UNIVERSITY OF GHANA

RURAL FARMERS' ACCESS TO CLIMATE SMART AGRICULTURAL (CSA) INFORMATION IN GHANA: EVIDENCE FROM PRU DISTRICT IN THE BONO EAST REGION.

BY

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DECLARATION

I hereby declare that to the best of my knowledge, apart from references to other peoples' work which have been dully acknowledged, this MPhil thesis is the product of my own original research and no part of it has been submitted to this university or any university for the award of another degree.

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DEDICATION

I dedicate this work to the rural farmers of Ghana, especially female farmers, who in their own little ways feed the country while they themselves struggle to feed their own families. Again, I dedicate this work to all those who strive in the little ways they can to make the voices of the marginalised heard and their problems addressed.

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ACRONYMS AND ABBREVIATIONS

CCAFS	Climate Change, Agriculture and Food Security
CSA	Climate Smart Agriculture
GSS	Ghana Statistical Service
FAO	Food and Agriculture Organisation
MoFA	Ministry of Food and Agriculture
NGOs	Non-Governmental Organisations
SDGs	Sustainable Development Goals
UN	United Nations

ABSTRACT

Despite the important role information plays in ensuring that farmers are abreast with innovative farming practices, access to Climate Smart Agricultural (CSA) information is low in rural areas in Ghana. However, in the Pru District, an essential area of concern that has not been given due exploration is a comparison of rural female and male farmers' access to information in order to ascertain whether they have equal access to CSA information or there is a gender differential in this regard. Using a mixed method approach, the study sought to analyse rural farmers' access to CSA information in the Pru District of Ghana and ascertain whether there are gender differences in access to CSA information and the factors accounting for that. Both quantitative and qualitative data were collected from 133 male and 139 female farmers for the study. Using the Statistical Package for Social Sciences (SPSS) software, both inferential and descriptive statistics were used to analyse the quantitative data while the qualitative data was analysed by employing Dey's (1993) three steps processes of qualitative data analysis.

The study revealed that the major source of CSA information for both male and female farmers is government extension officers. The major channel through which the extension officers transfer CSA information to female farmers is *farm visit by the extension officers*. The major channel for male farmers is *farmers' visit to the extension officers' office*. However, both male and female farmers preferred extension officers to transfer CSA information to them through *farm visit by extension officers.* The study also revealed that there is a poor level of CSA information dissemination in the Pru District. However, there is a gender differential in access to CSA information among farmers in the Pru District, which is biased towards men. Male farmers have more access to CSA information than female farmers because female farmers are not involved in deciding meeting schedules with extension officers, female farmers miss extension

programs because of their numerous farm and off-farm duties, cultural norms that limit female farmers from interacting with strangers for information, and female farmers could not afford to regularly visit extension officers' office for CSA information.

The study therefore recommends that extension officers should involve female farmers in deciding meeting schedules, there should be social and economic empowerment programs to help female farmers access CSA information through diverse means such as radio and television, and there should be campaigns by the government and NGOs to eradicate cultural norms that limit women's mobility as they make efforts to access CSA information. The study again recommends that the Ministry of Food and Agriculture (MoFA) must strengthen its extension department by increasing the number of extension officers and logistics so that the officers can regularly and easily visit farmers on their farms to deliver information on CSA practices.

CHAPTER ONE

INTRODUCTION

1.1 Background

Agriculture is currently undergoing significant transformation to meet food demands under the realities of climate change. Without doubt, this effort will bring into focus the important role that information plays in creating awareness and enabling farmers to adopt innovative practices for increasing production levels. Based on food consumption patterns and population growth, food production needs to increase by 70% or more in order for food demands to be met by 2050 (Ashish et al., 2017). This is a huge task as climate change is expected to reduce food production and therefore threaten the capacity of agriculture to feed the ever increasing population of the globe, especially in developing countries where additional 2.4 billion people are expected by 2050, concentrated in Sub-Saharan Africa and South Asia (Leslie et al., 2014). Climate change has already reduced global yields of maize by 3.8% and wheat by 5.5% (Leslie et al., 2014). Across Africa, wheat yields are estimated to drop by 17% and maize by 5% before 2050 (Knox et al., 2012).

The devastating impacts of climate change have necessitated agriculture to depend more on the transfer of information regarding weather trends and best farm practices. Information dissemination regarding these areas aids farmers to plan their farm activities in order to adapt to the devastating effects of climate change on crop yield. For instance, farmers' access to information regarding rainfall and temperature patterns, crops to plant, market price of farm produce, where to buy farm inputs, where to get credit, how to operate farm tools, how to apply

fertilizer etc. are very crucial in enhancing the farmer's output levels and resilience to climate change.

Despite the significance of information dissemination in food production, access to farm and climate related information is low in rural areas in Ghana (Alemna & Osei, 2007; Bonye et al., 2012; Anaglo et al., 2014). Several rural areas do not have communication infrastructures that ease the transfer of information to farmers (Lawal et al., 2016). This is compounded by inadequate agricultural extension officers who could contact farmers directly to teach them about climate smart agricultural (CSA) practices (Alemna & Osei, 2007). The agricultural extension officer to farmer ration is as low as 1:1,500, implying that 1,500 farmers depend on one extension officer. Extension service coverage in Ghana is not uniform (SEND-Ghana, 2014). Extension agents have been sent to only 56% of operational areas and this is compounded by low running motor bikes that could aid agents to effectively contact farmers and provide them with extension services (SEND-Ghana, 2014). This situation limits farmers' access to vital information for increased production and climate change resilience. Lack of CSA information reduces farmers' production levels and this has the potential of disrupting rural economy because most rural dwellers in Ghana depend on agriculture as their main source of livelihood and income.

In Ghana, agriculture employs over 60% of the country's population with the crop sub sector as the single largest economic activity accounting for 14.2% share of Gross Domestic Product (GDP) in 2017 (MoFA, 2018). Women make up more than half of the labour force engaged in agriculture (NCCP, 2013; SEND-Ghana, 2014). Food production is dominated by the rural poor most of whom are women (Nyanteng & Dapaah, 1993). With simple farm tools like cutlasses and hoes, women farmers in the Pru District, just like in many parts of Ghana, cultivate small

and marginal lands. In Ghana, women produce 70% of subsistence crops, account for more than half of the labour force (52%) and make a vital contribution of 46% of total GDP (NCCP, 2013). Despite the importance of women in food production, it is widely acknowledged that women have less access to climate and farm related information that could enhance their resilience to climate change (FAO, 2009).

In Ghana, agricultural information dissemination caters for the needs of male farmers to the neglect of the needs of female farmers (SEND-Ghana, 2014). Rural female farmers usually do not get agricultural information that enhance food production due to the fact that agricultural information dissemination does not pay attention to the concerns of women (SEND-Ghana, 2014). Inequalities in access to CSA information puts women farmers in a disadvantaged position in their efforts to adopt and benefit from CSA practices (World Bank, FAO, & IFAD (2015). As the combat against climate change requires the input of everyone, the enhancement of both rural female and male farmers' access to CSA information is crucial in ensuring increased production levels, resilient communities, and a reduced greenhouse gas (GHG) emissions from agricultural activities. It is against this background that this study sought to investigate the presence of gender differentials in access to CSA information by taking evidence from the Pru District and to also suggest measures to help make CSA information accessible to both male and female farmers.

1.2 Problem statement

There is a global evidence of gender inequality in agriculture where women are characterised by less access to agricultural extension services compared to men (FAO, 2011). Several studies have revealed male biased access to climate and agricultural information. For instance, in rural

Malawi, Morna (1989) found that extension officers usually interact only with men when they visit farmers to provide extension services. In Ethiopia, Abebe (2017) found that female farmers have less access to extension training than their male counterpart. SEND-Ghana (2014) also revealed that agricultural extension in Ghana does not pay attention to the needs of women farmers. Other studies have also revealed less access to farm and climate related information by rural farmers in Ghana (Alemna & Osei, 2007; Bonye et al., 2012; Anaglo et al., 2014). However, in the Pru District, an essential area of concern that has not been given due exploration is a comparison of rural female and male farmers' access to information in order to ascertain whether they have equal access to CSA information or there is a gender differential in this regard.

There has not been much work done in the Pru District on this critical area. It is therefore not clear whether rural female and male crop farmers in the Pru District have equal access to CSA information. The absence of gender-disaggregated data implies that little is available to prove the efficiency or benefits of interventions that aim at fighting gender inequality. Gender is a crucial basis of ownership and control of resources and access to CSA information. It will therefore be useful to make a gender analysis of access to CSA information in order to ascertain the challenges facing both female and male farmers in accessing CSA information. It is important to note that, in order to strengthen the effectiveness and sustainability of CSA practices, gender inequality and other social differences must be considered (World Bank, FAO, IFAD, 2015).

If gender inequality in access to CSA information in Ghana is not addressed, there is a likelihood that in implementing CSA practices, existing gender inequalities will be reinforced. This is because rural female and male farmers may not be starting off on a level playing field and as such may not benefit equally from the gains accruing from implementing CSA practices. It will

then be very difficult to maintain food and nutrition security in the country. Thus, this research is being carried out to ascertain the existence of gender differences in access to CSA information in Ghana by taking evidence from the Pru District. The intention is to help the country adapt to climate change by suggesting appropriate measures to make CSA information accessible to both female and male farmers. Providing a clearer explanation and evidence for gender disparities in the access to CSA information has become increasingly important especially towards the effectiveness and sustainability of CSA practices in the face of the devastating effects of climate change in developing countries specifically Ghana. The problem identified above raises the question; are there gender differences in access to CSA information and what factors account for that?

1.3 Research questions

The above research problem raised a number of questions that formed the focus of the study. The main research question was: Are there gender differences in access to CSA information and what factors account for that?

However, key research questions were:

1. What are rural male and female farmers' sources of CSA information?

2. What are rural male and female farmers' channels and preferred channels of CSA information?

3. What are the gender differences in the accessibility of CSA information and what factors account for that?

4. What factors hinder rural male and female farmers from accessing CSA information?

1.4 Study objectives

The main objective of the study was to assess rural female and male farmers' access to CSA information and suggest appropriate measures to make CSA information accessible to both rural male and female farmers. However, the specific objectives were:

- To analyse rural male and female farmers' sources of CSA information.
- To examine rural male and female farmers' channels and preferred channels of CSA information.
- To ascertain the gender differences in access to CSA information and the factors accounting for that.
- To assess the challenges in accessing CSA information by rural female and male farmers and suggest possible solutions to address the challenges.

1.5 Hypotheses

The study was based on the following hypotheses:

H_O. There is no significant relationship between farmers' socio-economic characteristics and access to CSA information.

H_A. There is a significant relationship between farmers' socio-economic characteristics and access to CSA information.

H_O. There is no significant relationship between gender and access to sources of CSA information.

H_A. There is a significant relationship between gender and access to sources of CSA information.

1.6 Significance of the study

In order to successfully adapt to climate change, there is the need to identify and address farmers' challenges in accessing vital CSA information. Hence, this research could help Non-Governmental Organisations (NGOs) and the government of Ghana identify the peculiar situations of rural male and female farmers in order to make interventions sensitive to their differential concerns. This will help bring into focus their needs, priorities, and challenges in order to influence policy on information dissemination regarding climate change adaptation. Also, many studies are limited to the CSA practices adopted by farmers. It is not enough to limit research to just understanding the CSA strategies adopted by farmers. Research needs to further explore the gender disparities in accessing information on CSA practices because gender is very potent in influencing farmers' decision to adopt CSA practices. Women's role and contribution to food production is likely to be underestimated when there is no sex disaggregated data in a key sector of the economy like agriculture.

Though literature on CSA is on the rise globally, there has not being much work done in Ghana on the selected study area. It is therefore not clear how rural male and women farmers in Ghana access CSA information and how they differ in their level of access to CSA information. No information is available regarding gender differences in access to CSA information in the Pru District. This study, therefore, has come to fill this gap. The research will share knowledge on gender and access to CSA information in the Pru District to the rest of Ghana and also to the world that might be relevant to women empowerment, sustainable development, and global agricultural concerns. Data from the study could be useful in informing policies and development interventions that contribute to some United Nations Sustainable Development Goals (SDGs)

such as No poverty (Goal 1), Zero hunger (Goal 2), Good health and well-being (Goal 3), Gender Equality (Goal 5), and Life on land (Goal 15). Moreover, this research could be a useful reference material for researchers and agencies that are interested in related area.

1.7 Scope of the research

The research is limited to the rural farmers in Pru district who are engaged in crop cultivation. The Pru district served as the study area of this research. The agricultural produce of concern to the study were food crops. The study sought to investigate the access to CSA information by rural farmers and establish whether rural male and female farmers have equal access to CSA information.

1.8 Definition of key concepts

In this section, certain key terms are operationally defined to ratify their use in the study.

Sources of information

Contextually, sources of information are the various public and private agricultural extension service agents who deliver agricultural services to farmers. It also includes the farmers' networks that the farmers get information from. For instance, farmers' neighbours, spouse, colleague farmers etc.

Channels of information

Channels of communication are the means throw which information reaches its receivers. Channel is the means by which a message (for example weather forecast) gets from the source (for example, extension agent) to the receiver (for example, farmers) (Rogers, 2003). Channels

can be categorised into mass media and interpersonal. Mass media are channels such as radio, television, newspaper, internet, and phone. Interpersonal channels are face-to-face means of transferring information to people. An example is extension officer's visit to the farm/home of farmers.

Climate change/variability

Operationally, climate change is an identifiable significant change in the elements of global climate, such as temperature, precipitation, wind, that lasts for an extended period of time – decades or longer. Operationally, Climate variability is referred to as the dynamics of the climatic elements which result from natural means over a shorter period of time.

Climate change adaptation and Climate change mitigation

Operationally, **adaptation** has to do with coping with the adverse effects of climate change by taking measures that reduce the negative impacts or take advantage of the positive impacts. **Mitigation** are human interventions that can either reduce the emission of greenhouse gas (GHG) or absorb them from the atmosphere. Examples are capturing and storing carbon dioxide underground and planting more trees to absorb carbon dioxide. Operationally, mitigation involves putting in measures to halt climate change.

Agriculture and Sustainable Agriculture

Agriculture means transforming natural resources into useful products through the application of human, financial, social and physical resources to satisfy human needs.

Sustainable Agriculture is the production of agricultural produce through the use of environmentally friendly farming techniques. Its basic aim is the protection of the environment, human communities, animals, soil, natural resources and the environment in general.

Climate information (CI) and Agricultural information (AI)

Climate Information has to do with knowledge concerning past, present, and future state of the climate. Agbamu (2006) defines agricultural information as all published or unpublished knowledge on all aspects of agriculture.

Climate smart agriculture (CSA)

CSA is a strategy to increase food production, increase farmers' resilience to climate change, and reduce Greenhouse Gasses (GHGs) emissions from all kinds of agricultural activities.

Gender and Gender Equality

Gender is the culturally and socially constructed attributes that differentiate women from men. Simply put, it is the state of being a female or male as opposed to sex (the state of being a man or a woman). According to FAO (2009), cited in Nelson & Huyer (2016), gender equality is a state whereby both females and males enjoy equal opportunities, rights, and entitlements in political and civil life.

1.9 Organisation of the research

The study is divided into six major chapters. The first chapter entails an introduction to the study. It outlines the background of the study and also presents the problem statement. Also, it looks at the research questions, the research objectives, hypotheses that were tested, importance of the

research, the scope of the research, definition of key terms used in the work, and the limitations of the research. Finally, it outlines the structure of the research. Chapter two presents a critical review of related and relevant literature on the research topic. It is comprised of an overview of extension service delivery in Ghana, overview of CSA, integrating gender into CSA practices, importance of climate and farm information in food production, rural farmers' sources and channels of climate and farm related information, and challenges of accessing farm and climate related information by rural farmers. Finally, the chapter presents the conceptual framework underpinning the research.

Chapter three presents the profile of the study area as well as the research methodology. It comprises the physical as well as the socio-economic features of the research areas that combine to influence activities in the research area. It also entails the research methodology. It explains the processes or methods that were used to gather and analyse data. Chapter four presents the findings of the study. It discourses the socio-economic variables of respondents, and their sources, channels, and their preferred channels of CSA information. Chapter five presents an analysis of farmers' access to CSA information. It looks at the gender dimensions in access to CSA information. The chapter ends by presenting farmers challenges of accessing CSA information. Finally, the last chapter presents summary of key findings, conclusion, and recommendations. It concludes by highlighting areas that could be studied further by researchers interested in gender and CSA.

