieved with the use of Kendall's coefficient of concordance. This objective was analyzed by first establishing the constraints faced by maize farmers with regards to accessing and utilizing information and ranking these constraints in order of severity.

The Kendall's concordance analysis was used to test for the agreement among the rankings by the respondents. According to Legendre (2005), Kendall's coefficient of concordance (W) is a measure of the agreement among several (p) judges who are assessing a given set of (n) objects.

W is an index that measures the ratio of the observed variance of the sum of ranks to the maximum possible variance of the ranks. This idea is to find the sum of the ranks for each constraint being ranked. If the ranking is in perfect agreement, the variability among these sums were maximum (Mattson, 1986). The Kendall's concordance coefficient (W) is therefore given by the equation:

$$W = 12S/p^2 (n^3 - n) - pT \quad \ldots\ldots (5)$$

Where W denotes the Kendall's Concordance Coefficient, p denotes number of constraints, n denotes the number of respondents (sample size), T denotes correlation factor for tied ranks and s denotes sum of square statistics. The sum of square statistic (S) is given as:

$$S = \sum (R_i - R)^2 \quad \ldots\ldots (6)$$

Where: R_i = rows sums of ranks

R = the mean of R_i

The correlation factor for tied ranks (T) is also given as:

$$T = \sum (t_k^3 - t^k) \quad \ldots\ldots (7)$$

Where: t_k = the number of ranks in each (k) of m groups of ties.

The hypothesis to be tested is stated as follows, where H_o and H_1 denotes null and alternative hypothesis respectively.

H_o: There is no agreement among the rankings of the constraints

H_1: There is an agreement of the Kendall's concordance was done using the chi-square (X^2) statistic which is computed using the formula;

$$X^2 = p\,(n - 1)\,W \quad \ldots\ldots (8)$$

p = number of constraints

w = Kendall's coefficients of concordance

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 INTRODUCTION

This chapter presents and discusses the results of the study. Section 4.1 explains the breakdown of the various sections in this chapter. Section 4.2 presents the descriptive statistics of socio-demographic characteristics of the respondents. Section 4.3 presents the factors influencing accessing and utilizing of agricultural information. In section 4.3, types and sources of agricultural information used by maize farmers has been looked at. Whiles, section 4.4 presents the perceived effects of agricultural information on maize yield and finally and section 4.5 presents the challenges faced by small holder farmers in accessing and utilizing agricultural information.

4.1. Demographics Characteristic of Respondents

This section presents findings of selected demographic characteristics of the sampled population. The demographic characteristics selected are those deemed important to the purpose of this study as informed by available literature on the issues explored.

4.1.1 Gender of respondents

The survey results (Table 4.1) show that majority of maize farmers (68.2%) were males, with 31.8 percent of maize farmers being females. Although females form the least group in the survey, they play several roles such as planting, harvesting and shelling of legumes. However, much of what the women do on the farm is, mostly considered as family labour and this could account for the small number of female farmers (31.8%) in the study area. The findings concur with the observation that farming in Ghana is generally male dominated activities as reported by MoFA (2015).

Table 4.1: Gender distribution of respondents

Gender of Respondents	Frequency	Percentage (%)
Male	266	68.2
Female	124	31.8
Total	**390**	**100**

Source: Field Survey Data, 2019

4.1.2 Age of respondents

Results of analysis of the data collected for this study reveals that, 21 percent of the farmers were below the age 30 and above 60 years were 4.1%. However, 45.6% of farmers were between 30 and 45 years, whiles 29.2 percent of the respondents were between the age 46 and 60 (Table 4.2). This result shows that most of the farmers in the study area were economically active.

Table 4.2: Frequency distribution of Age of respondents

Age of respondents	Frequency	Percentage (%)
Below 30	82	21.0
30-45	178	45.6
46-60	114	29.2
Above 60	16	4.1
Total	**390**	**100**

Source: Field Survey Data, 2019

4.1.3 Marital Status of Respondents

Marital status of farmers was explored for the purpose of this study as shown in Figure 4.1. The analysis shows that, the majority of farmers (77.0%) interviewed were married, while very few (5.0%) were divorced and 12% and 6.0% single (never married) and windows respectively. In the content of Ghanaian society, marriage is considered as one of the most important institution, as such someone who is not married at a certain age is perceived to be abnormal, whiles every woman in African society wants and hopes to be married (Gyekye, 1998). People who are married are more like to adhere to information received.

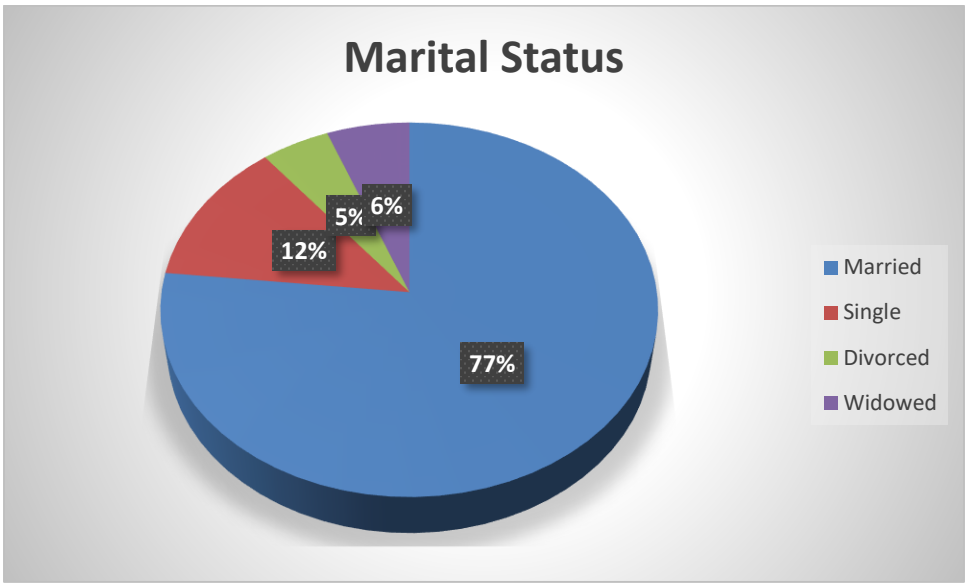


Figure 4.1: Marital Status of Respondents

Source: Field Survey Data, 2019

4.1.4 Educational Level of Respondents

On the educational status of respondents, 279 (71.5%) of farmers had no formal education, 31(7.9%) of respondents had primary education and Senior High School (SHS) Level education. However, 29 (7.4%) of the respondents had Junior High School (JHS) level education, with only 20 (5.1%) of the respondents having tertiary education. The results clearly indicate that the majority of the farmers had no formal education, as shown in Figure 4.2. According to Namara et al. (2013) higher educational status of farmers increases their ability to process and use information disseminated to them on agricultural innovation, which implies that, it might be challenging for illiterate farmers to properly understand information disseminated to them as shown in figure 4.2.

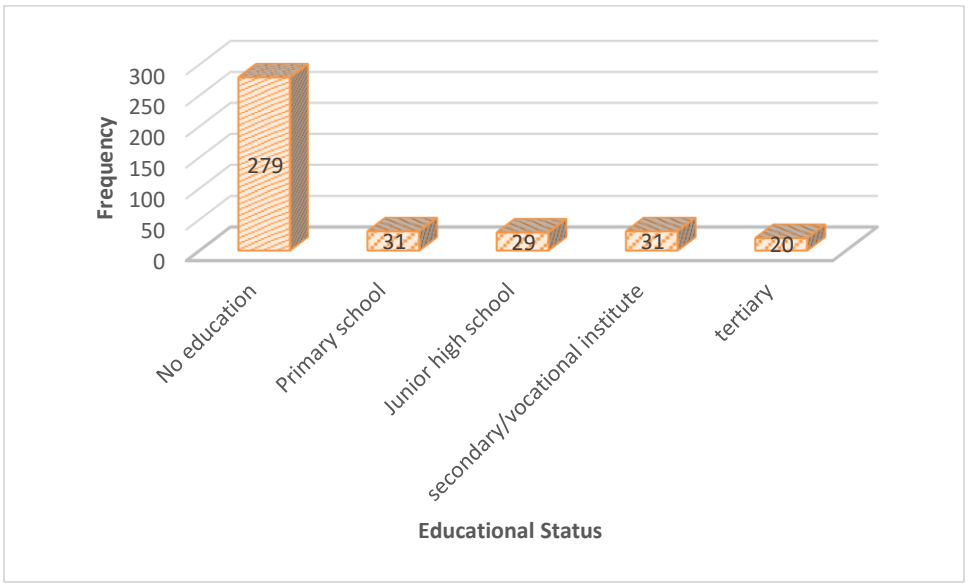


Figure 4.2: Bar Chart illustrating educational level of respondents

Source: Field Survey Data, 2019

4.2 The Extent of Agricultural Information Accessed by Maize Farmers

This section of the chapter presents analysis leading to understanding of farmers' access of agricultural in the study area.

4.2.1 Types of Agricultural Information Accessed by Maize Farmers

World Bank (2006), argues that, in the absence of information, smallholder producers face problems of adverse selection that limit the performance of agricultural commodities and input markets and in turn the participation of small producers in these markets which ultimately impact on overall living standard.

From the analysis it was revealed that farmers in the study area had access to several types of agricultural information (Table 4.3). Farmers received information on row planting, appropriate fertilizer application rate, weed control, pest and insects control, planting on time, harvesting on time, proper storage practices, marketing of maize, selection of viable seed for planting, how to conduct germination test, drying of maize before storage, recommended seed rate usage and information on improved method of weed control.

As shown in Table 4.3 the result revealed that, 58.2% and 41.8% of farmers had low and very low interest attached to information on how to conduct germination test before planting their maize crop. In spite of the low interest in information on germination test before planting, most (49.2%) and (46.9%) of farmers had a very high and high interest respectively in information regarding row planting. On appropriate fertilizer application rate, the analysis revealed that most (44.4%) and (47.4%) of farmers had a very high and high interest respectively. With weed control, pest and insects control, planting on time, harvesting on time, proper storage practices, marketing of maize information, selection of viable seed for planting and drying of maize before storage, the analysis revealed a similar

trend of (45.1%) & (44.9%), (47.9%) & (44.1%) and (57.5%) & (42.5%) very high and high interest respectively.

The finding in the analysis is in consonance with Evanson and Mwabu (2001) as they noted that information needed by farmers mostly includes land preparation, crops spacing, appropriate varieties, pests' management, acquisition of credit facilities and marketing of agricultural products. According to Kiplagat and Ochola (2005) farmers require to be updated on the agricultural information on production activities in order to affect their agricultural production positively. Additional information obtained from the field suggest that promoting institutions such as private extension service delivery and extension officers from MoFA all have one way or the other help enhanced farmers knowledge based on improved farming methods as evident of higher yields in the 2017-2018 farming season.

Table 4.3: Types of Agricultural Information Accessed by Maize Farmers

Types of Agricultural Information	Level of Effective of Information Accessed (Percent)				
	Very High	High	Moderate	Low	Very Low
Information on row planting	49.2	46.9	3.8	0.0	0.0
Information on appropriate fertilizer application rate	44.4	47.4	8.2	0.0	
Information on weed control	45.1	44.9	10.0	0.0	0.0
Information on pest and insects control	47.9	44.1	8.0	0.0	0.0
Information on planting on time	57.5	42.5	0.0	0.0	0.0
Information on harvesting on time	48.5	51.5	0.0	0.0	0.0
Information on proper storage practices	59.7	36.4	3.8	0.0	0.0
Information on marketing of maize	43.6	41.8	14.6	0.0	0.0

Information on selection of viable seed for planting	46.2	53.8	0.0	0.0	0.0
Information on how to conduct germination test	0.0	0.0	0.0	58.2	41.8
Information on drying of maize before storage	50.0	50.0	0.0	0.0	0.0
Information on recommended seed rate usage	61.8	38.2	0.0	0.0	0.0
Information on improved method of weed control	50.0	0.0	0.0	50.0	0.0

Source: Field Survey Data, 2019

4.2.2 Source of Agricultural Information Used by Maize Farmers

According to Kiplagat and Ochola (2005) appropriate information source is very important in meeting farmers' information needs. Also, the most widely and commonly used agricultural information sources by farmers in accessing information in general are radio, interpersonal communication thus colleagues/fellow farmer and extension officers (Benard, Dulle & Ngalapa 2014; Ndaghu et al., 2013).