1.10 Summary

This chapter presented the introduction to the research and the identified problem that necessitated the research. It revealed that climate change has grave effects on food production

and as such food production is under transformation to meet food demands by 2050 by which time populations of country', especially developing countries, are expected to increase significantly. Information has a key role to ensure that nutrition and food security is maintained in the wake of climate change, yet rural farmers still have low access to CSA information. However, an area of concern that needs more exploration is the gender inequalities in access to CSA information, especially in the Pru District. Though literature on CSA is on the rise globally, there has not been much work done in Ghana on the selected study area. It is therefore not clear how rural female farmers and male farmers in the Pru District of Ghana access CSA information and how they differ in their level of access to CSA information. If gender considerations are not made in the process of implementing CSA practices, there is the likelihood that existing gender inequalities will be strengthened. The chapter also delved into the objectives that the study sought to achieve. The focus of which was on ascertaining the presence of gender differences in access to CSA information and the factors influencing access to CSA in order to suggest solutions to make CSA information accessible to all rural farmers. Also, it revealed that the research will add knowledge to literature on gender in CSA as well as provide data that could be useful in informing policies and development interventions that contribute to the achievement of United Nations (UN) Sustainable Goals that focus on gender equality and food security.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This chapter entails what various researchers have said regarding rural farmers and climate smart agricultural (CSA) information. It comprises of an overview of extension service delivery in Ghana, overview of CSA, integrating gender into CSA practices, importance of climate and agricultural information in food production, rural farmers' sources and channels of farm and climate related information, and factors that hinder rural farmers from accessing farm and climate related information. The chapter ends by discussing the theoretical framework adopted to further explain the study.

2.2 Agricultural extension service delivery in Ghana

Currently, agricultural extension approaches in Ghana include Training and Visit (T&V), farmer field schools (FFSs), the use of mobile phones, and community based radio stations, and ICT based methods that provide services on-line (GFAAS, 2018). Agents that have been actively involved in these extension services include the government, NGOs, farmer organisations, and agro-chemical input suppliers (GFAAS, 2018). Over the years, the Ministry of Food and Agriculture (MoFA) has transferred agents to teach farmers about best farm practices and also help farmers solve challenges they encounter in their farming endeavour. However, extension service delivery in Ghana has not been successful in transferring information to farmers especially those in the remote areas of the country. For instance, Anaglo et al. (2014) stressed that, there is still a gap between extension agents and farmers in Ghana, This situation could be

attributed to the numerous challenges that face the extension system. For instance, Alemna & Osei (2007) reported that the number of staff involved in agricultural information provision in Ghana are not many. McNamara et al. (2014) reported that, despite the fact that there are 4-5 million small scale farmers in Ghana, the government has only 3,500 agricultural extension agents. McNamara et al. (2014) stressed that many of these extension agents are not in the field, which implies that the farmer to extension agent ratio is closer to 1: 2,000 or 1: 3,000. This implies that as high as 2,000 or 3,000 farmers depend on one extension agent. SEND-Ghana (2014) stated that the low farmer to extension agent ratio is compounded by low running motor bikes that could aid agents to effectively provide services to farmers. Also as high as 44% of operational areas do not have agricultural extension officers (SEND-Ghana, 2014). This could be attributed to the limited number of extension officers or the unwillingness of officers to be posted to rural areas. This implies that farmers who find themselves in these areas have limited access to extension services. For instance, Anaglo et al. (2014) revealed that rural farmers in Ghana do not receive timely, relevant, and accurate information.

The approaches adopted by extension agents in delivering extension services to farmers have also come under criticisms. For instance, Hanna et al. (2012) hold the position that the oral transmission techniques used by MoFA agents is not effective. Similarly, Bonye et al. (2012) stressed that the main approaches (transfer of technology approach, Training and Visit (T&V approach), and contact farmer) that the government uses to deliver extension services to farmers are not effective in delivering information to rural farmers. Peterson (2014) also hold the view that the "farmer field school" method where farmers learn by doing, rather than hearing, has to be emphasized further in order to make improvements in information transfer to farmers in Ghana. These criticisms seem valid in the sense that in an effort to deliver services to farmers,

extension agents usually fail to consider the social-demographic characteristics of farmers (SEND-Ghana, 2014). When communication channels do not suit farmers' socio-economic characteristics, issues of language barrier, poverty, and illiteracy can easily prevent farmers from accessing CSA information from extension agents and communication channels.

Poor social infrastructure in rural areas and high illiteracy rate on the part of farmers make it difficult for rural farmers to receive information from diversified sources like ICT based channels. For instance, Alemna & Osei (2007) reported that access to agricultural information through telephone, internet, and websites in Ghana is very limited. Access to the few telecentres in the country is limited due to high illiteracy in rural areas, high internet connectivity cost, and frequent power outages (Alemna & Osei (2007). The cultural setting in most communities in Ghana also limit rural farmers from getting agricultural information. Limited mobility of women, coupled with culture norms in many rural communities that impede women from having direct interactions with outsiders, especially men, prevents women from getting market information resulting in weak bargaining power (SEND-Ghana, 2014). This situation is compounded by lack of female extension agents in several parts of Ghana. At the national level only 13% of agricultural extension officers are females, which is below the 30% target by MoFA, and about 70% of households are reached by extension agents with female farmers mostly left out (SEND-Ghana, 2014).

2.3. Overview of climate smart agriculture (CSA)

World Bank (2010) and FAO (2010) came out with the concept of Climate Smart Agriculture (CSA). This move was a response to the adverse effects of climate change on developing countries. CSA is seen as a strategy that will help countries to maintain food security in the wake

of climate change. It strives to achieve increased production while fighting climate change at the same time. According to FAO (2010), CSA is "Agriculture that sustainably increases productivity, resilience (adaptation), reduces/removes Greenhouse Gasses (GHGs) (mitigation) where possible, and enhances achievement of national food security and development goals". Others see CSA as a strategy to achieve an end. For instance, Lipper et al. (2014) defined CSA as an ''approach for transforming and reorienting agricultural development under the new realities of climate change''.

The principal goal identified in the definition of CSA is food security and development (FAO, 2013; Lipper et al., 2014). However, CSA is built on three pillars. These pillars help to achieve the goal of CSA. The pillars are (1) sustainably increasing agricultural productivity and incomes; (2) adapting and building resilience to climate change; and (3) reducing and/or removing greenhouse gas emissions, where and when possible. This is termed the *triple win*. However, not all CSA practices produce the triple win. Intervention programs may decide which of the three pillars or which combinations are best suitable for the situation at hand. An important feature of CSA is that it involves the poor and vulnerable groups in the society such as females, migrants, and marginalised groups (CCAFS, 2018). These groups are usually poor and occupy marginal lands that are prone to extreme climate events like floods and drought.

CSA practices include both traditional and innovative practices that help to achieve food security in a sustainable way. According to Aggarwal et al. (2013), CSA practices can be categorised into weather smart, water smart, carbon smart, nitrogen smart, energy smart, and knowledge smart. There are several practices under each classification. According to Anuga & Gordon (2016) weather smart implies awareness of past, present, and future weather occurrences that aid farmers to avoid/or reduce the risks of weather events. Weather smart practices include

receiving weather updates through radio or television, using monitoring weather through personal experience, accessing weather information through appropriate and smart technologies like internet and phones, and taking insurance as protection against weather risks (Baurzhan & Jenkins, 2016. Cited in Anuga & Gordon, 2016). Climate smart knowledge deals with the sharing of agricultural information, knowledge, and practices between and among individual farmers, farmer groups, and stakeholders through farmer to farmer learning, farmer networks, extension and technical assistance, cooperation, and development of outreach. This helps to scale up the adoption of CSA practices. It also includes seed storage as a community preservation of genetic diversity of seeds and also as insurances against years of insufficient seeds.

Water smart aims at enhancing the efficiency and production of water through resilient water management practices such as rainfall harvesting, water conservation, drip irrigations, community management of water, aquifer recharge, laser levelling, and drainage (drainage helps floodwater to seep into the natural aquifer. This recharges the aquifer and also protects standing crops) (Aggarwal et al., 2013). Carbon smart deals with increasing the content of carbon in the soil and the reduction of carbon content in the atmosphere as well as reducing the emissions of carbon from agricultural activities. According to Aggarwal et al. (2013) agricultural practices that can increase carbon content in the soil include agroforestry, conservation tillage, residue management, livestock and manure management, and diversified land-use systems. Energy smart comprise of practices that ensure fuel efficiency, conserve fuel, and reduce greenhouse gas (GHG) emissions. These practices include the use of biogas, fuel efficient agro-machines, reduced tillage, and residue management (Aggarwal et al., 2013). Nitrogen smart deals with efficient use of nitrogen fertilizer for maximum crop yield and reduced GHG emissions. It takes into consideration the condition of the soil and crops before applying a specific fertilizer.

According to Aggarwal et al. (2013) farmers use handheld crop sensors, nutrient decision maker, and leaf-colour chart to make decision as to the appropriate dosage of nitrogen fertilizer for specific crops. This has the potential to reduce cost and GHG emissions.

2.3.1 Integrating gender into CSA activities

Climate change affects females and males differently (World Bank, FAO, IFAD, 2015). This implies that climate change interventions must be gender sensitive. In designing and implementing CSA practices, the peculiar situations of both females and males need to be taken into consideration. According to Farnworth & Colverson (2015), cited in World Bank, FAO, & IFAD (2015), gender has been recognised as a critical issue in development for decades and there is evidence that gender equality results in poverty reduction, improved food and nutrition security, enhanced resilience of rural dwellers, and other better agriculture and development outcomes.

There is therefore the need for gender considerations in the design and implementation of CSA interventions. World Bank, FAO, & IFAD (2015) hold that the ultimate aim of integrating gender in CSA practices is to reduce inequalities and ensure that interventions benefit both women and men equally in order to reduce climate change risks. CSA practice must be responsive to the concerns of both women and men (Nelson & Huyer, 2016). According to Nelson & Huyer (2016), the implementation of any CSA practice must be preceded by a gender analysis. There must be a thorough scrutiny of ownership and control of resources as well as power relations between men and women. Again, both men and women must be actively involved in the entire process of developing and implementing the development intervention in question. They further stress that obstacles that impede adoption of the CSA practice need to be

removed to ensure that both men and women successfully adopt the CSA practice. Ultimately, in both short and long term, the CSA practice should benefit both women and men and make their lives better.

It is important to note that adopting CSA practices comes with risk of investing both resources and time into the specific practice. Usually women do not have these resources that could enable them to successfully adopt CSA practices. For instance, adopting irrigation implies that farmers have to buy irrigation tools and extra labour and also have access to sources of water for irrigation. Doss (2001) concludes, in a review of agricultural innovation and female farmers in Africa, that due to fear of losing access to land and investment, women lack the motivation to adopt soil management practices. This makes female farmers more vulnerable to climate related risks. As men may succeed in adopting, women may be limited by resources and cultural norms that hinder them from owning or controlling resources. World Bank, FAO, & IFAD, (2015) conclude that there is therefore the need for more support to address women's needs as they make decisions whether to adopt new practices or not, taking into consideration the risks and trade-offs involved in the decisions.

Agricultural innovations must therefore be sensitive to the differential needs and priorities of both women and men. This implies the involvement of both women and men in decision making as this will make their voices heard. According to Naab & Koranteng (2012), until female-specific interventions are embedded in climate change adaptation measures, intervention to climate change is not complete. Similarly, World Bank, FAO, IFAD, (2015) stressed that in order to strengthen the effectiveness and sustainability of CSA interventions, gender inequality and other social differences must be considered.

2.4 Importance of climate and agriculture related information in food production

As agriculture transforms to meet food demands, it has become imperative that farmers are made aware of best farm practices that increase production levels under the realities of climate change. Thus, information has become crucial for social progress (Nitin, 2012). Information is an important resource needed in daily activities (Nitin, 2012) and as such has become an essential tool for the development of agricultural activities (Muhammad et al., 2016). According to Anaglo et al. (2014), agriculture is rapidly reaching the limits of natural resources and as such production will need to dependent more on intensification via effective use of inputs rather than expanding existing farm land. They stressed that the key roles of knowledge, information, technology, and skills will be needed in this process. Climate and agriculture related information helps farmers to make critical decisions that can influence their production levels. Nitin (2012) held that farmers are able to make right decisions to aid agricultural growth when relevant and timely information is available. He added that farmers make right decisions regarding the type of crop to plant, where to sell farm produce, and where to buy farm inputs when information covering weather trends, best farming practice, and timely market information are provided. Information in these areas aids farmers to maximise their production and income levels. Higher income levels could help farmers to adopt innovative farm practices that are money-demanding.

Apart from helping farmers to make decisions pertaining directly to the farm, it also helps them to make decisions regarding their off farm activities. Naab & Koranteng (2012) conducted a study in the Upper West region of Ghana. The farmers revealed that the daily weather forecast information they receive helps them to plan their farming activities as well as protect their properties. The farmers stressed that information on shorter rains helps them to plant early maturing crop varieties. However, when they get information on longer rainfall pattern it helps

them to expand their farm sizes. Roofs are also prevented from being blown off by placing boulders and logs on them when information on storms are received by farmers. Also the farmers indicated that they protect themselves from diseases such as cerebrospinal meningitis when they get information on excessive heat. Female farmers indicated that they wanted more daily weather forecast and information on whether it would rain so as to aid them plan their activities like collecting water, cooking, milling flour, washing, and collecting firewood.

Information helps farmers to better manage their farms. For instance, in a study on access to agricultural information among rural women farmers in Abuja, Nigeria, Lawal et al. (2016) observed that rural women farmers are the majority of rural dwellers, they use their backyards for growing crops and rearing livestock. They stressed that, as little as their land sizes may be, they need agricultural information that will enable them to make effective and efficient use of land, make proper management of soil and water, and control pests and diseases as well as solve other farm related problems. Farmers' access to vital farm and climate related information is very crucial in ensuring that farmers are able to manage productive resources in a way that will increase their production levels. For instance Blait (1996) held that farmers' access to agricultural information regarding early warning systems on flood, drought, pest infestations, disease insurgencies, fertilizer inputs, new farming technologies, market prices, and credit are crucial for sustainable and improved rural and agricultural development.

2.5 Rural farmers' sources of climate and agricultural information

Farmers receive climate and agricultural information from varied sources. Whiles some depend more on formal sources like government and NGO extension agents, others depend more on

informal sources like their spouse, other family members, neighbours, colleague farmers, and friends.

Adio et al. (2016) investigated the use of agricultural information sources and services by farmers for improved productivity in Nigeria. The study revealed that the major available information sources utilised by farmers were informal sources such as town crier and colleague farmers. Similarly, Nitin (2012) carried out a research on rural farmers' information needs in Maharashtra, India. The study revealed that farmers' major source of information was their colleague farmers. The findings from the above two studies from different geographical areas reflect farmers' dependence on informal sources for climate and farm related information. There is a concern that the local knowledge shared among farmers is not reliable and does not contribute to increased yield (Adio et al., 2016). However, it is important to point out that these informal sources are vital part of food production in several rural areas. Without thought, these sources contain relevant traditional farming knowledge that can be tapped and embedded in the current formal agricultural extension service delivery. Contrary to the above findings, Murage et al. (2015) revealed that in eastern Africa, majority of farmers get information from extension agents. In Tanzania, the study revealed that NGOs are a major source of information. However, few farmers also get information from other farmers who have already adopted the technology (early adopters). They stressed that, considering the intensive nature of women's domestic and farm roles, women do not get the time to attend village meetings and as a result extension officers who mostly visit homes become the main source of information for women.

Regarding rural female farmers, Naab & Koranteng (2012), conducted a research in Upper West, Ghana. They tested tools and methodologies developed by the Climate Change, Agriculture and Food Security (CCAFS) and FAO on analysis of gender issues in climate change, agriculture,

and food security. The study found that female farmers' sourced information on new farming practices from their husbands, agricultural extension agents, and NGO. In this part of the country, SEND-Ghana (2014) reported that cultural norms do not permit women to have direct interactions or engagements with strangers, especially men. This hinders female farmers from accessing information form extension agents, who are mostly men and outsiders. This situation is compounded by the lack of female extension agents in this part of the country (SENG-Ghana, 2014). This situation could compel female farmers to depend on their husbands who usually are able to meet extension agents for CSA information.

Peterson (2014) also carried out a study in the Lawra area of the Upper West region. The research sought to find out the factors that hinder farmers from adopting CSA practices. The study revealed that female farmers' sources of information on agricultural innovations are their own experience, traditional knowledge, and their neighbours. It is important to note that female farmers are a vital repository of knowledge on farming practices because of their active participation in food production. For instance, Naab & Koranteng (2012), reported that women perform the most of farm labour, among other duties they are in charge of gathering and applying manure on crops, involved in dry season gardens, and also engaged in cultivating some non-cereal food crops like yams. Peterson (2014) stressed that female farmers are not able to attend agricultural extension programs either because they are usually not invited or their time and work burden makes it difficult for them to participate in the programs. What compounds the situation, according to Peterson (2014), is the fact that husbands do not always share with their wives what they learn from extension programs.