The analysis in Table 4.4 shows a similar trend as the study results revealed that radio, mobile phone, internet, journals, input suppliers and AEAs were the various sources farmers in the study area access information on maize farming. However, from the analysis, the most predominantly sources of information among maize farmers were input suppliers in the community and agricultural extension agents (AEAs) as 390 (100.0%) of the respondents alluded to the fact that their main sources are input suppliers and AEAs. The study results show that all farmers in the study location have one way or the other accessed information from input suppliers in the community and agricultural extension agents. The high dependence on input suppliers in the community and AEAs is not surprising since

farmers always interact with them. The next most used source of agricultural information is radio. The results revealed that, out of 390 respondents, 382 (97.9%) used radio as a means of accessing information on maize farming activities. Farmers indicated that radio is generally reliable source of information especially in their local language. This finding supports the studies of Okwu and Daudu (2011) as they reported that farmers are always interested in effectiveness agricultural radio programs for their farming activities. It was showed that most of the farmers to listen programs about agronomic and plant production. However, none 0(0.0%) of the maize farmers in the study area ever used either the internet or journals in accessing agricultural information for their farming activities. It is appropriate to understand that effective and efficient information source offer farmers the ability to increase the amount of information they need for their farming activities (Mittal & Mehar, 2016). As farmers have access to agricultural information through radio, mobile phone, internet, journals, input suppliers and AEAs, It can be implied that these information sources will help facilitate farmers' information acquisition and understanding of information, which ultimately influence their maize yield.

Table 4.4: Source of Agricultural Information Accessed by Maize Farmers

	Frequency		Percent (%)	
Source of Agricultural Information	**Yes**	**No**	**Yes**	**No**
Radio	382	8	97.9	2.1
Mobile Phone	60	330	15.4	84.6
Internet	0	390	0.0	100.0
Journals	0	390	0.0	100.0
Input Suppliers	390	0	100.0	0.0
AEAs	390	0	100.0	0.0

Source: Field Survey Data, 2019

4.2.4 Frequency of Use of Agricultural Information Sources by Maize Farmers to Access Information

Table 4.5 shows the frequency of which maize farmers used radio, video, colleague farmer, demonstration plot, extension agent (MoFA) and input dealers. From the analysis, majority 382 (97.9%) of maize farmers always used radio as a means for accessing information. This is likely to be influence by most people possessing radio set at their home as well as the cheapest means of passing information to large group of farmers (Kock, Harder & Saisi, 2010).

Further analysis in Table 4.5 revealed that all maize farmers interviewed for the study were of the view that, they sometimes access agricultural information through video broadcast. However, farmers were able to interact with each other always, as the results revealed that majority 385 (98.7%) of maize farmers obtained agricultural information from fellow

farmers. This finding is not far from the finding of Oto & Dauda (2011) of farmers' reliance on fellow farmers for agricultural information instead.

With farmers visiting demonstration plot/field for agricultural information on maize farming, all 390 (100.0%) farmers were of the view that they sometimes visit demonstration plot/field in order to access information on farming activities. Khan et al., (2009) on effectiveness of demonstration plots on improve farming activities aid farmers who participated in on-farm demonstration in gaining practical know-how about an innovation. The same trend was reported by farmers on the frequency of Extension agent (MoFA), where all 390 (100.0%) farmers indicated that they access information from AEAs. This finding confirms the studies of Ojo, Bila and Iheanacho (2012) that ranked radio as the most popular means of disseminating information. Further analysis revealed that all 390 (100.0%) farmers from the study area said they always access agricultural information from input dealers on their maize farming activities.

Table 4.5: Frequency of Use of Agricultural Information Sources by Maize Farmers

Information Sources	Farmers frequency of access (Percentage)			
	Never	Rarely	Sometimes	Always
	n(%)	n(%)	n(%)	n(%)
Radio	8 (2.1)	0 (0.0)	0 (0.0)	382 (97.9)
Video	0 (0.0)	0 (0.0)	390 (100.0)	0 (0.0)
Colleague farmer	0 (0.0)	0 (0.0)	5 (1.3)	385 (98.7)
Demonstration plot	0 (0.0)	0 (0.0)	390 (100.0)	0 (0.0)
Extension agent (MOFA)	0 (0.0)	0 (0.0)	390 (100.0)	0 (0.0)
Input dealers	0 (0.0)	0 (0.0)	0 (0.0)	390 (100.0)

Source: Field Survey Data, 2019

4.2.5 Perceived Importance of Agricultural Information Sources

Table 4.6 shows the degree of perceived importance of agricultural information sources used by maize farmers. From the analysis, the majority, 382 (97.9%) of maize farmers perceived that radio had very high significance in terms of accessing information for their farming activities. This finding is in consistent with that of Ndaghu et al., (2013) as they reported that radio is a mass information tool and the most popular source of method of accessing information among farmers.

Furthermore, the analysis Table 4.6, revealed that 285(73.1%) farmers perceived that video had high significance in terms of accessing information for their farming activities. However, only 96(24.6) maize farmers interviewed perceived that video had moderate significance in terms of accessing information for their farming activities.

The analysis revealed that most 349(89.5%) farmers perceived that their fellow farmers had very high significance in terms of accessing information for their farming activities. While 41(10.5%) maize farmers interviewed for the study perceived that their fellow farmers had high significance in terms of accessing information for their farming activities. On the perceived importance of demonstration plot/field visit for information access, the analysis revealed that most 304(77.9%) and 15(3.8%) of farmers perceived that demonstration plot/field visit had a high and moderate significance respectively in terms of accessing information for their farming activities.

However, 71(18.2%) of maize farmers interviewed perceived that demonstration plot/field visit had low significance in terms of accessing information for their farming activities.

On the perceived importance of Extension agent (MOFA) for information access among farmers, the analysis revealed that the majority 326(83.6%) of farmers perceived that extension agent (MOFA) had a high significance in terms of accessing information for their farming activities. Though, some 55 (14.1%) of maize farmers interviewed for the study perceived that extension agent (MOFA) had no significance in terms of accessing information for their farming activities.

Finally, on the perceived importance of input dealers to meeting farmers information needs, the analysis revealed that majority 283(72.6%) of farmers perceived that input dealers had a very high significance in terms of accessing information for their farming activities. However, the rest 107(27.4%) of maize farmers interviewed for the study perceived that input dealers had high significance in terms of accessing information for their farming activities. According to Ayele and bosire (2011) input dealers largely support farmers with first-hand information on application and use of agricultural innovation.

Table 4.6: Degree of Perceived Importance of Agricultural Information Sources by Maize Farmers

Information Sources	Farmers Rating of Perceived Importance of Agricultural Information Sources				
	Very high n(%)	High n(%)	Medium n(%)	Low n(%)	Very low n(%)
Radio	382 (97.9)	0(0.0)	0(0.0)	0(0.0)	8 (2.1)
Video	0(0.0)	285(73.1)	96(24.6)	0(0.0)	9(2.3)
Colleague farmer	349(89.5)	41(10.5)	0(0.0)	0(0.0)	0(0.0)
Demonstration plot	0(0.0)	304(77.9)	15(3.8)	71(18.2)	0(0.0)
Extension agent (MOFA)	0(0.0)	326(83.6)	0(0.0)	9(2.3)	55 (14.1)
Input dealers	283(72.6)	107(27.4)	0(0.0)	0(0.0)	0(0.0)

Source: Field Survey Data, 2019

4.3 Factors Influencing Smallholder Maize Farmers in Accessing and Utilizing Agricultural Information

The study sought to determine the factors influencing maize farmers accessing and utilizing agricultural information. The dependent variable (access to agricultural information) is limited and therefore propels the use of the probit regression model. The independent variables included in the model were; age, sex, educational level, farming experience, farm size, land ownership, cultivation of other crops, timely information, importance of information, understanding of information, utilization of information, access to labour, access to credit, access to extension, FBO, access to market and maize yield. The probit regression results (Table 4.7) shows that land ownership, timely information, importance of information, understanding of information, utilization of information, access to labour, access to credit and access to extension influence farmers access to agricultural information in the study area.

The probit regression results in Table 4.7, shows a likelihood ratio chi-square value of 341.62 which is significant at the 1% level of significance. This means that the explanatory variables or factors included in the model jointly explained the decision to access agricultural information. The Pseudo R^2 value of 0.6456 also provides an indication that all the explanatory variables included in the model were able to explain about 64.5% of the probability of the decision of farmers to access agricultural information.

Specifically, the analysis shows that land ownership, importance of information and utilization of information were significant at 1%. However, understanding of information was significant at 5%. Additionally, timely information, access to labour, access to credit and access to extension were significant at 10%.

Land ownership

Land ownership was a statistically significant factor influencing the probability accessing agricultural information (at 1%) if the plot where maize is cultivated is a family owned land (see Table 4.7). The positive significant influence of land ownership on the probability of accessing Agric information means that accessing Agric information is more likely if maize cultivation is undertaken on family plots compared with land accessed through other means (*rented, etc.),* holding another variables constant. This is expected because one can argue that with increase in land ownership, there is available land to cultivate more maize and therefore the need for extra information on improve farming methods as proposed by Zeng et al. (2018).

Timely information

Timely information was a statistically significant factor influencing the probability accessing agricultural information (at 10%) if the farmer has access to timely agricultural information (see Table 4.7). The positive significant influence the probability of accessing agricultural information timely for maize farming as compared to not having access to information, holding another variables constant. This is expected because one can argue that agricultural activities are naturally guided with time, hence, meeting farmers time needs on agricultural production is the surest way of increasing maize output and yield. This result is collaborated by Glendenning, Babu and Asenso-Okyere, 2010; who found out that farmers accessing agricultural information on leads to increase productivity.

Importance of information

Importance of information was found to have a positive significant influence on access to agricultural information by maize farmers in the study area. This means that when a farmer

perceives that information needed for agricultural activities are very important, there is the likelihood that such a farmer would have positive access for information in order to improve maize yield. With a coefficient of 1.112 and significant at 1%, indicates that importance of agricultural information, would result to farmer increasing their access to agricultural information by 1.112. If all things remain the same. This is expected because one can contend that farmers are always ready for important information on agricultural activities. According to Takahashi et al. (2018) farmers always search for information that are relevant to their farming activity. Hence, this is not surprising that results revealed a positive relationship between access to agricultural information and importance of agricultural information.

Understanding of information

Understanding of information was found to have a positive significant influence on access to agricultural information by maize farmers in the study area. This means that when a farmer perceives that information is needed for agricultural activities are very understandable, there is the likelihood that such farmer would have positive desire for agricultural information in order to improve maize yield. With a coefficient of 1.010 and significant at 1%, indicates that understanding of agricultural information, would result to farmer increasing their access to agricultural information by 1.010. If all things remain the same. This is expected because one can say that understanding of agricultural information is the only way farmers can properly apply it for their farming activities. Hence, it is not surprising that results revealed a positive relationship between access to agricultural information and understanding of agricultural information. According to Huggins and

Valverde (2018) farmers understanding agricultural information greatly depends on farmer level of education and the source of information.

Utilization of information

Utilization of information was found to have a positive significant influence on access to agricultural information by maize farmers in the study area. This means that when a farmer utilizes information received and achieve it benefits, there is the likelihood that such a farmer would increase his/her access to information in order to improve maize yield. With a coefficient of 1.096 and significant at 1%, indicates that utilization of agricultural information, would lead to increased access to agricultural information by 1.096. If all things remain the same. This is expected because one expects farmers to fully utilize agricultural information that they access on farming activities. This finding in line with Minot (2018) that farmers will not look for information, if the information is not important to them. Hence, this is not surprising that results revealed a positive relationship between access to agricultural information and utilization of agricultural information.

Access to labour

Access to labour was found to have a positive significant influence on agricultural information access by maize farmers in the study area. This means that when a farmer has access to labour, there is the likelihood that such farmer would increase his/her information access in order to improve maize yield. With a coefficient of 0.701 and significant at 10%, indicates that with an increase in labour by one person, the probability that the farmer would increase access to agricultural information by 0.701 is very high, if all things remain the same. According to Nandi, Haruna & Abudu (2012) a positively significant relationship between labour availability and adoption of Agricultural innovation through information

access and use. Also, Beshir (2014) identified a positive relationship between labour availability and intensity to use agricultural information for their farming activities.

Access to credit

Access to credit was found to have a negative significant influence on agricultural information access by maize farmers in the study area. This means that when a farmer has access to credit, there is the likelihood that such a farmer would decrease his/her information access in order to maintain maize yield. With a coefficient of -.594 and significant at 10%, indicates that with a decrease in credit by one unit, the probability that the farmer to decreases access to agricultural information by .594 is very high, if all things remain the same. This result is not expected because one expects that, access to credit by farmers should lead to increase access to agricultural information, but the find shows otherwise. This could as a result of agricultural credit not being made universal for all farmers, but certain conditions need to be met before a farmers can access credit. This situation was reported by Iddrisu, Ansah and Nkegbe, (2018) that most farmers turn not to receive agriculture credit due to the challenges associated with credit accessibility.

Access to extension

Access to extension was found to have a positive significant influence on agricultural information access by maize farmers in the study area. This means that when a farmer has access to extension services, there is the likelihood that farmer would be exposed to agricultural information in order to improve maize yield. With a coefficient of 0.557 and significant at 10%, indicates that with an increase in extension service per unit, the probability that the farmer would increase their access to agricultural information by 0.557 is very high, if all things remain the same.