Over the year, farmers have depended on traditional knowledge of farming (Adio et al., 2016). According to Alemna & Osei (2007), farmers are compelled to depend more on traditional ways

of farming when they do not get agricultural information from formal sources like extension agents. However, the overreliance on traditional knowledge might also have a negative impact on the adoption of CSA knowledge. It might not be a case of the lack of access to CSA information from formal sources that compels farmers' to rely on CSA but it could be the norm in some instances that farmers rely on traditional knowledge of farming passed down to them by their ancestors. Importantly, Adio et al. (2016) stressed that traditional knowledge of farming is unreliable and could lead to low production levels. However, this might not always be the case because these sources may contain vital information regarding food production and as such should be embedded into the formal extension service delivery. Alemna & Osei (2007) also reported that, male farmers learn about new farming practices from government extension agents, community meetings, and farmer field schools hosted by MoFA. This could be attributed to the fact that male farmers have more access to extension agents compared to women farmers. For instance, SEND-Ghana (2014) revealed that extension service delivery in Ghana centres on the needs of male farmers.

Okwu & Omuro (2009), in their study of women farmers' agricultural information needs and accessibility in Benue State, Nigeria, reported that the major sources of women farmers' agricultural information were their husbands and fellow women. Importantly, female farmers may feel comfortable sharing their farm issues with their fellow females or husbands. This could explain why women depend more on their fellow women and husbands for agricultural information. This might also be the reason for female farmers' low usage of extension officers who are mostly men and outsiders. For instance, Okwu & Omuro (2009) pointed to the fact that there is low usage of extension agents by women as sources of agriculture information. Thus, the study recommended that female farmers should be given more adult literacy education that will

provide basic skills and abilities in order to help them seek and receive farm related information from mass media and extension agents.

The above review reveals that farmers' information sources vary from one place to the other. Even in the same area, information sources change over time. This requires that farmers' information sources are tracked so as to ascertain the reliability of the information farmers receive. Also, there is the need to train more female extension officers to curb the gender imbalance in the extension work which is mainly dominated by men. This male dominated culture could also be the problem that has influenced female farmers' disconnect from such officers and also their inability to access information.

2.6 Rural farmers' channels of climate and agricultural information communication

Information channels can be categorised into mass media and inter-personal channels of communication. Mass media are channels such as radio, television, newspaper, internet, and phone. They are effective in creating awareness of agricultural innovations. They deliver quick farm related information to farmers. For instance, according to Anugua & Gordon (2016), mobile phones and radio/television provide reliable information that keeps farmers up-to-date with weather information. Aker & Ksoll (2015), cited in Anuga & Gordon, revealed that through phone calls and text messaging, mobile phone allows for easy and efficient farmer-to-farmer communication. On the other hand, interpersonal channels are a face-to-face means of transferring information to people. This method is widely adopted by many agricultural extension service providers. An example is extension officer's visit to the farm/home of farmers.

The channels through which rural farmers get climate and farm related information widely vary. Naab & Koranteng (2012) conducted a research in the Jirapa district of the Upper West region of

Ghana. The research revealed that radio in the local dialect, announcements on Sundays, and visits by extension agents were the channel female farmers preferred for receiving weather information. Also the farmers indicated that television should be used to deliver weather information to them so that they could hear as well as see. The use of visuals in delivering information is crucial in ensuring that farmers do not easily forget the information. Again, the farmers revealed that they learn about new farming practices through their involvement in farming with their husbands. Through interactions with others, farmers are able to learn and share best farm practices that increase production levels. Peterson, (2014) investigated the barriers of adopting CSA practices in the Upper West region of Ghana. Contrary to the findings to Naab & Koranteng (2012), the study reported that female farmers received information on new farming innovations through interactions with their neighbours. Farmers easily learn from their neighbours, especially those who experience increasing crop yields. It is important to note that strong social connections in rural areas afford farmers the opportunity to interact with their colleague farmers and share vital agricultural information. Female farmers may use periods of water and wood collection, visiting the grinding mill, and market times to share farm related information among themselves. As men sit under tree in the evenings and also meet at family meetings, these may serve as opportunities for them to also share farm related information among themselves.

Similar to the above research, Achugbu & Anie (2011) carried out a research on ICTs and information needs of rural female farmers in the Delta State, Nigeria. The findings of the study indicated that female farmers get agricultural information through their interactions with their community leaders. According to the study, female farmers also use other channels such as interactions with their husbands, neighbours, and their friends. Achugbu & Annie (2011) pointed

out that in rural areas people have respect for their leaders and this may have accounted for farmers' interactions with their community leaders for farm related information. The above literature review reveals that, farmers get farm information through different channels. Thus, it becomes imperative that climate and agricultural information providers keep track of the channels that are most available to farmers, channels most preferred by farmers, and channels that can reach many receivers. This is very crucial in ensuring that information gets to its intended recipients.

2.7 Gender and access to CSA information.

World Bank, FAO, & IFAD (2015) acknowledge that knowledge gaps remain with regard to CSA and gender. CSA and gender related studies is an emerging field and as such much work is not available regarding how gender and other socio-economic factors affect access to CSA information and adoption of CSA practices. World Bank, FAO, & IFAD (2015) stressed that information on socio-economic factors surrounding CSA is limited. Much is often said about CSA information to the neglect of the factors that determine its accessibility. Vital characteristics of farmers such as gender, marital status, literacy, place of residence (rural or urban), income levels, and language, are easily neglected. However, these variable factors have been found to influence farmers' access to agriculture related information. For instance, according to Glendenning et al. (2010), factors like literacy or access to resources affect farmers' information needs, their information searching behaviour, access to information, and information use. These factors are capable of disposing farmers to information source and also give farmers the ability to purchase information dissemination tools.

Wesseler & Brinkman (2003) presented a paper on bridging information gaps between farmers, policymakers, researchers and development agents, at the regional conference on Agroforestry impacts on livelihoods in Southern Africa. In the paper they revealed that factors such as literacy, education, language, social, economic factors, and physical location account for the existence of information gap among farmers. It is important to note that the availability of information does not necessarily connote its accessibility. This is because in todays' world of technology, information is mostly stored online and in document form. Thus, factors like illiteracy, language, poverty, and place of residence (rural/urban) easily set in to influence farmers' accessibility to the information. Rural areas that are characterized by poor network connectivity and those without electricity are usually deprived of the opportunity to access the internet for farm related information. Even in places where there is stable network connection and power source, poverty prevents farmers from buying communication tools like television, radio, and mobile phones.

In a study by Lawal et al. (2016) on Access to agricultural information among rural women farmers in Abuja, Nigeria, maximum Likelihood Estimate technique was used to determine the factors that influence rural women farmers' access to agricultural information. The considered farmer characteristics were marital status, educational level, age, household size, farm size, income level, farming experience, number of information accessed, cooperation/farm association, and contact with extension agents. The logit model results revealed that there is a positive and significant relationship between access to agricultural knowledge and information and women farmers' socio-economic variables such as age, marital status, and member of cooperative/farm association. Married female farmers usually receive CSA information from their husbands. Those who are not married as well as widowed farmers cannot access CSA

information from this source. Farmer associations serve as platforms where farmers learn new farming practices from and also share information on CSA practices with one another. Farmers usually learn from other members of the farmer association who experience higher crop yield. Thus, membership of a farmer association gives farmers the opportunity to access CSA information.

Importantly, farmer's socio-economic characteristics are very potent in influencing farmer's accessibility to CSA information. For instance, the fact that some farmers leave in rural areas can limit their level of access to CSA information because of unavailability of information dissemination infrastructure like communication network. Again, female farmers in several rural areas are usually hindered from accessing CSA information because of norms that limit their mobility (SEND-Ghana, 2014). Farmers with low income levels also find it difficult to buy information dissemination tools like television and radio. Again, illiteracy prevents farmers from accessing the internet for vital CSA information that could aid them to increase crop yields. What this imply is that, in the process of disseminating CSA information to farmers, their socio-economic characteristics must always be taken into consideration. This will ensure that the information gets to its intendent recipients.

2.8 Challenges of accessing climate and agricultural information by rural farmers

The threat of climate change on crop yield has made food production to depend on transfer of information, innovation, and skills that are essential in increasing food production in the wake of climate change. However, rural farmers are still faced with challenges in their efforts to access relevant climate and agricultural information. One would have thought that the advent of ICTs would make information transfer to farmers easier. Lawal et al. (2016) observed that even in the

presence of ICTs, rural farmers still face challenges in accessing information. Rural farming communities are faced with limited social amenities like information infrastructure and service centres and this does not allow for easy flow of vital agricultural information to rural farmers (Meitei & Devi, 2009; Anaglo et al., 2014; Muhammad et al., 2016). The weak information system means that rural farmers do not get timely, relevant and accurate information and this affects food production as more farmers may experience low yields or leave agriculture for non-agriculture activity (Anaglo et al., 2014).

Illiteracy and poverty among rural farmers impede them from accessing CSA information. Importantly, as information is increasingly stored online and in document forms, illiteracy and poverty could hinder farmers from accessing information. Thus, the fact that information is available does not necessarily mean farmers have access to information. Rural female farmers, especially, are hindered from accessing information due to factors such as illiteracy and poverty. For instance, Van & Fortier (2000) reported that generally, rural female farmers are illiterate and as such do not have access to agricultural information from traditional prints and libraries. They stressed that, this situation deprives rural females of the required skills that could enable them operate basic farm implements.

Time and workload usually prevents rural farmers, especially females, from fully benefiting from extension services. Women farmers are usually overburdened and as such do not have time to attend meetings with extension agents. For instance, Protz (1997) revealed that rural female farmers participate in both farm and off farm activities that prevent them from participating in extension programs. Among their responsibilities include, taking care of children and the elderly. Their numerous tasks conflict with periods scheduled for extension programs. Similarly, FAO (1998) revealed that rural females miss extension training programs because they are burdened

with so many domestic duties that keep them away from home. Usually females spend a lot of time collecting water and firewood from far places. These activities take them away from home most of the times and make them miss agricultural extension programs.

Socio-economic and cultural factors also limit rural farmers' access to climate and farm related information. For instance, Morna (1989) asserted that, in rural Malawi, extension officers usually engage with only men when educating farmers on improved technologies. This could be a possible reflection of cultural norms that prevent women from interacting with strangers. Similarly, SEND-Ghana (2014) revealed that in the northern parts of Ghana, cultural norms impede women from having direct interactions with outsiders, especially men, for information. This limits women's access to market information thus weakening their bargaining power.

Economic challenges also limit farmers' access to CSA information. Lawal et al. (2016) revealed that among others, major problems encountered by rural women farmers in Abuja, Nigeria in their efforts to access information were high cost of some media equipment, lack of agricultural library, lack of ICT centres, cost of transportation to agricultural centres, and poor roads to extension office. They added that current libraries do not have adequate infrastructure that will aid rural female farmers to utilise modern ICTs in order to gain agricultural knowledge and information that enhance production levels. Considering their findings, they suggested the provision of farm inputs and modern technologies to farmers, and accessible roads that will make it easier for rural female farmers to go to extension offices and farms. They also suggested that more female extension agents should be trained and sent to rural areas. In order to bridge the information access gap between rural farmers and information sources and channels, it is necessary to understand the gendered challenges that impede rural farmers from accessing vital climate and agriculture related information. It becomes imperative that in Ghana's effort to adapt

to the adverse effects of climate change, information on best farm practices and adaption measures are transferred through appropriate and effective channels to rural farmers who are the drivers of agricultural growth.

2.9 Conceptual framework

Communication process has been explained by several models. One of such models is the early work of the ancient Greek philosopher Aristotle. He depicted communication as an orator speaking to listeners. He had three elements in his model of communication: speaker, message, and listener. What is fundamentally missing in this model is the concept of feedback. Usually without feedback, it is not sure whether the message got to its intended receiver or whether the receiver understood the message. Also the model fails to recognise the influence that receiver's background characteristics have on the receiver's ability to understand the message as well as whether the message will actually get to its intended recipient.

Another communication model that emerged was Laswell's model of communication (1948). Elements of the model included communication, message, medium, audience, and impact. Harold Laswell asked the question, '' who says what in which channel with what effect''. An essential element he added to the process of communication is the idea of the impact a message has. Usually messages are expected to influence receiver's decisions to adopt an innovation or respond to a situation. However, the missing factor in this model is the concept of feedback. This is essential because without feedback if will be difficult to know whether the message had any impacts on receivers. Again, the model fails to recognise the vital role that the audience' background characteristics have on the ability of the audience to receive or understand the message.

Shannon and Weaver in 1949 came out with another viewpoint regarding communication. Shannon and Weaver added three elements missing in Aristotle's model. They are transmitter, sources of noise, and receiver. Transmitter and receiver are the hardware used in sending the message as in telecommunication. Noise may be environmental or language difference in communication that interfere with the communication process. The elements in this model include the information source, message, the transmitter that sends the signal, the receiver that receives the signal, and the message destination. Just like the previous models, the concepts of receiver's background characteristics and feedback are missing from this model. Berlo in 1960 brought on board a different approach to modelling communication process. Berlo's model identifies four elements of communication and their controlling factors. The elements and their controlling factors are Source (communication skills, knowledge, culture, attitude, social system), Message (code, content, structure, treatment, elements), Channel (hearing, smelling, seeing, tasting etc.), and Receiver (communication skills, knowledge, culture, attitude, social system). These controlling factors affect the ability of the receiver to get the message and the ability of the receiver to make sense of the message. The model recognises that certain factors may interfere with messages and prevent receivers from receiving the message. However, the model fails to recognise the vital role of the concept of feedback in ensuring that the intended receiver actually received, understood the message or acted on the message.

Considering the socio-economic characteristics of the respondents and the study objectives, the conceptual framework (Figure 2.2) of this research is based on Schramm's model of communication (Figure 2.1) introduced by Wilbur Schramm in 1954. Essential elements Schramm introduced into communication process were the ideas of feedback and the socio-economic background/field of experience of the sender and receiver of the message.

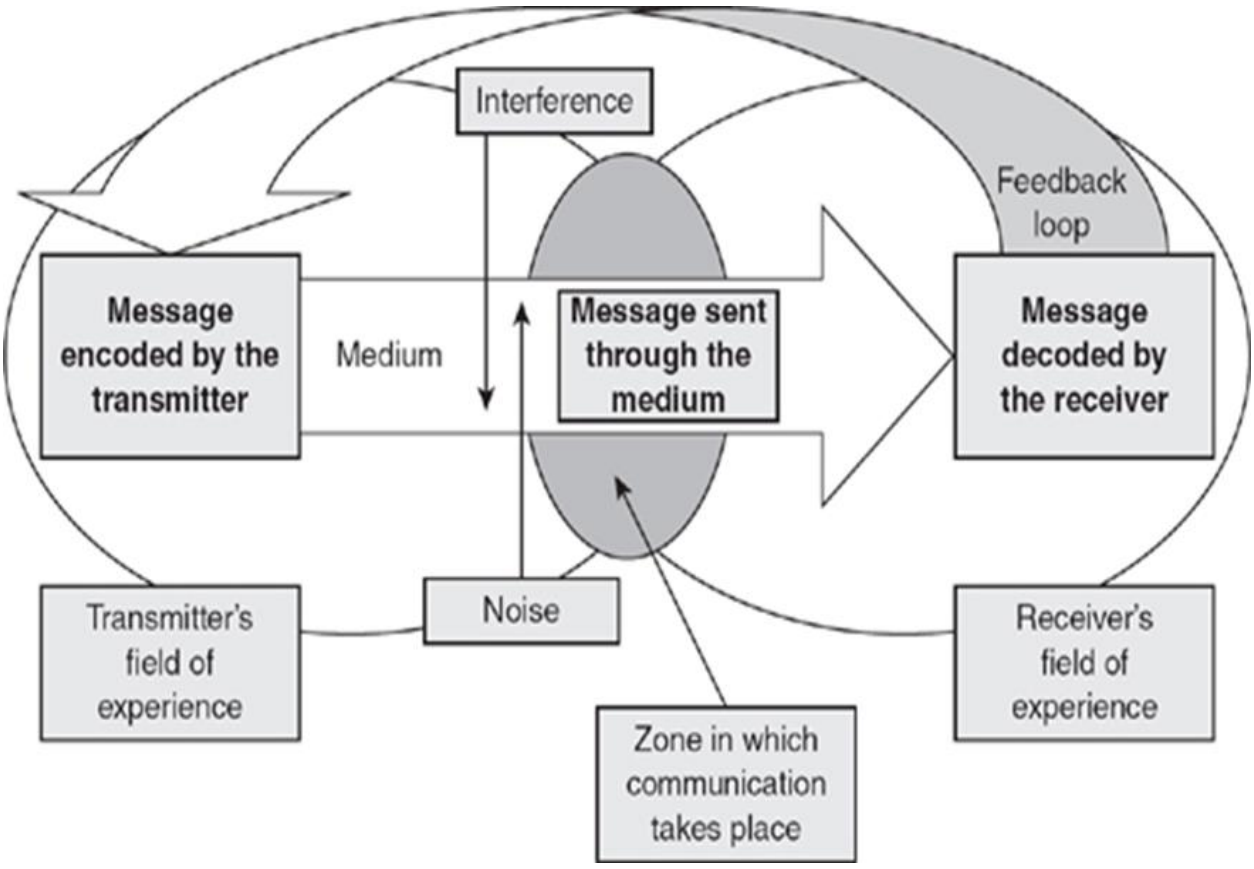

Figure 2.1: Schramm's model of communication.