Table 4.7: Factors Influencing Small Holder Maize Farmers' Access and Utilization of Agricultural Information

Variable	Coefficient	Std. Error	P>|z|
Age	0.006	0.019	0.727
Sex	-.226	0.240	0.347
Educational level	.003	0.020	0.873
Farming experience	.016	0.022	0.482
Farm size	-.040	0.046	0.388
Land ownership	.641***	0.222	0.004
Cultivation of other crops	-.368	0.243	0.131
Timely information	.626*	0.370	0.091
Importance of information	1.112***	0.370	0.003
Understanding of information	1.010**	0.382	0.008
Utilization of information	1.096 ***	0.300	0.000
Access to labour	.701*	0.363	0.054
Access to credit	-.594*	0.3141	0.059
Access to extension	.557*	0.268	0.038
FBO	.020	0.369	0.955
Access to market	-.012	0.290	0.966
Maize yield	.002	0.043	0.959
Number of observations	**388**		
LR chi^2 (17)	**341.62**		
Prob > chi^2	**0.0000**		
Pseudo R^2	**0.6456**		
Log pseudo-likelihood	**93.778762**		

***, ** and * denote that the variable is significant at less than 1%, 5% and 10% respectively

Source: Field Survey Data, 2019

4.4 Perceived effects of Agricultural Information Access and Utilization on Maize Yield

This section of the analysis presents the farmers' perception about the effects of agricultural information on maize yield. Also, farmers' attitude and behaviour towards information seeking is presented in this section.

4.4.1 Maize Farmers' Attitude and Behaviour towards Information Seeking

The analysis revealed that farmers had both attitudinal and behavioural perceptions towards information seeking in the study area (Table 4.8). From the analysis, the majority 212 (54.4%) and 178 (45.6%) of farmers interviewed for the study had a positive and very positive perception that information is very expensive to acquire. However, most 384 (98.5%) farmers in the study area had a very positive perception that they sometimes feel reluctant to seek for information for their farming activities.

Furthermore, all 390 (100.0%) farmers had a positive perception that information available is enough for my farming needs hence discouraging them for seeking information from non-known sources like radio, input dealers etc. Additionally, the analysis on easy understanding information package. The results revealed that 323 (82.8%) of farmers had a positive perception that information package is difficult to understand. Finally, the study results revealed that the majority, 243 (62.3%) of farmers had negative perception about the trust worthiness of agricultural information source.

On behavioural perceptions of farmers towards information seeking in the study area. The analysis in Table 4.8 revealed that 173 (44.4%) and 160 (41.0%) of farmers had very positive and positive behavioural perceptions respectively indicated that they prefer information that is specific to their crop production need. According to farmers in the study,

the most motivating factor for them to seek for agricultural information that are relevant to their farming needs.

Furthermore, the analysis revealed that the majority, 224 (57.4%) of farmers had a positive behavioral perception that they prefer timely information on crop production. According to farmers in the study area, timely access to information is very important to meeting their challenges in relation to improved farming methods.

Generally, farmers prefer cheap source of information on crop production needs, considering the poor financial status of farmers in the study area. The study result revealed that almost 148 (37.9%) and 206 (52.8%) of farmers had very positive and positive behavioral perceptions respectively about the cheapness of information. Thus, the cheapness of agricultural information influences farmers' behavior in seeking for information.

Analysis on farmers preference regarding reliable information on crop production revealed that majority 232 (59.5%) of farmers had a positive behavioral perception on reliable information on crop production. Finally, on ease of understanding information received, most, 245 (62.8%) of the farmer had a positive perception on ease of understanding agricultural information. Findings in this part of the analysis is largely in agreement with Ebrahim (2006) and Tadesse (2008) assertion that having positive attitude towards innovation stand the chance of improving their agricultural activities. Moreover, Owolade (2008) noted that farmers having positive attitude towards information is influenced by their information needs.

Table 4.8: Maize Farmers' Attitude and Behavior towards Information Seeking

Attitudinal and Behavioral Statements	Farmers Attitudinal Rating n(%)				
	Very Positive	Positive	Neutral	Negative	Negative
Attitudinal Statements					
Information is very expensive to acquire	178 (45.6)	212 (54.4)	0(0.0)	0(0.0)	0(0.0)
I sometimes feel reluctant to seek for information	384 (98.5)	6 (1.5)	0(0.0)	0(0.0)	0(0.0)
The information available is enough for my farming needs	0(0.0)	390(100.0)	0(0.0)	0(0.0)	0(0.0)
The information package is difficult to understand	323 (82.8)	0(0.0)	67(17.2)	0(0.0)	0(0.0)
Information source is not trust worthy	60 (15.4)	0(0.0)	0(0.0)	87 (22.3)	243 (62.3)
Behavioral Statements					
Farmers prefer information that is specific to their crop production need	173 (44.4)	160 (41.0)	57(14.6)	0(0.0)	0(0.0)
Farmers prefer timely information on crop production	135 (34.6)	224 (57.5)	31 (7.9)	0(0.0)	0(0.0)
Farmers prefer cheap source of information on crop production	148(37.9)	206(52.8)	36(9.3)	0(0.0)	0(0.0)
Farmers prefer reliable information on crop production	158(40.5)	232(59.5)	0(0.0)	0(0.0)	0(0.0)

Farmers prefer information they can easily understand	127(32.6)	245(62.8)	18(4.6)	0(0.0)	0(0.0)

Source: Field Survey Data, 2019

4.4.2 Perceived Effects of Agricultural Information on Maize Yield and Income

Generally, farmers have different opinions on the agricultural information. In view of this assumption, this section of the analysis presents farmers perceptions on their rate of agreement on the influence of agricultural information on maize yield.

From the analysis in Table 4.9, all 390 (100.0%) of the farmers interviewed for the study strongly agreed that, agricultural information has led to increased farm output, while 202 (51.8%) of farmers strongly disagreed that agricultural information do not necessary lead to increases in farm output.

However, on agricultural information increasing farmer perceived level of income, most 341 (87.4%) of farmers agreed that accessing and using agricultural information leads to increased income level. The majority 295 (75.7%) of farmers were uncertain as to whether agricultural information leads to increase in income level of farmers or not.

On the perceived of agricultural information helping farmers improved the quality of their farm yield. The analysis in Table 4.9, revealed that, the majority, 309 (79.2%) of farmers strongly agreed that agricultural information has led to an improvement in the quality of their farm yield. Also, 298 (76.4%) of farmers strongly disagreed that agricultural information has not led to improving the quality of their farm yield.

However, on agricultural information reducing or stopping pests and diseases on their farm, the analysis revealed that the majority 328 (84.1%) of farmers strongly agreed that accessing and using agricultural information has reduced/stopped pests and diseases on their farm. Also, 301 (77.2%) of farmers were uncertain as to whether agricultural

information has reduced/stopped pests and diseases on their farm or not. Overall, all farmers in the study area one or the other seeks for information for their farming activities. The desire of farmers seeking for information for their farming activities, would in the long run enable farmers increase their as reported by Toma el al. (2018), that farmers accessing agricultural information at the right time stand and using it the chance of increasing their farm productivity. On the other hand, the World Bank (2006) reported that in the absence of information, smallholder producers face problems of poor information selection that limit the performance of agricultural commodities and input markets and in turn the participation of small producers in these markets.

Table 4.9: Perceived Effects of Agricultural Information on Maize Yield and Income

Perceived Effects	Rating of Agricultural Information on Maize Yield				
	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
Agricultural information has increased my farm output	390(100.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
Agricultural information has not increased my farm output	0(0.0)	0(0.0)	6(1.5)	182(46.7)	202(51.8)
Agricultural information has increased my level of income	49 (12.6)	341(87.4)	0(0.0)	0(0.0)	0(0.0)
Agricultural information has not increased my level of income	0(0.0)	0(0.0)	295(75.7)	38(9.7)	57 (14.6)
Agricultural information has improved the quality of my yield	309 (79.2)	81 (20.8)	0(0.0)	0(0.0)	0(0.0)
Agricultural information has not improved the quality of my yield	0(0.0)	0(0.0)	0(0.0)	92(23.6)	298(76.4)
Agricultural information has reduced/stopped pests and diseases on my farm	328 (84.1)	62 (15.9)	0(0.0)	0(0.0)	0(0.0)
Agricultural information has not reduced/stopped pests and diseases on my farm	0(0.0)	0(0.0)	89(22.8)	0(0.0)	301(77.2)

Source: Field Survey Data, 2019

4.4.3 Relationship between Access to Agricultural information and Maize Yield

Table 4.10 shows that farmers' access to agricultural information was significant with maize yield in the study area, (r = 0.158** p = .002). This clearly indicates that the more a farmer gets access to agricultural information, the likelihood of such farmer increasing his/her yield by 0.158 Kg per acre is very high. This finding implies that as farmers access agricultural information and uses it well, maize yield will directly improve. This result is in agreement with Asres (2005), who found a statistically significant relationship between farmers' access and agricultural productivity. Young (2003) in their study proposed that access to information is one of the critical elements in enhancing and improving agricultural productivity.

Table 4.10: Relationship between Access to Agricultural information and Maize Yield

Variables	**Measure**	**Maize Yield**
Access to Agricultural information	Pearson Correlation	0.158**
	Sig. (2-tailed)	.002
Sample size (n)		**390**

Source: Field Survey Data, 2019

4.5 Challenges Faced by Small Holder Farmers in Accessing and Utilizing Information

The study sought to determine the constraints faced by small holder farmers in accessing and utilizing information. The results in Table 4.11 revealed the rank of challenges in descending order; poor radio and television signals, poor government policies on information access and sharing, language barrier, lack of electricity and network service in rural communities, lack of awareness of information sources, lack of access to adequate extension services, inability to read and write (illiteracy), high cost of accessing information and agricultural information on media is aired at odd hours.

Kendall's Coefficient of Concordance (W) was used to test for the level of agreement among the ranking of the constraints by farmers on accessing and utilizing information. The Kendall's Coefficient of Concordance (W) was estimated from the study to be 0.758; chi-square statistic was estimated as 274.393 with 8 degrees of freedom and asymptotic significance of 0.000.

Kendall's Coefficient of Concordance (W) estimated as 0.758 indicating that there is 75.8% percent agreement among the respondents on the rankings of the constraints. With a mean rank of 4.58, farmers' inability to read and write (illiteracy) came out highest and with a general agreement level of about 76% for the entire population. This means on the average, 76% of the respondents agreed with the ranks and identified farmers' inability to read and write (illiteracy) as the highest constraint affecting their access to and use of agricultural information in the Tolon and Kumbungu district of Northern region. The high illiteracy rate of the respondents in the study area could account for the low to access to and use agricultural information.

High cost of accessing information by farmers was the second constraint affecting their access to and use of agricultural information in Table 4.11. Farmers were of the view that, the only way to obtained reliable and important information was through ESOKO services. However, information obtained from ESOKO is purely at a cost, of which farmers perceived to be too expensive for them to afford. Some farmers also said that, some network provider particular Vodafone Ghana provides them with market and weather information at cost per SMS. This is evident that, farmers perceived charges on information services to be too expensive considering their poor financial status as reported by GSS (2015).

According to Berdegue and Escobar (2001) effective provision of agricultural extension have direct and indirect impact on agricultural productivity and growth. However, with the declining rate of extension officer per farmer ratio in the country. Lack of access to adequate extension services was equally reported by farmers as the third constraint limiting their access to agricultural information in Table 4.11.

Another constraint limiting farmers' access to agricultural information was language barrier, farmers in the study area were of the view that good messages on agriculture are usually aired in English language. However, analysis from the demographic revealed that, 71.5% of farmers had no formal education, which could be a reason for farmers' inability to understand as English language as a medium of communication was a challenge to the farmers. In order wards, illiteracy couple with radio and television programme not broadcasting agricultural information programme in the native Dagomba dialect hindered farmers' access to agricultural information in Table 4.11. Surprisingly, farmers claimed lack of awareness of credible information sources was another constraint they usually

encounter in quest to seek for agricultural information for their farming activities. Farmers revealed in an in-depth interview that having just access to information is not enough, but such information should be credible enough in order to meet their information need on agricultural production.

Responses from farmers further revealed that, most important agricultural information were aired at odd hours. These farmers said it greatly impeded on their access to vital information on agricultural production. From the analysis farmers said agricultural information are usually aired at hour they are very busy on their farmers and sometime during evening prayers. This finding agrees with Boz and Ozcatalbas (2010) that most agricultural information are aired at hours where farmers are likely not to be at home.

Lack of electricity and communication network service in rural communities was also seventh limiting constraint to access of agricultural information. Most rural communities in Northern Ghana are not currently connected to the national grade. Hence, accessing agricultural information through electronic media is a major challenge to farmers in such areas. Finally, the least constraint ranked by farmers in the study area was poor radio and television signals in rural communities. Most of the radio station such as Zaa FM and Diamond FM are located within the Tamale Township, thus hindering communities in the hinterlands of getting proper coverage of their aired programme.