Source: Blythe, 2018

Schramm's model is built around components such as (taken from Blythe, 2018):

- **Sender/source** is the institution/person who delivers the information. Example; agricultural extension agent.
- **Coding** is the act of converting the idea into content (writing, audio, video etc.).
- **Message/information** is the data that the source sends and information received by the receiver. Example; how to apply fertilizer

- **Medium/channel** is the channel used to send the message to the receiver or feedback to the original sender. Example; radio, mobile phone, visit to extension agents' office, agricultural shows.
- **The receive**r is the individual who gets the information. Example; farmers
- **Decoding** is the act of trying to make meaning out of the message through reading, listening, watching etc.
- **Field of experience** is the background characteristics of the sender and the receiver. These characteristics are very essential in the coding and decoding process.
- **Feedback** is the process of responding to the message to acknowledge its reception or to ask make some enquiries.
- **Noise** is anything undesired that can interfere with effective transfer of message or feedback. It could be the backgrounds, beliefs, experiences, and values that influence how the sender conveys a message and how the receiver interprets it.

According to Schramm's communication model, a source or sender (such as extension agent or NGO) codes a message (such as audio or video), and sends the message (such as weather forecast and commodity prices) through a channel or medium (such as television, radio or visit), to a receiver (such as farmers, female farmers or widowed farmers). When the receiver gets the message, the receiver decodes the message, chooses a channel, and sends feedback to indicate reception of the message or ask for clarity. The model however stresses that certain elements, which are termed noise, may interfere with the message and feedback and therefore prevent them from getting to their intended recipients. Semantic noise which is the socio-economic characteristics, experiences, beliefs, and values that influence how a sender conveys a message

and how the receiver interprets it may interfere with both the message and the feedback. Noise is capable of distorting the meaning of a message.

The model emphasises that the receiver must be able to make meaning of the message in the sender's desirable way else the message is meaningless. Hence, without the appropriate coding of the message by the sender and a proper decoding by the receiver it is impossible for communication to take place. For instance, sending a message on weather forecast through television in English language to rural communities that do not have electricity and are also characterised by illiteracy implies that the message will not get to its intended recipients. This is because in the first place, the rural communities do not have access to television. Secondly, the rural dwellers do not speak English language and as such will not understand the message. The field of experience of the sender and receiver is very vital in communication because people of different backgrounds (different experience, knowledge, and culture.) may interpret things in different ways. According to the model, for an effective communication to take place, there must be an overlap of field of experience between the sender and the receiver. The sender codes the message based on his/her field of experience. Also, the receivers use their field of experience to decode the message. Hence, without an overlap of field of experience, communication cannot take place.

The conceptual framework (Figure 2.2) revolves around farmers' access to CSA information through farmers' preferred channel. Figure 2.2 identifies that farmers have high access to CSA information if the channel used by the extension officers to disseminate CSA information is preferred by the farmers. Farmers' preferred channel is the channel preferred by majority of the farmers. These preferred channels may be influenced by farmers' socio economic characteristics (such as gender, place of residence (rural/urban), marital status, educational level, and economic

status etc.). These socio-economic variables predispose farmers to CSA information channels like radio, television, internet, agricultural shows, farm visit by extension agent, home visit by extension agent, visit to extension agent's office etc. The extent of the overlap between farmers' preferred channel and the channel used by extension officers to transfer CSA information influences farmers' level of access to CSA information. Thus, the greater the overlap between the farmers' preferred channel and the channel used by extension officers, the greater the accessibility of CSA information. Also, according to the conceptual framework (Figure 2.2), farmers' level of access to CSA information can be measured by determining whether CSA information was transferred to them through their preferred channels. Perhaps, transferring CSA information through famers' preferred channel will result in more access to CSA information by farmers and change their attitude towards adopting CSA practices. However, accessibility to CSA information may still occur if farmers' preferred channels are not used, but accessibility will be higher if their preferred channel is used. When farmers' preferred channel of CSA information is used, there is a higher possibility that their access to CSA information will be higher compared to when their preferred channel is not used.

Also, Figure 2.2 identifies that when farmers receive information through their preferred channel, they send feedback to the extension agents to acknowledge reception of the message or ask extension agents for clarity. Without feedback from farmers to the sender, the communication process is not complete. Thus, effective communication may occur if the extension officer/NGO receives feedback from farmers. Again, the conceptual model holds that some socio-economic characteristics of farmers (such as gender, place of residence (rural/urban), marital status, educational level, and economic status etc.) are potent in influencing farmers' level of access to CSA information. However, high access to CSA information helps farmers to

adopt CSA practices which in turn helps to change farmers' socio-economic variables like crop yield per season and income level. The implication of the conceptual model is that, in order for CSA information to reach its intended recipients, farmers' preferred channel needs to be used in disseminating the information.

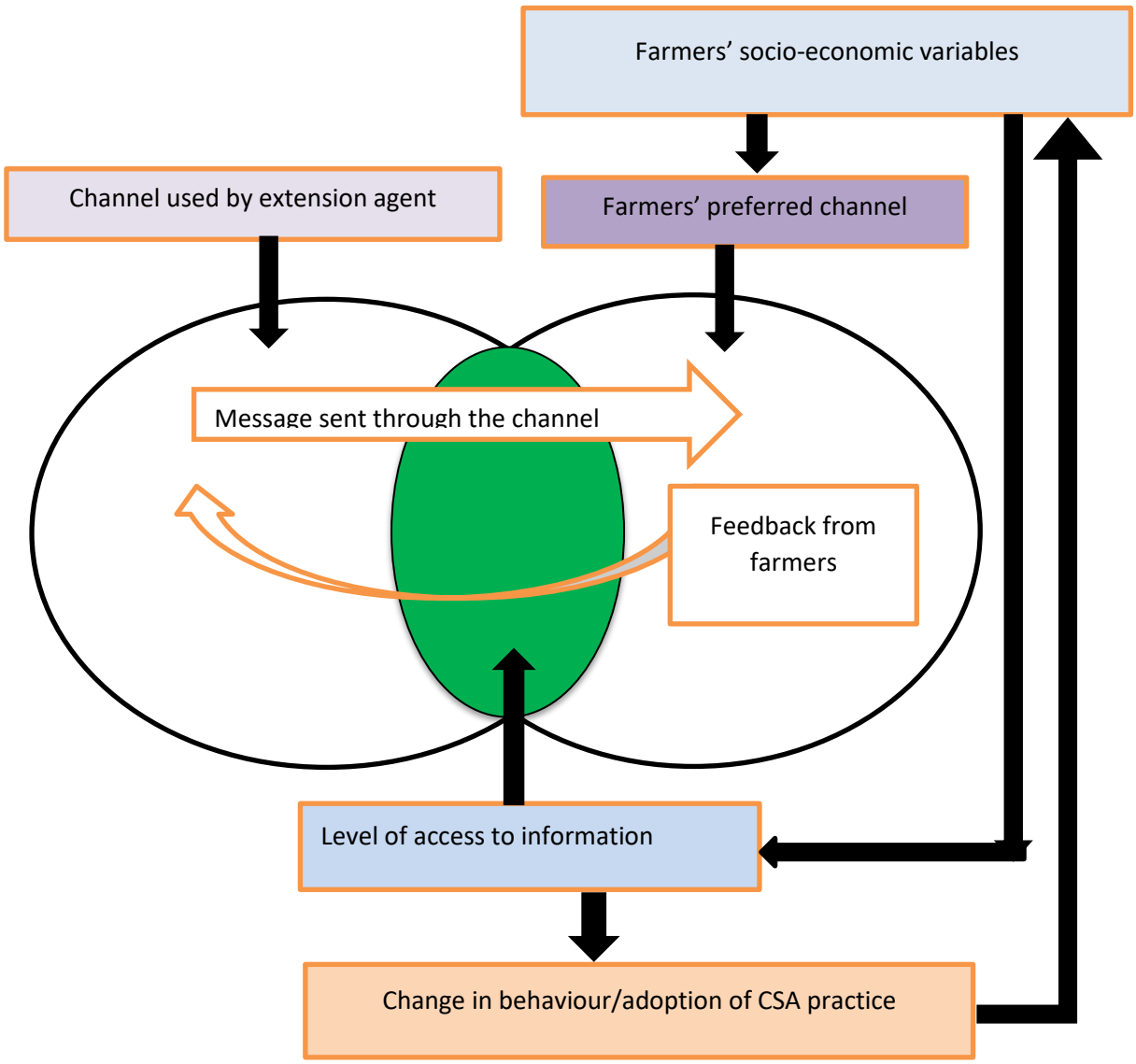

Figure 2.2 Framework of access to CSA information.

Source: Author's own construct, 2019. Based on Schramm's model of communication.

2.10 Summary

This chapter discussed what various scholars and researchers have revealed regarding gender and access to climate and farm related information. The literature review revealed that climate and farm related information plays a vital role in impacting farmers with the necessary skills to manage their farms for increased production levels. However, rural farmers have low access to climate and farm related information. The review also indicated that both rural male and female farmers get information from various sources like their spouses, colleague farmers, and agricultural extension agents, and through various channels like interactions with colleague farmers and neighbours. Again, the review indicated that factors such as poor social amenities, illiteracy, and poverty hinder rural farmers from accessing CSA information. The chapter ended by discussing the conceptual framework that was used to underpin the research. A framework of access to CSA information was constructed based on Shramm's model of communication to underpin the work. The conceptual framework identifies that, socio-economic variables of farmers influence farmers' preferred channel of CSA information, when farmers receive CSA information through their preferred channel, they send feedback to extension agents, and high access to CSA information influences farmers' adoption of CSA practices which in turn influences some socio-economic variables of farmers.

CHAPTER THREE

RESEARCH AREA AND METHODOLOGY

3.1 Introduction

This chapter discusses the physical and socio-economic characteristics of the Pru District that influence activities in the area. Also, it discusses the methods that were used to gather and analyse data.

3.2 The study area

Pru District is located in the Bono East region of Ghana. Falling within the interior savannah climate, it has an annual temperature range between 26.50C and 27.20C (GSS, 2014). However, in extreme cases temperatures can rise to about 40^{o}C. The district experiences a double rainy season with the first rains starting in June while the second starts in September. It has an annual rainfall which ranges between 800mm and 1400mm (GSS, 2014). The rains encourage vegetation growth but there are bush fires during the dry season and unsustain farming practices that are gradually destroying the vegetation. The dry season occurs from December to March. During this long dry season, male farmers are usually engaged in hunting while female farmers without alternative livelihoods become less engaged on the farm.

The land is generally flat which is suited for crop production but there also undulating surface that rise between 60 to 300 metres above sea level. The favorable climate coupled with fertile soil in the district supports the cultivation of food crops like yam, maize, groundnut etc. (GSS, 2014). The district is home to the Pru River, the Volta Lake, and several streams that serve as household's major sources of drinking water. Most of these streams dry up during the long dry

season thereby increasing the burden of women because they have to travel longer distances to collect water. This could make female farmers miss extension programs. The river banks and beds are rich in alluvial soil that are well suited to food production (GSS, 2014) and are used by women to cultivate vegetables such as pepper and tomatoes. However, the frequent flooding of the Pru River for instance destroys most of these farms.

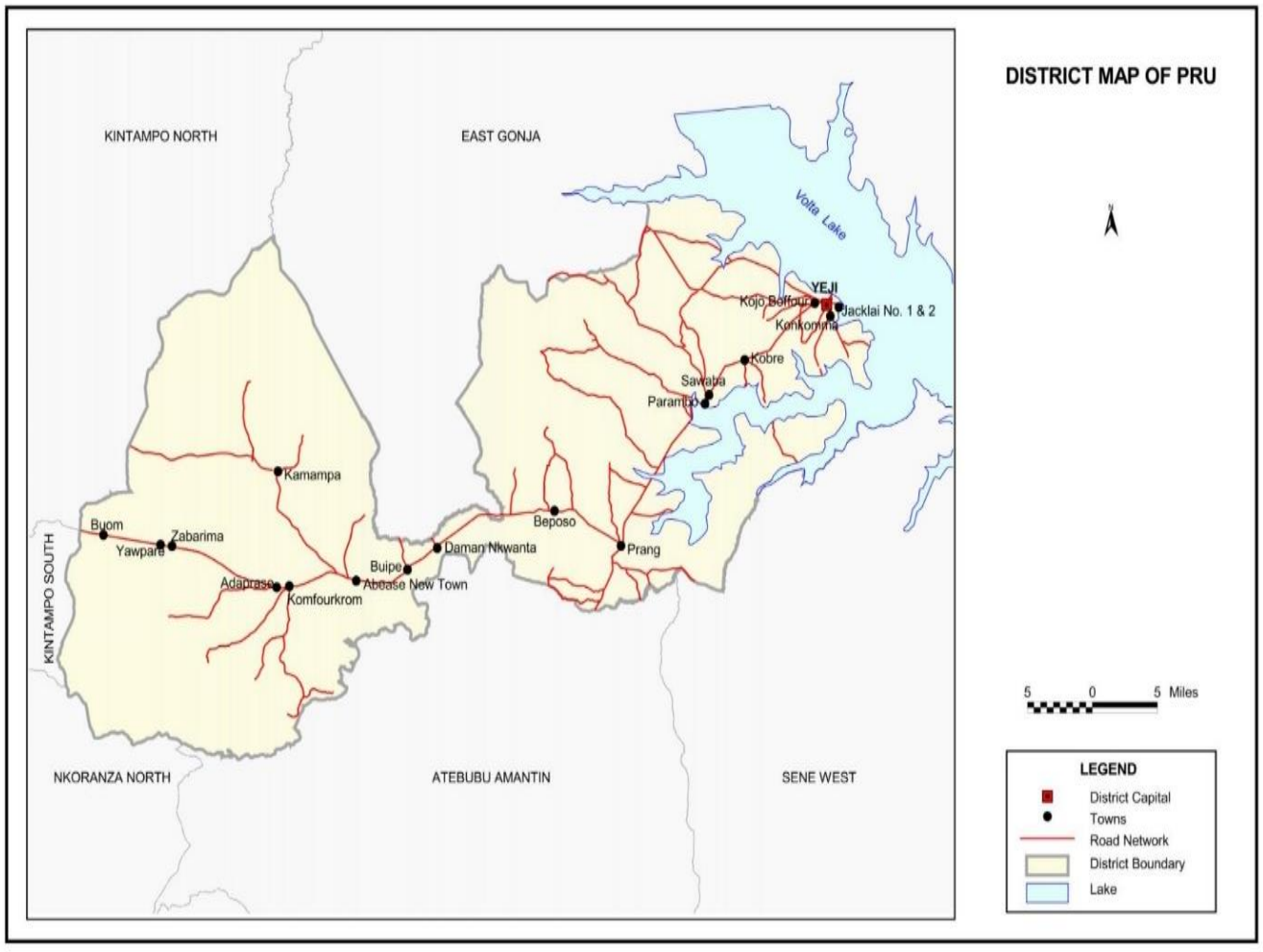

Figure 3.1: Map of Pru District.

Source: Ghana Statistical Service, 2014

3.3 Demographic characteristics

According to the latest available figures, from 2014, the population of the district was then approximately 130,000 (GSS, 2014). Men make up 50.9% of the population whereas females make up 49.1%. The district has a youthful population, with 44% of the total population younger than 15 years. There are approximately 3 deaths in every 1,000 people in the district per year. More men die after the age of 50 than women and this makes a lot of the older women widows. Widowhood is common among women than men (GSS, 2014). Many of these widows are landless, jobless, and illiterate. This sets several challenges on them in their agricultural endeavour. Also, as more men die, the implication is that more farm and off-farm responsibilities will be placed on women. The dependency ratio of the district is 92.04 (GSS, 2014). This implies that approximately 100 persons in the working ages of 15-64 years have 92 persons in the dependency ages (persons under 15 years and 65 years and older) to take care of. The youthful nature of the population coupled with the high dependency ratio places a burden on women because women are usually tasked with the duty caring for the aged and children. This workload reduces the time available for women to participate in agricultural extension programs.