Table 4.11: Rankings of Constraints Faced by Farmers in Accessing and Utilizing Information

Constrains	Mean Rank	Ranking
Poor radio and television signals	5.38	9th
Poor government policies on information access and sharing	5.34	8th
Language barrier	4.84	4th
Lack of electricity and network service in rural communities	5.29	7th
Lack of awareness of credible information sources	5.08	5th
Lack of access to adequate extension services	4.69	3rd
Inability to read and write (illiteracy)	4.58	1st
High cost of accessing information	4.63	2nd
Agricultural information on media is aired at odd hours	5.15	6th
No of observation	390	
Kendall's W	0.758	
Chi-Square	274.393	
Degree of freedom	8	
Asymp. Sig.	0.000	

Source: Field Survey Data, 2019

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the findings of the present study, conclusions and recommendations which when implemented could enhance information among farmers. The summary and conclusions are presented in section 5.2 and 5.3 respectively. Section 5.4 presents the policy recommendations based on the findings of the study. Suggestions for future research are also presented in section 5.5

5.2 Summary of Findings

The study examined the influence of access to and use of agricultural information on maize yield in the Tolon and Kumbungu districts. In achieving the main objective of the study elements were considered, factors influencing farmers' access to and utilization of agricultural information, types and source of agricultural information access by maize farmers, effects of the use of agricultural information on maize yield and challenges faced by small holder farmers in accessing and utilizing agricultural information in the Tolon and Kumbungu districts.

5.2.1 Socio-demographic Characteristic of Legume Farmers

Maize farmers interviewed for this study shows that, male farmers (68.2%) were more than their female (31.8 %) counterparts. On the educational status of respondents, 279 (71.5%) of farmers had no formal education. Similar number of respondents had 31(7.9%) had primary education and Senior High level education. However, 29(7.4%) of the respondents had Junior High level education, while only 20 (5.1%) of the respondents having tertiary

education. Furthermore, on the marital status of maize farmers, majority of farmers (77.0%) interviewed were married, while very few (5.0%) are divorced and 12% and 6.0% single (never married) and windows respectively.

5.2.2 Factors Influencing Farmers' Access to and Utilization of Agricultural Information

The survey revealed that, land ownership, timely information, importance of information, understanding of information, utilization of information, access to labour, access to credit and access to extension influence farmers access to agricultural information all had in the study area. The probit regression results shows a likelihood ratio chi-square value of 341.62 which is significant at the 1% level of significance. This implies that the explanatory variables or factors included in the model jointly explained the decision to or not to access agricultural information. The Pseudo R^2 value of 0.6456 also provides an indication that all the explanatory variables included in the model were able to explain about 64.5% of the probability of the decision of farmers to access agricultural information. Specifically, the analysis revealed that land ownership, importance of information and utilization of information were significant at 1%, but only understanding of information was significant at 5%. Also, timely information, access to labour, access to credit and access to extension were significant at 10%.

5.2.3 Extent of Agricultural Information Access by Maize Farmers

The survey revealed that, revealed that farmers in the study area had access to several agricultural information. The information usually received included row planting, appropriate fertilizer application rate, weed control, pest and insects control, planting on time, harvesting on time, proper storage practices, marketing of maize, selection of viable

seed for planting, drying of maize before storage, Information on recommended seed rate usage and improved method of weed control.

On the other hands, the source of agricultural information maize farmers' use are Radio, Mobile Phone, Input Suppliers and AEAs. However, the most dominant sources of agricultural information used by maize farmers are input suppliers in the community and Agricultural Extension Agents.

5.2.4 Perceived Effects of Agricultural Information on Maize Yield

The study revealed that majority of farmers interviewed for the study had very positive perception about information being expensive to acquire. On the other hand, farmers sometimes do feel reluctant to seek for information despite information availability in and around the surrounding. On behavioral attributes towards information seeking is a basic requirement. Majority of the farmers had a positive perception towards information seeking. Finally, in establishing the relationship between farmers' access to agricultural information and maize yield. The study results revealed that access to agricultural information had a significant influence on maize yield ($r = 0.158^{**}$ $p = .002$).

5.2.5 Challenges Faced by Small Holder Farmers in Accessing and Utilizing Information

The study identified and ranked challenges encountered with regards to accessing and utilizing agricultural information. the analysis revealed that poor radio and television signals, poor government policies on information access and sharing, language barrier, lack of electricity and network service in rural communities, lack of awareness of information sources, lack of access to adequate extension services, inability to read and write (illiteracy), high cost of accessing information and agricultural information on media is

aired at odd hours were some the challenges farmers faced in accessing and utilizing agricultural information. The Kendall's Coefficient of Concordance (W) estimated from the study was 0.758 indicating that there is 75.8% percent agreement among the respondents on the rankings of the constraints.

5.3 Conclusions

The study established that land ownership, timely information, importance of information, understanding of information, utilization of information, access to labour, access to credit and access to extension influence farmers access to and use agricultural information have significant influence on access to and utilization of agricultural information. The study further established that farmers in the study area mainly access agricultural information through radio, mobile phone, input suppliers and AEAs.

The information farmers considered very important to their maize farming were planting time and proper storage practices of maize. Generally, farmers had positive attitudinal and behavioral perceptions towards information seeking. Moreover, the study established that farmer's access to and use of agricultural information had influence on the average yield per acre of maize.

Finally, the study identified several constraints that maize farmers encountered in their quest to accessing agricultural information. Among these constraints are poor radio and television signals, poor government policies on information access and sharing, language barrier, lack of electricity and network service in rural communities, lack of awareness of information sources, lack of access to adequate extension services, inability to read and

write (illiteracy), high cost of accessing information and agricultural information on media is aired at odd hours.

5.4 Recommendations

With reference to the study results and conclusions presented in the study, the researcher recommends the following:

Research institutions should liaise with existing radio stations for airtime to have officers broadcast agricultural innovations in various local languages to farmers. Also, these institutions should identify and train community volunteers on radio broadcasting to assist AEAs reach out to farmers living in the rural area with information using the local language.

Research institutions should identify and train input dealers in the various communities' on improved maize farming methods. Since farmers interviewed are of the view that input dealers are their regular source of agricultural information. Hence, liaising with input dealers will help facilitate information sharing among farmers.

The study established that most farmers access information within and among themselves, hence government and other stakeholder responsible for the provision of improved agricultural information should offer training programme for lead farmers in the communities as there are mostly the first of conduct for their information needs.

MoFA and development partners should collaborate with radio stations to ensure that agricultural information aired on radio station should always be broadcast at the appropriate time where most farmers will be at home to benefit from the programme.

5.5 Suggestions for Future Research

Future research should be conducted on commercialization of agriculture by private research institutions and other actors involved in information dissemination.

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Appendix I

QUESTIONNAIRE FOR MAIZE FARMERS

EFFECTS OF ACCESS TO AND USE OF AGRICULTURAL INFORMATION ON MAIZE YIELD AMONG FARMERS IN TOLON AND KUMBUNGU DISTRICT OF THE NORTHERN REGION, GHANA.

This study is purely for academic purpose toward award of Master of Philosophy degree in Innovation Communication. You will be contributing to success if you answer the items as frankly and honestly as possible. You are assured of confidentiality and anonymity because the study is purely for academic purposes.

SECTION A: DEMOGRAPHIC DATA

1. Gender of respondent: 1 = Male [ ] 2 = Female [ ]

2. Age of respondent: 1 = Below 30[ ] 2 = 30-45 [ ] 3 = 46-60 [ ] 4 = Above 60 [ ]

3. Age of respondent……. years

4. Marital status: 1= Married [ ] 2 = Single [ ] 3= Divorced [ ] 4= Widowed [ ]

5. Educational level: 1= No education [ ] 2= Primary school [ ] 3= Junior high school [ ]

4 = secondary/vocational institute [ ] 5 = tertiary [ ] (In years in school……)

7. For how long have you been cultivating maize? …….years

8. What is the size of your household? .....

9. How many years have you been involved in maize farming? ……..years

10. What is the size of your maize farm? …… acres

11. What are the source of labour is used on your farm? 1= Family [ ] 2= Hired [ ] 3 =other (specify)…….

12. Apart from maize, which other crop(s) do you cultivate? (Multiple choice option)

1=Rice [ ] 2=Yam [ ] 3=Soybeans [ ] 4=Vegetables [ ] 5=Fruits [ ] 6= Other (Please specify)…….

SECTION B: ACCESS TO AND USE OF AGRICULTURAL INFORMATION

13. Do you have access to agricultural information in your area? 1= Yes [ ] 2= No [ ]

14. If yes, do you frequently have access to agricultural information in your area? 1= Yes [ ] 2= No [ ]

15. Is the information always on time? 1= Yes [ ] 2= No [ ]

16. Is the information received important for your maize farming? 1= Yes [ ] 2= No [ ]

17. Do you usually understand the information disseminated to you? 1= Yes [ ] 2= No [ ]

18. Do you usually apply the information you receive to your maize faming? 1= Yes [ ] 2= No [ ]

19. Kindly indicate your view on your access to the following items?

Variables	**Response**	
	Yes	**No**
Do you easily get access to labour in your area		
Do you have access to ready market		
Do you have access to credit		
Do you have access to extension service		
Do you belong any farmer group		

SECTION C: SOURCES OF AGRICULTURAL INFORMATION ACCESS BY MAIZE FARMERS

20. Kindly indicate where you access agricultural information from?

Variables	**Response**	
	Yes	**No**
Do you access agricultural information through radio		
Do you access agricultural information through Mobile Phone		
Do you access agricultural information through Internet		
Do you access agricultural information through Journals		
Do you access agricultural information through Input Suppliers		
Do you access agricultural information through AEAs		

21. How often do you use the information sources for information on maize farming?

Information Sources	**Farmers frequency of access**			
	Never	**Rarely**	**sometimes**	**always**
Radio				
Video				
Colleague farmer				
Demonstration plot				
Extension agent (MOFA)				
Input dealers				
NGOs/private extension				

22. What is your rating of your information source on maize farming?

Information Sources	**Farmers Rating of Information Sources**				
	Very high	**High**	**Medium**	**Low**	**Very low**
Radio					
Video					

Colleague farmer					
Demonstration plot					
Extension agent (MOFA)					
Input dealers					
NGOs/private extension					

23. How will you rate the level of effectiveness of the following innovations received on maize farming? **(1= Very high 2=High 3=Medium 4=Low 5=Very low**)

Agricultural practices	Level of Effective of Innovation				
	VH	H	M	L	VL
Row planting					
Appropriate fertilizer application rate					
Weed control					
Pest and insects control					
Planting on time					
Harvesting on time					
Proper storage practices					
Marketing of maize					
Selection of viable seed for planting					
Conducting of germination test					

Drying of maize before storage					
Recommended seed rate					
Improved method of weed control					

24. What is your perceived rating of your attitude towards information seeking in the table below (1=Very Positive, 2=Positive, 3=Neutral, 4=Negative, 5=Very Negative)

Statement on farmers attitude towards information seeking behavior	**Rating**				
	1	**2**	**3**	**4**	**5**
Information is very expensive to acquire					
I sometimes feel reluctant to seek for information					
The information available is enough for my farming needs					
The information package is difficult to understand					
Information source is not trust worthy					

25. What is your perceived rating of your behavior towards information seeking (1=Very Positive, 2=Positive, 3=Neutral, 4=Negative, 5=Very Negative)

Statement	**Rating**				
	1	**2**	**3**	**4**	**5**
Farmers prefer information that is specific to their crop production need					
Farmers prefer timely information on crop production					
Farmers prefer cheap source of information on crop production					

Farmers prefer reliable information on crop production					
Farmers prefer information they can easily understand					

SECTION E: EFFECTS OF AGRICULTURAL INFORMATION ON MAIZE YIELD

26. What is your perceived rating of farmers access to agricultural information on maize output (1=strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)

Perceived Effects	**Level of Rating**				
	1	**2**	**3**	**4**	**5**
Agricultural information has increased my farm output					
Agricultural information has not increased my farm output					
Agricultural information has increased my level of income					
Agricultural information has not increased my level of income					
Agricultural information has improved the quality of my yield					
Agricultural information has not improved the quality of my yield					
Agricultural information has reduced/stopped pests and diseases on my farm					

Agricultural information has not reduced/stopped pests and diseases on my farm					
Agricultural information has not eradicated pests and diseases on my farm					
Agricultural information has not enabled the use of new innovations on my farm					

27. If yes, how many bags of maize did you obtain per acre of land last season? (In bags……..)

SECTION F: CHALLENGES MAIZE FARMERS FACE IN ACCESSING AGRICULTURAL INFORMATION SEEKING

28. What are the challenges you face in accessing agricultural information for your farming activities?

Challenges facing farmers in accessing agricultural information	**Ranking**
Lack of access to adequate extension services	
Lack of awareness of information sources	
Inability to read and write (illiteracy)	
Poor radio and television signals	
Language barrier	
Agricultural information on media is aired at odd hours	
Poor government policies on information access and sharing	
Lack of electricity and network service in rural communities	

High cost of accessing information	
Others	

THANK YOU