3.4 Social characteristics

Patriarchy is very strong in the Pru District. Community leaders are mostly men and decision making is the sole role of men. Women are hardly involved in deciding on even matters that affect their lives. Even at the family level, women do not have a say in the distribution and utilisation of resources. Men have the control of and power over productive resources like land. By ages 25 and 29 years, 68.9% of females are married. As high as 57.4% of women who are 65 years and older are widows and the number of widows increases as the population advance in

age. Illiteracy rate is very high in the district. 46% of the population is illiterate. As low as 43% of women are literate whereas 56.8% of men are literate GSS, 2014). The high illiteracy rate, especially among women, could affect the farmers' ability to access modern channels of CSA information like mobile phones, newspapers, and the internet. Most rural dwellers travel longer distances to access schools in other communities. The district is basically rural. Majority of the population and households are in the rural areas. The rural areas do not have good road and communication infrastructure that could enable easy transfer of CSA information to farmers. Also, poverty rate is high in the Pru District. The high poverty rate prevents the people from buying information transfer tools such as television, radio, and mobile phones (GSS, 2014).

3.5 Agricultural activities

According to official statistics (GSS, 2014), agriculture employs 65.2% of the population and 61.8% of households in the district. As high as 54.4% of the women who are economically active are into agricultural activities. The prominent agricultural activity is crop farming, comprising 93.8% of rural households and 87. 2% of urban households (GSS, 2014). This is attributed to the fertile soils in the district that are suited for crop cultivation (GSS, 2014). The major food crops that are cultivated in the district are yam, maize, groundnut, beans, and cassava. The cultivation of crops such as Yam and cassava is dominated by men. This could be because of the large land size, money, and labour required for the cultivation of these crops. In general, approximately 92.3% of households are into crop farming, 35% are engaged in livestock rearing, 0.1% are fish farmers, and 0.3% are engaged in tree planting (GSS, 2014). Poverty and hunger are still high even though majority of the people is into agriculture (GSS, 2014). This may be attributed to unsustain farming practices that destroy soil quality and consequently reduce production levels.

3.6 Economic characteristics

Agriculture forestry and fishing is the major employer (65.2%) of the economically active population, according to official statistics (GSS, 2014). The district is basically agrarian. According to GSS (2014), the fertile land for crop production and the Volta Lake which serves as a means of transporting agricultural produce account for high percentage of the population in agriculture. Agriculture is dominated by men. 76.6% of men are engaged in agriculture compared to 53.6% of women (GSS, 2014). According to (GSS, 2014), the manufacturing industry employs quiet a significant number (11.5%) of the population with 19.1% being females and 4.0% males. In other places in the country, this industry employs more males than females. Retail and wholesale is the third largest industry. GSS (2014) attributes this to the presence of markets in the district that sell motorcycles, motor vehicles, and out-board motors. Unlike other districts in the country, this industry employs less men (5.8%) than women (17.1%) in the Pru District (GSS, 2014).

3.7 Information and communications technology (ICT)

Ownership and use of mobile phones and internet facilities is very low in the Pru district. The percentage of women who use these tools is lower than the proportion of men (GSS, 2014). According to GSS (2014), the low ownership of ICT tools is because of the high poverty levels that hinder the people form purchasing such tools. The implication is that, the farmers, especially female farmers, may have limited access to CSA information through mobile phones and the internet. Information dissemination centres that could help transfer CSA information to farmers are very few in the Pru district.

3.8 Study design

The research used a cross-sectional design which involves the selection of a sample at a point in time and finding out the prevalence of a phenomenon without manipulating the research environment. This design is appropriate for the study because the sampled data was used to make generalisation about the population that was targeted. The research also employed mixed-method approach. The use of mixed method approach helped the study to overcome the weakness of using one method. The approach provided the opportunity for the research to examine the socio-economic characteristics of the respondents using a four-point Likert scale for the quantitative approach. By employing statistical and participants' points of view, the design also helped to give a comprehensive meaning to the findings of the research.

3.8.1 Study population and sampling technique

The study population included food crop farmers in the Pru District. The study employed a multi stage sampling technique. The first stage involved the purposive selection of the Pru District. The district was purposely selected because the district is basically agrarian and known for its contribution to food crop production in the country. Also, women in the Pru District participate actively in food crop production with most of them involved in maize, groundnut, and cassava cultivation. The second stage was the random selection of eight study communities (Ajaraja, Labon, Zabarima, Kobre, Kumfourkrom, Kamampa, Daman Nkwanta, and Buipe) from the Pru District. A list of the various communities in the Pru District was made and each name was written on a piece of paper, folded, and put into a bowl. A blind folded person was made to pick eight communities, one at a time, from the bowl. This method was adopted to give all the communities an equal chance of being selected to participate in the study.

The third stage involved using convenient sampling technique to select farmers up to the sample size for each study community. Using the principle of disproportionality, 34 respondents were selected from each study community. In total 139 female farmers and 133 male farmers were conveniently selected to form a sample size of 272. In convenient sampling technique, data is collected from respondents who are available and willing to participate in the research. The selected farmers were food crop farmers. Researchers visited houses and farms in the selected communities and the farmers who were available and willing to participate in the study were selected until the sample size of the study community was up. On the other hand, a number of farmers were purposively selected to participate in Focus Group Discussion (FGD). This sampling technique is basically used to select information rich individuals. According to Neuman (2007) purposive is used in cases where a researcher uses expert judgement to select respondents with a specific purpose in mind. Babbie (2011) also suggested that sometimes it is appropriate to select a sample based on the researcher's knowledge of the population and the purpose of the study.

3.8.2 Sample size.

A total of 272 farmers formed the sample size for the questionnaire survey. This was mathematically determined using the following approach suggested by Scott (2018);

Sample Size = $(\text{Z-score})^2$ * Standard Deviation*(1-Standard Deviation) / $(\text{margin of error})^2$

Therefore, using a 90% confidence level (90% confidence level equals a Z-Score of 1.645), a standard deviation of 0.5, and +/- 5% margin of error (confidence interval) the sample size is calculated as below;

Sample Size = $(1.645)^2$ x 0.5(1-0.5) / (0.05)2 = (2.71 x 0.25) / 0.0025 = 0.68 / 0.0025 = 272. Therefore sample size is 272.

3.8.3 Types and sources of data

Both qualitative and quantitative data were collected for the study. The qualitative data included transcripts of FGD and interviews with farmers. The quantitative data covered the socio-economic background of farmers. The study used both primary and secondary sources to gather data. The farmers were the primary source from which data was gathered using questionnaires and FGD. In addition, data was gathered from secondary sources like journal articles, books, and national survey documents like the report of the Ghana Population and Housing Census (PHC) conducted in 2010 by the Ghana Statistical Service (GSS).

3.8.4 Data collection

The data collection tools were pretested in two communities. This was done to ensure that the tools could gather the intended data. It also helped to determine the appropriate time for data collection and whether the research assistants understood the data collection tools and could effectively and efficiently use the tools to gather the intended data.

Interviews, questionnaires, and Focus Group Discussion (FGD) were used to collect data. Research assistants were recruited and trained to help in data collection. The research assistants comprised of four females and four males who hail from the study communities and could fluently speak the local languages. The researcher monitored the data collection process. Female research assistants interviewed female farmers whereas the male research assistants interviewed male farmers. This approach was taken in order to respond to gender issues in the study area. It

also made sure that female farmers felt comfortable discussing their problems with their colleague females. The same applied to male farmers. Farmers were interviewed face-to-face with semi-structured interview guide comprised of both open and closed-ended questions. This provided the opportunity for the research team to engage directly with the farmers. The questions were read out to the farmers in the local languages but in few occasions English language was mixed when appropriate. The local languages were used because of the high rate of illiteracy in the study area.

The time and work burden of farmers, especially female farmers, was taken into consideration during the data collection. The interviews took place during the evening when most of the farmers had return from farm. However, interviews with female farmers took place in the evening when they were done with household chores like cooking. In some cases, farmers were interviewed on their farms. The questionnaire was structured into four major sections. The first section covered the socio-economic characteristics of respondent such as sex, educational status, age, years of farming, membership of farmer association, marital status, and farm sizes. The second section covered farmers' CSA information sources, their channels and preferred channels of CSA information. The third section dealt with farmers' access to extension service. The final section also covered farmers' challenges of accessing CSA information and suggested solutions. Respondents were asked to choose or state their sources of CSA information, the channels they use and the channels they prefer to use. They were also asked to state the factors that hinder them from accessing CSA information and the possible solutions to the identified challenges.

FGD and in-depth interviews were also used to collect qualitative data. It provided the opportunity for the farmers' to give a detailed account of the climate and information related challenges they encountered in their farming activities. Four FGD were held with the farmers.

FGD was held with 16 female farmers and 16 male farmers separately and later transcribed for analysis. The FGD took a detailed look at farmers' factors that hinder farmers from accessing CSA information and farmer' suggested solutions to the identified factors. Interviews and FGD were recorded and also written in field note book.

Additionally, data was gathered from journal articles, books, and national survey documents like the report of the Ghana Population and Housing Census (PHC) conducted in 2010 by the Ghana Statistical Service (GSS).

3.8.5 Data management and analysis

3.8.5.1 Quantitative data analysis

Descriptive and inferential statistics were used to analyse the gathered quantitative data using the Special Package for Social Sciences (SPSS) software. The descriptive statistics gave the opportunity for the research to examine farmers' socio-economic characteristics. Descriptive statistics was carried out to describe respondents' socio-economic characteristics and represented on bar graphs, tables, percentages and frequencies. Farmers' level of access to CSA information was measured based on a four point Likert-type scale: high=4, moderate=3, low=2, no access=1. In order to ascertain the mean level of farmers' access to CSA information, the SPSS software was used to calculate farmers' mean level of access to CSA information and compared with the calibrations on the four point Likert-type scale. Chi square test was also carried out to test the stated hypotheses. The Chi square test enabled the research to ascertain the significance of the relationship between farmers' socio-economic characteristics and access to CSA information and the significance of the relationship between gender and access to sources of CSA information.

3.8.5.2 Qualitative data analysis

The qualitative data was analysed thematically by employing Dey's (1993) suggested three step process of data analysis. These three step processes helped to comprehensively analyse the qualitative data by taking a detailed look at every aspect of the gathered data and ascertaining relationships between and among themes found in the data. The three steps include transcription, classification, and interconnecting. Transcription involves converting the gathered data (speech) from the focus group discussions and interviews into text form. Classification has to do with grouping the transcribed data into related or similar themes. Finally, interconnecting involves identifying associations or linkages between themes. Possible interpretations are made regarding the identified linkages.

The gathered data from the interviews and FGD was converted from speech to text. After the conversion, they were grouped into related subjects or themes. Finally, linkages between themes were identified and possible interpretations were made out of the linkages. Importantly, direct quotations were used to present specific and subjective assertions and viewpoints of the research participants to imply that the viewpoints are not that the researcher.

3.9 Ethical and security considerations

The research took into consideration a number of ethical and security issues. The research team sought permission from community leaders before starting the data collection. Community leaders and the respondents were briefed on the purpose of the research, its importance, and the confidentiality of the information they will provide. This encouraged the communities to participate in the research and gave out the needed information. Participation in the research was voluntary and respondents were made aware that they could opt out at any time they found

necessary. Gender issues are sensitive area in many communities in Ghana, including the Pru District. Engaging women, especially married women, in a research may raise concerns among community members especially husbands of the women. Going into the field as a male researcher, there is a common tendency for the community members to read different meanings into the research. Many rural areas in Ghana frown on women engaging with men who are not their husbands (SEND-Ghana, 2014). Thus, the families of the women were notified regarding the research and permission was sought to carry out the research.

Again, four female and four male research assistants were recruited and trained to assist in the data collection. Female research assistants attended to female farmers whereas male research assistants attended to male farmers. Importantly, the researcher strived to avoid any kind of prejudices. Prejudices are capable of influencing the results of a research. The researcher's background characteristics like ethnicity and religious affiliation were taken into consideration in order to avoid mistrust between the researcher and the research respondents. Thus, the researcher went into the field as an objective researcher doing research for a graduate program. The researcher understands the concept of gender and power relations between men and women in the study site and as such applied gender sensitive mechanisms that helped in getting the answers to the stated research questions. Also, the research methodologies that were used were flexible enough and were able to respond to the issues of gender and power relations in the district.

3.10 Limitations of the study

There is not enough academic articles covering the Pru district. Thus, access to information regarding CSA and climate change in the study area was very difficult. However, proxy data was used when necessary. The Fourth Assessment Report of the Intergovernmental Panel on Climate

Change (IPCC) acknowledges the paucity of data for empirical downscaling of findings to the local level (Parry et al., 2007). The study covers only rural crop farmers and may not be projectable to the entire farming population of the study area. This is because different groups of farmers have different needs and challenges. Again, the study was based on data gathered from 272 respondents. Thus, the results of the study may not apply to the entire population of the Ghana. However, the study recognises the similarities among farmers in Ghana and Africa at large. Hence, generalisation can be made.

3.11 Summary

The chapter discussed the physical and socio-economic features of the study site. It revealed that the soils are fertile for crop production and as such majority of the population are employed in agriculture. Crop production is the dominant agricultural activity in the Pru District employing majority of the farming population in both urban and rural area. Again, illiteracy and poverty are high which results in the low usage of ICT tools like mobile phones and internet, especially among women. The chapter also discussed the methods that were employed by the study. The study used a mixed method which employed both quantitative and qualitative methods to research. 272 farmers were sampled for the study. Primary data was gathered from the respondents by the use of questionnaires, interviews, and FGD. Secondary data was also collected from journal articles and nation survey documents. Qualitative data was analysed using the three steps (transcription, classification, and interconnecting) proposed by Dey (1993) while the quantitative data was analysed by the use of SPSS software. Chi-square test of independence was conducted to establish the relationship between gender and access to CSA information sources as well as the relationship between the socio-economic variables of farmers and access to CSA information.

CHAPTER FOUR

SOURCES, CHANNELS, AND PREFERRED CHANNELS OF CSA INFORMATION

4.1 Introduction

Having addressed the techniques used by the research to achieve the objectives of the research, this section discusses the socio-economic characteristics of the farmers, farmers' awareness of CSA practices, CSA practices on which farmers receive information, farmers' sources of CSA information, farmers' channels of CSA information, and farmers' preferred channels of CSA information.

4.2 Socio-economic characteristics of respondents

Socio-economic characteristics are very potent in influencing farmer's access to CSA information and adoption of CSA practices. These factors are capable of disposing farmers to information sources and channels and also give farmers the ability to purchase information dissemination tools. Socio-demographic characteristics have an effect on farmers' agricultural practices and access to information. For instance, Glendenning et al. (2010), stressed that socio-economic variable such as literacy affects farmers' information needs, their information searching behaviour, access to information, and information use. In line with this, Table 4.1 presents results of key demographic characteristics of the 272 respondents for the study. The essence of background information of participants in a study is that it offers knowledge or understanding about the people and the context under study

Table 4.1 Socio-economic characteristics of farmers

Variable	Category	Female	Male	Total	
		n=139 (51.1%)	n=133 (48.1%)	N=272	(100 %)
Age	18-24 years	7.9%	8.3%	22	8.1%
	25-30 years	21.6%	21.1%	58	21.3%
	31-34 years	33.8%	30.8%	88	32.4%
	More than 35 years	36.7%	39.8%	104	38.2%
Marital Status	Married	59.7%	59.4%	162	59.6%
	Single	20.9%	21.1%	57	21.0%
	Divorced	6.5%	18.8%	34	12.5%
	Widowed	12.9%	.8%	19	7.0%
Educational level	None	33.1%	15.8%	67	24.6%
	Primary	38.1%	28.6%	91	33.5%
	SHS	21.6%	22.6%	60	22.1%
	Tertiary	7.2%	33.1%	54	19.9%
Ethnic background	Konkomba	28.1%	31.6%	81	29.8%
	Mole-Dagbani	33.1%	33.1%	90	33.1%
	Akan	16.5%	27.1%	59	21.7%
	Dagaaba,Frafra,Kusasi	22.3%	8.3%	42	15.4%
Religion	African Tradition	18.7%	15.0%	46	16.9%
	Christianity	46.0%	45.1%	124	45.6%
	Islam	35.3%	39.8%	102	37.5%
Annual income	Less than 500 cedis	46.0%	19.5%	90	33.1%
	501-1000 Cedis	34.5%	38.3%	99	36.4%
	1001-1500 Cedis	14.4%	11.3%	35	12.9%
	1501-2000	3.6%	12.0%	21	7.7%
	More than 2000	1.4%	18.8%	27	9.9%

Source: Field survey, 2019

4.2.1 Gender and educational distribution of the farmers

With reference to Table 4.1, 272 respondents were sampled for the questionnaire survey, comprising 139 (51.1%) females and 133 (48.9%) males. More females than males engaging in farming could be explained by the fact that women are the key actors in Ghana's agricultural sector where they constitute over half of the agricultural labour force (SEND-Ghana, 2014). Majority of the female farmers had primary education while majority of the males had tertiary education. Another major divergence in the educational attainment of both genders is that fewer numbers of the females had tertiary education relative to the males while 16.9% of the females had no formal education comparative to 7.7% of males who had no formal education. It is important to note that literacy level is very potent in influencing farmers' access to modern means of CSA information such as the internet, mobile phones, and newspaper. (See Figure 4.1 for further details of participants' gender and educational traits).

4.2.2 Age and marital status of the farmers

Majority of the farmers (38.2%) were 35 years and above and 32.4% was within the age of 31-34 years. The age range of 18-24 years had 8.1% of the farmers recording the least proportion of responses. 7.9% of women were in this category compared to 8.3% of men. Within marital status, 59.6% of the respondents were married, 21% were single, and 12.5% were divorced while 7% were widowed. This implies that marital status does not matter in agriculture; one can be in agriculture regardless of their marital status. However, the issue with marital status is that sub-groups of women such as married, single, and widows may have different challenges in agriculture because of their differential needs and priorities. 59.7% of the women were married whereas 59.4% of men were married. As high as 12.9% of women compared with 8% of men are widowed. Widowhood is common among women in the district than among men because as the

population advances in age more men die leaving most of the women as widows (GSS, 2014). Majority of the widowed respondents are also 35 years and above. (See Table 4.1 for further details of participants' age and marital status).

4.2.3 Respondents annual income from farm

As shown on Table 4.1, majority of the farmers (36.4%) earn between GHS500 and GHS1000 from farm per year. 34.5% of women fall in this category whiles 38.3% of men fall in this category. 33.1%. of the farmers earn an annual income below GHS500. 46.0% of women earn less than GHS500 per annum compared to only 19.6% of men. This indicates higher poverty levels among women. More women are poor compared to men in the district (GSS, 2014). High poverty rates hinder the population of the Pru District from purchasing information dissemination tools such as radio and television (GSS, 2014). Food crop farmers earn low income from farm probably because of lower premium placed on their output relative to the output of cash crop farmers. Since most of the farmers were into subsistence farming (see Figure 4.1 for more details on the types of farming system farmers operate), they only trade the leftover output for income, thus making them earn lower income from the venture. As low as 9.9% of the farmers earn more than GHS2000. 1.4% women and 18.8% men fall in this category. The relatively lower income earned from trading their farm produce, especially among women, is explained by the subsistence nature of their farming. Since the prime motive of most of the farmers is to produce for consumption and not for sale, they primarily produce smaller quantities of farm outputs thus making them to earn little from it compared to the production for commercial purpose. Also, this could be attributed to women's cultivation on small and marginal lands which limits their production levels.

4.2.4 Farming systems and number of farms owned

The number of farms the respondents owned was analysed against the farming system they operated (subsistence or commercial farming) and the results are presented in Figure 4.1. Subsistence farming was the dominant farming system among the respondents as approximately three-fourth (72.4%) of them were involved in the sector relative to 27.6% who were into commercial farming. Majority (51.5%) of the subsistence farmers cultivated on multiple lands and only 6.6% of commercial farmers cultivated on multiple lands. However, 21% of the subsistence farmers and 21% of commercial farmers owned single farms. In other words, majority of the commercial farmers cultivated on a single piece of land. This can be attributed to the fact that, majority of the commercial farmers cultivated single food crops and as such they have access to large uniform farmlands, but the subsistence farmers cultivated multiple foods crop that thrive under varied conditions. As such, they diversify their farms to meet the varied nutrient requirements of the various crops they cultivate unlike the commercial farmers who mostly cultivate one crop.

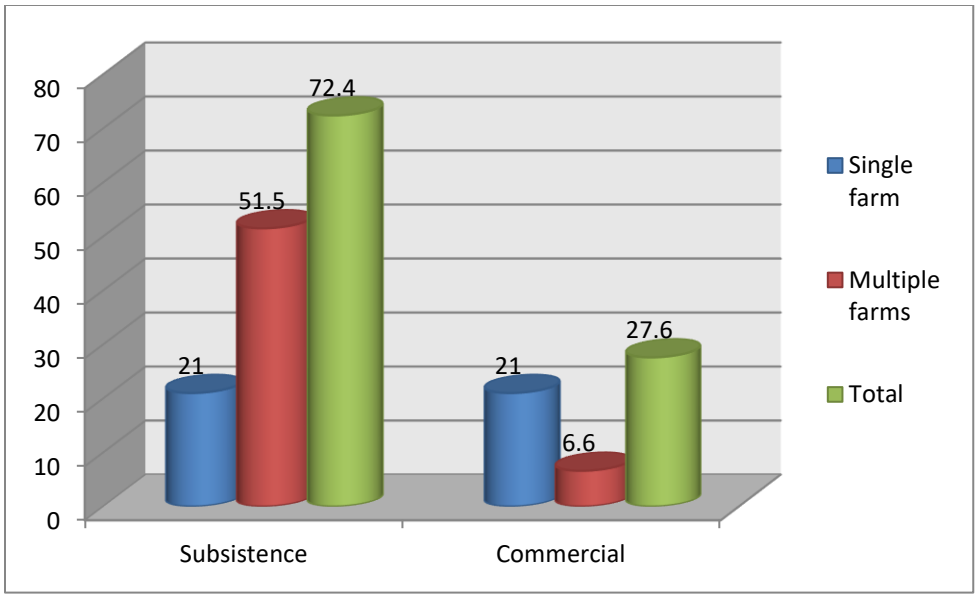

Figure 4.1: Farming system and number of lands owned.

Source: Field survey, 2019

4.2.4 Size of farmland cultivated

Regarding the size of farmland cultivated by the rural farmers, the findings revealed that significant proportion of the farmers (45.6%) cultivated on farmlands ranging from 0-3 acres while 30.9% of them cultivated on farmlands ranging from 4-7 acres. Also, regarding the type of farming systems, the study revealed that majority of the farmers were into subsistence farming and this can actually explain the reason why most of the respondents farmed on smaller acres of land. On the other hand, 17.3% and 6.3% of the farmers cultivate on farmlands averaging between 8-11 acres and more than 12 acres respectively. The number of farmers who cultivate on smaller parcels of land far exceeds the number of farmers who cultivate on larger parcels of land because of the few number of commercial farmers relative to the number of subsistence farmers who participated in the survey.

4.2.5 Main source of income and other livelihoods

The main source of income for a large majority of the respondents is from farming. Up to 70.6% of the farmers indicated that their main source of income is from farming while up to 15.4% obtain their income from salaried work. The district is basically agrarian. The lands are fertile and suited for crop production and as such majority of the people of the Pru District are into agriculture (GSS, 2014). These salaried works include teaching and those who work in the clinics as nurses and other medical attendants. Similarly, 11.8% of the respondents obtain their incomes from businesses they operate. 2.2% of the respondents obtain their main source of income from their spouse.

For the 117 (43%) of the respondents who have other sources of livelihood, 68.4% of them engage in farming as an alternative source of sustenance, 16.2% of them engage in business and artisanal works, 9.4% engage in salaried works while 6% of them depend on their spouse as an alternative source of income. Within the income range, 29.9% of them earn between GH$501 and GH$1000 per annum from their alternative source of income, 27.4% earn between GH$1001 and GH$1500 per annum whereas 24.8% of them earn less than GH$500 from such alternative income source. Table 4.5 presents a detailed account of the farmers' other sources of income against their annual income.

Table 4.2: Respondents other source of income against their annual income

Income source	Less than 500 Cedis	501-1000 Cedis	1001-1500 Cedis	1501-2000 Cedis	More than 2000	Total
Farm	5.1	28.2	22.2	5.1	7.7	**68.4**
Salary	3.4	0.9	0.0	5.1	0.0	**9.4**
Business	11.1	0.0	5.1	0.0	0.0	**16.2**
Spouse	5.1	0.9	0.0	0.0	0.0	**6**
Total	**24.8**	**29.9**	**27.4**	**10.3**	**7.7**	**100**

Source: Field survey, 2019

4.3 Farmers' awareness of CSA practices

Farmers were first queried about their awareness of CSA practices. The CSA practices that were in question included weather forecast, market information, fertilizer application, agroforestry, water harvest, and minimum tillage. These CSA practices are vital to crop production. Weather forecast covers areas such as the time and duration of rains, shift in the rainy season, occurrence of drought, and temperature variability. Information in these areas helps farmers to decide on which crop to plant and also whether to expand their farmlands. Market information deals with the demand for food crops, relative prices of farm produces, fluctuations in prices, relative prices of farm inputs, and where to sell farm produce. Information in these areas gives farmers high bargaining power which helps them to get higher prices for their farm produce. It also helps farmers to locate markets where they can get farm inputs at relatively cheap price. Market

information helps to reduces production cost as farmers are able to get higher revenue from their farm produce.

Fertilizer application deals with the timing of application, the type of fertilizer to apply on which soil type and food crop, and the quantity that is required on a particular food crop. These practices help farmers to experience increased crop yields. Agroforestry are the practices of incorporating trees into farms. Tress are good absorber of carbon dioxide. They also help to cause rainfall. Access to information on agroforestry is capable of helping farmers to decide which type of agroforestry to adopt on a particular farm. Minimum tillage are practices that ensure that the soil is not turned over for crop production. These practices help to check soil erosion from water and wind. It also reduces labour and fuel cost of production. Finally, water harvesting deals with the capture and storage of water for production purposes. Run off water and rain water are usually collected instead of allowing the water to cause erosion. The stored water can be used for irrigation. This practice also conserves soil and water. Farmers were therefore queried about their awareness of these vital CSA practices. These CSA practices are crucial in food crop production.

The survey revealed that 35.4% of the male farmers were aware of CSA practices while 36.2% of the females were also aware of CSA practices. However, 14.8% of the males were not aware of these CSA practices compared to 13.7% of females who were also not aware of these CSA practices. Those who responded in affirmative that they were aware of CSA practices were further asked whether they received information about such practices. A total of 79.5% of them reported that they receive some form of information about CSA practices from varied sources. Nonetheless, 20.5% of them said they are aware of CSA practices but have not received any form of information about the practices. Up to 16.9% of the females relative to 4.4% males did

not receive any form of information about CSA practices. The farmers attributed their unawareness to CSA practices to low CSA information dissemination in district. They indicated that there is a poor level of information dissemination by agricultural extension officers regarding CSA practices.

4.4 CSA practices on which farmers receive information

The CSA practice on which information was received predominantly by the farmers is fertilizer application. As high as 55.8% of the farmers indicated that they received information on the need for fertilizer application and how they are expected to apply it (the timing of application, the type of fertilizer to apply and the quantity to apply). The farmers stated that the extension officers visit them on their farms to teach them how to apply fertilizer. In line with the conceptual framework, this implies that farmers have high access to information on fertilizer application. This is because the extension officers used the farmers' preferred channel (see Table 4.5 for more details on famers' preferred channels of CSA information). The farmers stressed that decreasing crop yields has compelled them to depend more on the application of fertilizer and as such they are always on the look for the cheapest available fertilizer.

Another CSA practice that the respondents reported that they receive information on was weather forecast. Regarding this practice, 27% of them said they received information through the extension officer's visit to their homes. With respect to the conceptual framework, this means that farmers have limited access to information on weather forecast. This is because home visit by extension officer is not the farmers' preferred channel of CSA information. None of the female farmers preferred extension officers to visit them at their homes (see Table 4.5 for more details of farmers' preferred channels). With respect to weather forecast, the basic information

disseminated is on rainfall and temperature trends as well as where variations will occur. To them this information helps them to know when to plant their crops so as to make the most yields out of them. The farmers bemoan that the rainfall pattern is constantly becoming unpredictable and unreliable and as such it is now difficult for them to easily predict the weather. This makes them seek weather information from government and NGO agricultural extension agents. However, the farmers stressed that information from these agents, though helpful, are sometimes unreliable.

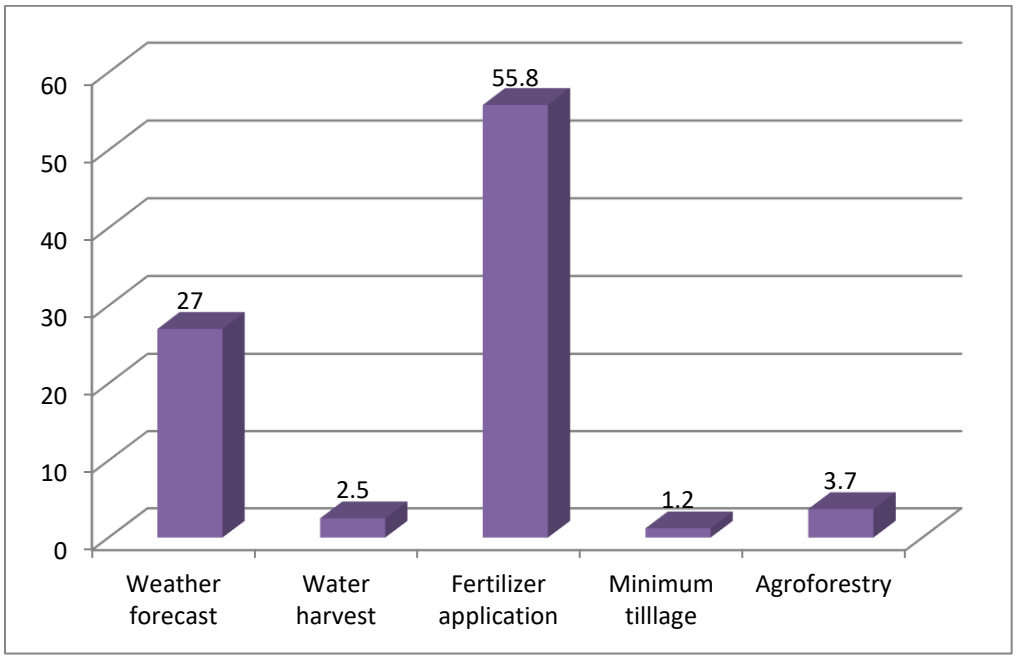

Figure 4.2: CSA practices on which farmers receive information.

Source: Field survey, 2019

Other CSA practices the farmers reported include market information, agroforestry, water harvest, and minimum tillage. Concerning the market information, they reported that information disseminated was on market demand for various food crops, their relative prices and when prices are expected to rise or fall. However, the extension officers disseminated this information

through agricultural shows. Again, with respect to the conceptual framework, farmers have limited access to information on market prices of produce. Agricultural show is preferred by only 3.6% of women and 3.6% of men, making a total of only 7.2% of the farmers. In relation to agroforestry, the information they received was in connection with mixed cropping among others. Farmers receive information on this practices through farm visit by the extension officer. According to the conceptual framework, this implies that farmers have high access to information on agroforestry. This is because the extension officer used farmers' preferred channel (see table 5.4 for more details on farmers' preferred channels). The finding is an indication that extension officers do not always consider farmers' preferred channels when delivering CSA information to farmers. There is therefore the need for the district to regularly organise seminars to give extension officers more information about the farmers, especially their preferred channel of information delivery, in the district.

It is important to note that CSA practices such as irrigation and minimum tillage are not common in the Pru District. This might have accounted for the low percentage of farmers who receive information on water harvesting (2.5%) and minimum tillage (1.2%). Farming is basically rain-fed. Farmers rely on the rains for food production. As climate change is expected to negatively affect crop yield through increasing temperatures and low and unreliable rainfall, the findings of this study imply that there is the urgent need to encourage irrigation in the study areas so that farmers can farm all year round without relying on the rains.

4.5 Farmers' sources of CSA information

The *first objective* of this study was to analyse the sources of rural female and male farmers' CSA information. Sources of information are key in influencing farmers' knowledge on novel and sustainable practices which are key in the agricultural value chain. Farmers were asked some questions regarding their sources of information on CSA practices. Table 4.3 presents farmers' sources of CSA information. The survey revealed that *government extension officers* represent the largest information source concerning CSA practices among both genders. 16.3% of males and 12% of the females obtain CSA information from government extension officers. This shows that the extension officers constitute the major source of information on CSA practices to both male and female farmers; however, the proportion of males exceeds the females who obtain CSA information from this source. The study revealed that meeting schedules with agricultural extension officers are usually taken without considering women's work and time burden. A farmer supported the above by saying the following;

''Meeting schedules are usually fixed at the time and place that suit men. What happens is that these meeting schedules do not always favour me because I have several house and farm duties that I am always performing''. (Female farmer, Labon)

The above situation limits women's participation in agricultural extension programs and implies that women have low access to CSA information compared to men. The findings of this study are contrary to the findings of Naab & Koranteng (2012) and Okwu & Omoro (2009) who reported that female farmers' major source of information is their husbands. The findings also contradict Nitin (2012) who revealed that farmers' major source of information are their

colleague farmers. However, the findings conform to the findings of Murage et al. (2015). Their study revealed that in eastern Africa, majority of farmers get information from extension agents.

Another vital source of information with regards to CSA practices among the male farmers is *colleague farmers*. Through interaction with their colleagues, 12.7% of the male farmers received CSA information relative to only 6% of the female farmers who obtained their information from this source. Men in the Pru District frequently meet as they sit under trees in the evening when they return form farm. Family meetings also offer men the opportunity to frequently meet. According to the male farmers, these meetings serve as opportunity for them to share information about CSA practices among themselves. Women, on the other hand, barely meet because of their numerous farm and off farm duties. The few opportunities they get to meet are periods of fetching water and fire wood, grinding flour, and going to the market. However, according to the women, these meeting opportunities are used to discuss their personal and family issues because these are the only opportunities they get to talk about such issues. Conversely, 9% of the female respondents received CSA information from their friends in comparison to the 7.2% of the males who received CSA information through this medium. These friends were not necessarily farmers, but social capital they have built over the years. Information about CSA practices through this medium was obtained through cconversations with friends. Farmer organizations served as an information source to only 9.1% of the farmers. This also tally's with the fact that majority of the respondents did not belong to farmer organizations and as such most the farmers did not receive information about CSA practices from farmer organizations. These farmer organizations provided information to their members through regular meetings.

Table 4.3: Source of CSA information

Source of CSA information	Males	Females	Total
Government Extension Officers	16.3	12	**28.3**
NGOs	10.2	4.9	**15.1**
Spouse	0	1.8	**1.8**
Friends	7.2	9	**16.2**
Family	3.6	6	**9.6**
Colleague farmers	12.7	6	**18.7**
Farmer organisations	4.2	4.9	**9.1**
Input sellers	1.2	0	**1.2**
Total	**55.4**	**44.6**	**100**

Source: Field survey, 2019

NGOs as a source of CSA information has been reported by 10.2% of the males while only 4.9% of the females received information through this medium. The variation between the genders can be attributed to the fact that majority of the females do not always avail themselves for agricultural shows where information about such CSA practices were conveyed. This is because of other family engagements. Unlike female farmers, none of the male farmers receive CSA information from their spouse. The reason could be that in rural settings women are not seen as

farmers. They are regarded as farm-helpers and thus are not considered in decision making regarding farm practices. A respondent supports this assertion by saying:

''*I am the man and as such I am the family head. I own the farm we eat from and decision making regarding that farm is my sole role. My wife only helps me on the farm, she doesn't own the farm and I can't ask her how to run my farm*'' (a male farmer from Ajaraja)

Another farmer states ''*If I ask my wife how to manage my farm, my colleagues will laugh at me, they will think I am not man enough to manage my own farm*'' (a male farmer from Kamampa)

The above assertion are clear indications of patriarchy. Some of the male farmers had the notion that, as men they are the heads of the family and for that matter should manage their farms without asking their spouse for any advice or information. Husbands have been found to be a major source of farm related information used by women farmers (Naab & Koranteng, 2012; Okwu & Omoro, 2009). However, in this study, the low percentage (1.8%) of women who receive information from their spouse can attribute to the significant number of widows, divorced, and single women in the Pru District. According to GSS (2014), widowhood is common among women than among men in the Pru District. It is important to note that none of the female farmers receive CSA information from input sellers. This could be attributed to social norms in the Pru District and other several rural areas in Ghana that do not allow women to have direct engagement with men who are not their husbands or direct family members. This situation limits women's interactions with input sellers, who are usually men and strangers, for CSA information.

The implication of the findings is that majority of both rural male and female farmers receive CSA information from government extension officers and as such there is the need for extension

officers to be provided with logistics like motor bikes that will ease their movements from one community to the other to deliver CSA information to farmers. Also, there is the need for education in rural areas to discourage cultural norms that limit women's mobility for CSA information.

4.6 Rural farmers' channels and preferred channels of CSA information

The *second objective* of this study was to examine rural female and male farmers' channels and preferred channels of CSA information. Farmers were thus asked some questions concerning the means through which they get information on CSA practices and the means through which they prefer to receive CSA information on CSA practices.

4.6.1 Rural farmers' channels of CSA information

The survey revealed that majority of the male farmers (32.6%) as well as majority (22.4%) of the female farmers received their CSA information through conversation with their colleague farmers, neighburs, friends, spouse or family members. In total, this channel represents 55% of the respondent's channel of information on agricultural practices. This finding corroborates the finding of Peterson (2014) who revealed that female farmers receive information on new farming innovations through interactions with their neighbours. Again, the finding agrees with the findings of Naab & Koranteng (2012). Their study revealed that female farmers receive information on new farming innovations through interactions with their neighbours. Spouse, friends, and colleague farmers are farmers' social capital that they easily approach for information regarding farming activities. Social ties are very strong in the Pru District and as such farmers depend on these ties in their daily activities. Frequent interactions among farmers

present the opportunity for CSA information to be shared between and among farmers. These informal channels are used extensively by rural farmers to share information regarding their farming activities.

The second channel through which female farmers receive CSA information is *farm visit by extension officers.* 10.8% of the female farmers, compared to 3% of male farmers, indicated that they use this channel to access CSA information. Extension officers deliver CSA information to farmers mainly through four channels; home visit by extension officers, agricultural shows, farm visit by extension officers, and visit to extension officers' office. However, the major channel used by extension agents to deliver CSA information to female farmers is *farm visit*. This is because majority of female farmers receive CSA information from extension agents through this channels (See Table 4.4). The conceptual framework underpinning the study identifies that, farmers have more access to CSA information when their preferred channel is used to deliver CSA information to them. With respect to the conceptual framework, the above finding implies that female farmers have high access to CSA information from extension agents. This is because female farmers' preferred channel of CSA information is *farm visit by extension agents* (See Table 4.5 for more details on farmers' preferred channels). The women explained that because they are always engaged in household activities, they do not get the chance to attend agricultural extension programs and as such get access to CSA information when extension officers visit them on their farms.

On the other hand, the second channel through which male farmers get CSA information is *visit to extension officers' office*. 8.4% of the male farmers, compared to only 1.25% of female farmers indicated that they get information on CSA practices through this channel. This can be attributed to the fact that male farmers are rich compared to their female counterparts and as such

can afford transportation means to the extension officers' office. Also, because men are not always engaged in household activities compared to women, they find it easy to travel to the extension officers' office to receive information on CSA practices. As shown on Table 4.4, majority of male farmers receive CSA information from extension agents through *visit to extension agents' office.* This implies that the major channel through which extension agents deliver CSA information to male farmers is farmers' *visit to extension agents' office*. Regarding the conceptual framework, this finding implies that male farmers have low access to CSA information from extension agents. This is because *visit to extension officers' office* is not the preferred channel of male farmers. Their preferred channel is *farm visit by extension agents* (See Table 4.5 for more details on farmers' preferred channels)

The least channel through which male farmers received information about CSA practices is *home visit by extension officers* (1.8% of men). Radio was the least channel by which females received CSA information. Poverty is very pronounced in the Pru District with the rate being higher among women. GSS (2014) reported that the higher poverty levels in the Pru District impede the people from buying information communications tools like radio. This could be the reason for which as low as 0.6% of female farmers and 3% of male farmers receive CSA information through radio. Again, in the Pru District, tradition hinders women from owning properties and as such women who can buy radio set may be prevented from buying. In such rural setting, women may only access the radio when their sons or husbands are at home and turn it on.

Table 4.4: Farmers' channels of CSA information

Information channels	Males	Females	Total
Home visit by extension officers	1.8	3.6	**5.4**
Agricultural shows	3	3	**6**
Farm visit by extension officers	3	10.8	**13.8**
Visit to extension officers office	8.4	1.2	**9.6**
Conversation with spouse, colleague farmers, neighbours etc.	32.6	22.4	**55**
Farmer organization meetings	4.2	2.4	**6.6**
Radio	3	0.6	**3.6**
Total	**56**	**44**	**100**

Source: Field survey, 2019

The study revealed that the major channel of CSA information for both genders is the daily interactions the farmers have with their colleague farmers, neighbours, friends, spouse, and family members. The least used channel for males is home visit by extension officers and the least channel for females is radio. In general, the least used channel is radio which implies that modern means of CSA information dissemination are not popular, especially among women farmers, in the study area and as such poverty alleviation programs are needed to help the farmers buy ICT tools like radio which delivers reliable, quick, and prompt CSA information to

farmers. Also, there is the urgent need for the government and NGOs to engage with rural areas to educate them on the need for gender equality, particularly the need to eradicate cultural norms that hinder women from owning properties. There is also the need for the government and NGOs to give farmers adult education to help them access the internet for CSA information.

4.6.2 Farmers' preferred channels of CSA information dissemination

According to the conceptual framework (Figure 2.2), farmers' socio-economic variables affect the level of access to information farmers' preferred channel of CSA. Also, farmers will have more access to CSA information when extension officers deliver CSA information through farmers' preferred channel. The farmers were asked about their preferred channels of CSA information. The survey revealed that, the preferred channel through which majority of both sexes prefer to receive information on CSA practices is through *farm visit by extension officers*. As high as 48.2% (22.3% of males and 26.1% of females) of the farmers indicated that they prefer to receive CSA information through *farm visits by extension officers*. The reason for which they attach much prominence to this channel of information dissemination is that, it offers them opportunity to interact with the extension officer, ask as many questions as possible, and inquire about other agricultural practices. The socio-economic background of the farmers reveals that the farmers are characterized by low income and literacy levels (see Table 4.1 for more details on farmers' socio-economic characteristics). Low literacy level impedes the farmers from using modern channels of CSA information such as the internet and the newspaper. The high poverty level hinders them from buying ICT tools like radio and television. The female farmers in particular are poorer and as such could not afford to regularly visit extension officers' office or buy information tools like radio. Also, they are always occupied with both farm and off-farm duties and as such do not get the time to attend extension programs. Therefore, the farmers prefer

extension officers to visit them on their farms to deliver CSA information. The finding of this study conforms to the finding of Naab & Koranteng (2012) who revealed that visit by extension agents is preferred by female farmers in receiving weather information in the Upper West region of Ghana.

Conversations with colleague farmers, neighbours, friends, spouse, and family members also constitute female farmers' second highest preferred channel of CSA information. This can be attributed to the fact that their husbands usually share extension program meeting proceedings with them. As some women help their husbands on their farms, this creates the opportunity for them to interact with their husband regarding CSA practices. Also, due to strong social connections in rural areas, female farmers could easily share information with other members of the community. On the other hand, male farmers' second preferred channels of CSA information are farmer organization meetings (6.6% of male farmers) and conversation with spouse, friends, neighbours, and colleague farmers (6.6% of male farmers). Men usually interact with other farmers and their social networks for information regarding farming activities. Farmer organization meetings and family meetings offer men the opportunity to interact with one another for CSA information.

The least preferred channels for female farmers were *visit to extension officers' office* (0.6%) and *internet* (0.6%) whiles the least preferred channel for male farmers was *radio* (1.8%). In general, the least preferred channel for both male and female farmers were *radio* (2.4% of the farmers) and *internet* (3% of the farmers). The reason for which farmers do not prefer radio and internet is that, most of the farmers (both male and female) said they spend much of their time on the farm and on other economic activities such that, they have little time listening to radio. Female farmers added that they do not have money to buy radio set. This is an indicative of the effect of

farmers' income level on farmers' preference for CSA channel. This is in line with the conceptual framework. On their non-preference for internet sources, they indicated that, they could not read nor write English language; thus hampering their ability to obtain information from internet sources. This is an indicative of the effects of farmers' socio-economic variables on farmers' preferred channel of CSA information. This is in line with the conceptual framework.

Table 4.5: Preferred channels of CSA information dissemination

Preferred channels	**Males**	**Females**	**Total**
Home visit by extension officers	4.2	0	**4.2**
Agricultural shows	3.6	3.6	**7.2**
Farm visit by extension officers	22.3	26.1	**48.4**
Visit to extension officers office	7.8	0.6	**8.4**
Conversation with spouse, friends etc…	6.6	12	**18.6**
Farmer organization meetings	6.6	1.2	**7.8**
Radio	1.8	0.6	**2.4**
Internet	2.4	0.6	**3**
Total	**55.3**	**44.7**	**100**

Source: Field survey, 2019

None of the female farmers preferred to obtain CSA information through home visit by extension officers. They attributed this to the fact that, they are always engaged in the house thus making

them have little time to actually engage the extension officers when they visit them at home. Few female farmers (1.2%), compared to males (6.6%), prefer farmer organization meetings as channels through which they wish to obtain CSA information; owing to the fact that, most of the females do not belong to farmer organizations. The findings of this study are contrary to the findings of Naab & Koranteng (2012) who found that farmers in the Jirapa District of the Upper West region of Ghana preferred radio broadcast in the local dialect as the channel for receiving weather information. The implication of the findings of this research is that, both male and female farmers prefer to receive CSA information through extension farm officer's visit to their farms and as such there is an urgent need to increase the budget of the district's agricultural extension department as well as equip them with running motor bikes and cars so that extension officers can easily visit farms to have engagements with farmers.

4.7 Summary

The chapter discussed the socio-economic background of farmers and farmers' sources, channels and preferred channels of CSA information. In general, the educational levels and economic status of the farmers were low. The percentages were lower among women than among men. Sub-groups of women such as married, single, divorced, and widows were identified in the study. Majority of the farmers were subsistent farmers who farmed on small parcels of land. The farmers indicated that there is poor CSA information dissemination in the Pru District. However, farmers get information on CSA practices such as weather forecast, fertilizer application, water harvest, agroforestry, minimum tillage, and market information. The CSA practice on which information was predominantly received by farmers was fertilizer application whereas minimum tillage was the practice on which farmers did not receive much information. It was also found that agricultural extension agents were the major source of CSA information for both male and

female farmers. The major channels through which extension officers deliver CSA information to female farmers is *farm visit by extension officers* and the major channel for male farmers is farmers' *visit to extension officers' office*. However, in general, the major channel of CSA information for both sexes was interactions with colleague farmers, neighbours, friends, and family members. However, both male and female farmers prefer extension officers to visit them on their farms to deliver CSA information.

CHAPTER FIVE

ACCESS TO CLIMATE SMART AGRICULTURAL INFORMATION (CSA)

5.1 Introduction

The research sought to investigate the access of rural farmers to CSA information and whether rural female and male farmers have equal access to CSA information. This chapter therefore presents a discourse on the data gathered and analysed regarding access to CSA information and its gender dimensions. The data has been analysed objectively by means of descriptive and inferential statistics located within the SPSS software. The chapter has been structured along themes such as gender differentials in accessing the sources of CSA information, farmers' level of access to information on CSA practices, and the presence of gender differentials in accessibility of CSA information. The chapter ends by presenting the challenges of accessing CSA information by rural female and male farmers.

5.2 Farmers' level of access to information on CSA practices

The farmers level of access to some CSA practices were ranked on a Likert scale ranging from No Access (1) to High Access (4). Within this range is low access (2) and moderate access (3) to CSA information. High access to information on the scale represents the situation where the individual is previewed to large volume of information about the CSA practice and this information is easy to access and also easy to comprehend. On the other hand, no access connotes the unavailability of information about a particular CSA practice to respondents while low and moderate access implies some level of information access but not to the degree of high access to information.

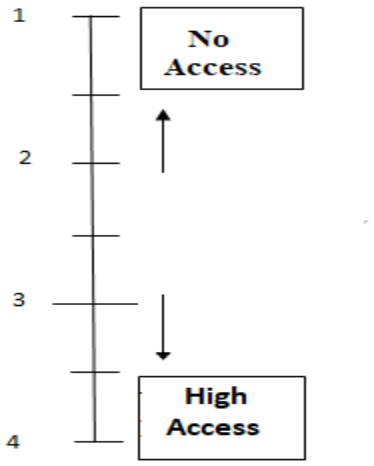

Figure 5.1: Likert scale showing level of access from No Access to High Access.

Source: Researcher's construct, 2019

The results showed that for weather forecast, the mean level of information access is 1.52 with a standard deviation of 0.888 from the mean. Comparing this result to the Likert scale calibration, it can be observed that the mean of 1.52 implies that there is low level of access to information on weather forecast by the rural farmers. This is in line with the conceptual framework because information on weather was not transferred through farmers' preferred channel (farm visit by extension agents) (See Table 4.4 for more details on channels used by extension agents to transfer information on CSA practices). For water harvest, the mean value of 1.25 implies that there is low level of information access by the farmers on water harvest. The deviation from the mean for water harvest is 0.73. The mean of 2.25 for fertilizer application also lies within the low access range with a standard deviation of 1.33 implying that, there is wider spread of the responses from the mean relative to the other CSA practices. Low access to information on fertilizer application is contrary to the conceptual framework because extension officers deliver

information on fertilizer application primarily through farmers' preferred channel (farm visit by extension officers)

The mean information receipt on minimum tillage is 1.35 with a standard deviation of 0.859. This indicates that there is low information receipt about this CSA practice by the farmers. The mean information received by respondents about agroforestry is 1.17 with a standard deviation of 0.65. This means that there is limited information received on such CSA practice among the respondents. This is contrary to the conceptual framework because information on agroforestry was transferred through farm visit by extension agents. Similarly, the mean value for market information did not vary from the other CSA practices as the value of 1.4 indicates low access with a spread of 0.891 from the mean. In general, there is low level of access to information about CSA practices among the farmers. Despite their awareness of the concept, there seems to be little access to information about the concept and its operationalization among the farmers. This occurrence has the potency of affecting the farmers' productivity particularly in the face of increasing variations in climate and its attendant repercussions on crop yield.

Table 5.1: Farmers level of access to information on CSA practices

CSA Practice	N	Mean	Std. Deviation	Range	Minimum	Maximum
Weather forecast	272	1.52	0.888	3	1	4
Water harvest	272	1.25	0.73	3	1	4
Fertilizer application	272	2.25	1.32	3	1	4
Minimum tillage	272	1.35	0.859	3	1	4
Agroforestry	272	1.17	0.657	3	1	4
Market information	272	1.4	0.891	3	1	4

Source: Field survey, 2019

5.3 Level of access to sources of CSA information

Farmers' access to CSA information from various sources was ranked on a four point Likert scale ranging from no access to high access where 1 implies no access and 4 implies high access to CSA information from that particular source. The findings (see table 5.2) showed that government extension officers constitute the most accessible CSA information source to the rural farmers. The mean of 2.24 with a standard deviation of 1.186 for accessibility of CSA information from government extension officers ranks moderate on the Likert scale. The standard deviation also proves that the individual responses deviate from the mean of 2.24 by 1.186 points. This finding is in line with the conceptual framework. The major channel used by extension officers to deliver CSA to farmers is *farm visit* (see Table 4.4). The study earlier revealed that farmers' preferred channel of CSA information is *farm visit by extension officers*

(See Table 4.5). With respect to the conceptual framework, this explains why farmers did not have low access to CSA information from extension agents.

Accessibility of CSA information from NGOs was pitched at a mean of 1.29 with a standard deviation of 0.715 from the mean. This implies that, there is low level of accessibility of CSA information from NGOs in the communities. This could be explained by the paucity of NGOs in the Pru District.

There is low to moderate level of accessibility to CSA information from colleague farmers, neighbor, friends, family members, and input sellers. For sources such as spouse, religious organisations, and farmer organisations, there is low level of information accessibility on CSA practices. On the whole, access to CSA information by the rural farmers from the various sources is low. Among the various sources, religious organisations emerged as the source with limited information accessibility followed by farmer organisation. The least information accessibility from religious organisations can be attributed to the fact that emphasis is not placed on economic activities in such organisations while a justification for the limited information access from farmer organisations can be attributed to the fewer number of farmers who belonged to such associations. Spouse also constitute a source with limited information accessibility because 26.8% of the farmers were never married or divorced or widowed and 34.2% who were married have spouses who are not into farming activities for livelihood thus they do not receive any CSA information from them. Hence, majority of the farmers (61%) do not receive CSA information from *spouse*.

Table 5.2: Level of access to sources of CSA information

	N	Mean	Std. Deviation	Range	Minimum	Maximum
Government extension officer	272	2.24	1.186	3	1	4
NGOs	272	1.29	0.715	3	1	4
Spouse	272	1.35	0.892	3	1	4
Friends	272	1.47	0.909	3	1	4
Family members	272	1.65	1.083	3	1	4
Colleague famers	272	1.86	1.161	3	1	4
Religious groups	272	1.08	0.413	3	1	4
Farmer organization	272	1.31	0.73	3	1	4
Input sellers	272	1.72	1.104	3	1	4

Source: Field survey, 2019

5.4 Gender differences in access to sources of CSA information

The first hypothesis that was tested was; there is no significant relationship between gender and access to sources of CSA information. There is a universal gender gap in agriculture; in which women into agriculture have limited access to extension service (FAO, 2011). Whereas gender modifies both men's and women's lives, the propensity is for women to have an underprivileged position in relation to men. This can have momentous repercussions for the implementation and sustainability of practices within a CSA framework. Furthermore, there is a possibility that, if this gender gap is not considered, inequalities between women and men will be reinforced in the process of implementing CSA practices. It is against this backdrop that the study examined the relationship between gender and accessibility of sources of CSA information among the farmers.

Table 5.3 shows a Chi-Square independent test performed to establish a relationship between farmer's sex and accessibility to sources of CSA information. The test revealed that, there exist a relationship between farmer's sex and some CSA information sources. The first of such source is government extension officers. The Chi-Square result shows that there is a significant relationship between gender of the farmer and access to CSA information from government extension officers. Significantly, females had more access to extension officers relative to males in the chi-square test [$\chi 2$ (3, N = 272) = 16.161, p = 0.001] which was statistically significant. Also, there was a statistically significant difference [$\chi 2$ (3, N = 272) = 13.837, p = 0.003] between gender of the farmer and access to CSA information from NGOs. These findings suggest that, CSA information was common among female farmers than their male counterparts mainly during farm visits by extension officers or NGO representatives.

The study revealed earlier that the extension officers use female famers' preferred channel in delivering CSA information to female farmers. It also revealed that extension officers do not use male farmers' preferred channel in delivering CSA to male farmers. According to the conceptual framework, this explains why female farmers have higher access to CSA information than male farmers from extension officers. This finding agrees with the findings of Naab & Koranteng (2012). Naab & Koranteng (2012) revealed that, female farmers in the Jirapa district of the Upper West region of Ghana get information on new farming practices from extension agents and NGOs. Because of the intensive nature of women's domestic and farm roles, women do not get the time to attend village meetings and thus, they rely extensively on extension officers who visit them as the main source of information.

Another source of CSA information which has a significant relationship with sex of the respondent is information receipt from friends. This relationship is depicted by the Chi-Square result of [$\chi 2$ (3, N = 272) = 12.714, p = 0.005]. With this however, the males had greater access to information on CSA practices than the females had from their friends. This might be due to the regular discourse between male farmers and their friends on agricultural practices, thereby disposing them to varied CSA practices compared to their female counterparts.

Table 5.3: Gender differences in access to sources of CSA information

Sources of Information	Sex of Farmer Pearson Chi Square	Df	Asymp. Sig. (2-sided)	N
Government extension officers	16.161[a] **	3	0.001	272
NGOs	13.837[a] **	3	0.003	272
Spouse	9.396[a]	3	0.024	272
Friends	12.714 [a] **	3	0.005	272
Family members	5.563 [a]	3	0.087	272
Colleague famers	2.547 [a]	3	0.467	272
Religious groups	6.684 [a]	3	0.083	272
Farmer organization	20.282 [a] **	3	0.001	272
Input sellers	19.985 [a] **	3	0.001	272

**** Chi Square value is significant at the 0.05 Sig. level (2-tailed).**

Source: Field survey, 2019

The results also showed that famer's sex has an association with information receipt from farmer organisations and input sellers. The Chi-Square value of P (X2 > 20.282) = 0.001 for gender against information receipt from farmer organisations and P (X2 > 19.985) = 0.001. Males in both instances received more information from input sellers and farmer organisations relative to the females. This might be because males had more access to input sellers relative to females likewise majority of the males being members of farmer organisations. Also, this might be because of the existence of exist a more structured male organisations due to the patriarchal

norms evident in the study area. This finding was vindicated from qualitative responses from farmers. For instance, a female farmer stated;

"……..Many of the groups in this community are seemingly influenced by our husbands since we (wives) respect them a lot. And from what I hear, important information from agriculture, education and health are mostly discussed during their (male) group meeting before it trickles down to us……' (Female middle-aged farmer, Daman Nkwanta).

On the contrary, information receipt from sources such as spouse of a farmer, family members, colleague famers, and religious groups do not have significant relationship with farmer's sex. This is because, fundamentally, most of the male farmers have spouses who engage in agricultural activities while most of the females have spouses who are not farmers. In all, the implications of the gender related findings suggest that, more gender-based interventions are required in the study area and Ghana as a whole in CSA based information. Although, the gap is not so uniform, women might in the bottom-line suffer from the disparities evident in information services delivery in the agricultural sector especially in rural Ghana as evident in many communities in the Pru-District.

5.5 Nexus between socio-economic traits of farmers and access to CSA information

The third objective of the study sought to ascertain the presence of gender differences in access to CSA information and the factors accounting for that. Also, the second hypothesis which the study tested was: there is no significant relationship between farmers' socio-economic characteristics and access to CSA information. The gender differentials in accessibility of sources of CSA information warranted a probe into the nexus between farmers' socio-economic characteristics and farmers' access to CSA information. A Chi-Square test of independence was

used to determine if there is a significant relationship between socio-economic characteristics of farmers and their accessibility to CSA information. The results are presented in Table 5.4.

5.5.1 Gender differences in access to CSA information

The sexes of the farmers were run against their accessibility to CSA information using a Chi-Square test of independence. The result shows that the Chi-Square value of 15.266 with 1 df is significant at 0.002. Written mathematically, the Chi-Square result is P ($X^2 > 15.266$) = 0.002. The results are statistically significant suggesting that there is sufficient evidence to indicate that the two variables (gender and access to CSA information) are not independent at the 5% significance level. Majority of the males had access to CSA information relative to the females. The female farmers indicated a number of factors that account for their low level of access to CSA information relative to male farmers. They bemoan the inaccessibility of agricultural extension officers.

A farmer in Ajara had this to say in support of the above. ‘*‘ I do not receive information on CSA practice because as a woman, the extension officer does not visit me on my farm or even in the house and I do not also have the means to visit the extension officer in his office which is not in this community’’* (Female farmer, Ajaraja)

The female farmers bemoaned that extension officers do not visit them on their farms and even when the officers visit homes they usually engage with men only. They also indicated that unlike their male counterparts, they do not have motorbikes, bicycles, and time that will enable them to regularly visit the extension officers’ offices. Importantly, different sub-groups of women will have different reasons for their limited access CSA practices because of the differential needs

and challenges of these sub-groups. Widowed farmers might be disproportionately disadvantaged because they are usually landless and poorer than married women.

However, some women revealed that they have less access to CSA information due to unfavourable meetings schedules. A respondent at Kobre said this in support of this point during the Focus Group Discussion (FGD).

''I have not received any information on CSA practices because; I find it difficult to participate in agricultural programmes. My work as a businesswoman does not permit me to participate in such programmes and moreover, it is difficult to get in touch with the extension officer''. (Female farmer, Kobre).

Some of the women had other occupations like trading. These works usually conflict with periods of extension programs thus making it difficult for the women to participate in extension programs. The unfavourable meeting schedules seem to affect farmers who had other occupations than farmers who do not have other sources of livelihood. Another important concern that was raised by the women is the numerous farm and off-farm duties that limit their participation in extension programs. A female farmer said this during the one of the FGD.

'' I don't receive information on CSA practices because I am always performing household duties anytime the extension officer comes and this makes me not able to meet the officer for information'' (Female farmer, Zabarima)

Women in the Pru District are actively involved in almost all farming activities. Apart from their own farms, they are a major source of labour for their husbands and families. They help their husbands in several farming activities. This is compounded by the

numerus domestic duties they perform. They are usually the first to wake up in the morning and the last to go to bed. They perform a lot of domestic duties like fetching water, grinding flour, fetching water, washing, and cooking. These activities take a lot of their time and hinder them from attending meetings with extension officers. Another respondent had this to say in support of the above point'

''I perform many duties both in the house and on the farm. As a woman I am in charge of all the activities that will make sure that the family has something to eat. For example going to fetch water, firewood, and going to the grinding mill to grind flour. I also help my husband on his farm'' (female middle aged farmer, Ajaraja)

The numerous duties women perform both on the farm and in the house limit them from participating in meetings with extension officers. Similarly, Peterson (2014) indicated that females do not attend meetings with extension agents either because females are not invited to meetings or they are constrained by time.

Another concern the female farmers raised was that meeting schedules are always made without taking into consideration their numerous farm and off-farm duties and as such they usually are not able to meet extension officers for CSA information. This is indicative of a patriarchal society where decision making and resources are in the hands of men. This implies that education is needed to raise the awareness of gender equality in rural areas. A farmers said this during one of the FGD;

''The men are in charge of everything in this community. They are those who decide when the extension officer should come and where they will meet the extension officer. As a woman, I am not involved in such decision making''

As revealed by the profile of the study area, the Pru District is a patriarchal society were resource are owned and controlled by men. Even at the family level, men are solely in charge of decision making. Women are usually not involved in deciding on even matters that affect their lives. Thus, meetings with extension officers are always scheduled by men at the time and place that suit men. This makes a lot of women miss extension programs because the women are always engaged in household and farm activities that make meeting schedules unfavourable to them.

The women also indicated that, unlike men, they have limited mobility. Cultural barriers in the rural areas of the Pru District hinder women from having direct engagements with outsiders, particularly men, for information. The study found that the communities frown on women having direct interactions with strangers. This is compounded by the fact that the extension officers in the district are men and strangers. Also, those involved in selling farm input are predominantly men who come from other areas in the District. Thus, female farmers are impeded from meeting input sellers and extension officers for CSA information. The finding of the study agrees with the finding of SEND-Ghana (2014). SEND-Ghana (2014) revealed that in the northern parts of Ghana, cultural norms hinder women from having direct engagements with outsiders, especially men, for information. This deprives females of market information thus weakening their bargaining power. This finding is also in conformity with the finding of Morna (1989) where he asserted that, in rural Malawi, extension officers usually engage with only men when educating farmers on improved technologies. This could be a possible reflection of cultural norms that prevent women from interacting with strangers.

Again, the women stressed that they do not have money to buy information dissemination tools like radio and television. Some women indicated that their societies frown on women owning

such properties because the man, as the head of the family, is the one who should own properties in the family. This situation puts more hindrance on women and as such they are not able to buy information dissemination tools. According to GSS (2014), the high rate of poverty in the Pru District prevent the population from buying information dissemination tools like mobile phones. The women again indicated that they do not have money to afford transportation means on regular basis to the extension officers' office like the men always do. The world's poorest people are made up of women and they are most affected by climate change (Boko et al., 2017). The inability of the female farmers in the Pru District to afford information dissemination tools for CSA information could increase their vulnerability to the negative impacts of climate change. There is therefore the urgent need to economically empower women to help them afford ICT tools that provide quick, prompt, and reliable CSA information to farmers.

The findings of the study are in line with the conceptual framework. The framework identifies that some socio-economic variables of farmers have influence on farmers' access to CSA information. In this case, farmers' sex has been found to have effects on farmers' access to CSA information; male farmers have more access to CSA information than female farmers.

Table 5.4: Nexus between socio-economic characteristics of farmers and access to CSA

Socio-demographic traits of farmers	Access to CSA information Pearson Chi Square	Df	Asymp. Sig. (2-sided)	N
Farmer's sex	15.266 [a] **	1	0.002	272
Age of farmer	3.441 [a]	3	0.309	272
Marital Status	4.803 [a]	3	0.187	272
Educational Status	5.812 [a]	3	0.121	272
Ethnicity	12.329 [a]	3	0.006	272
Religion	2.391 [a]	2	0.303	272
Years into farming	3.062 [a]	4	0.547	272
Farming type	8.795 [a] **	1	0.003	272
Member of Farmer organization	1.276 [a]	1	0.259	272

**** Chi Square value is significant at the 0.05 Sig. level (2-tailed).**

Source: Field survey, 2019

5.5.2 Other socio-economic variables of farmers and access to CSA information

Gender is not the only factor affecting CSA information accessibility. Quisumbing & Pandolfelli (2009) highlighted that other socioeconomic parameters, such as age, marital status, education level, and size of landholding can also affect agricultural technology adoption. The Chi-Square results (table 5.4) for these variable revealed that the type of farming engaged in by farmer also influences his or her accessibility of climate smart information. The Chi-Square result is P (X2 > 8.795) = 0.003 shows that there is a significant relationship between the type of farming engaged

in by a farmer and access to CSA practices. It therefore implies that access to climate smart information and the type of farming engaged in are not independent of each other at 5% significant level. The farmers who are into commercial farming received CSA information more than farmers into subsistence farming. This might be as a result of their knowledge and social capital they have built over the years with government extension officers, NGOs and other individuals. The implication of the above findings is that, in line with the conceptual framework, farmers' socio-economic variables play essential role in influencing farmers' access to CSA information. This is therefore the need to consider farmers background characteristics when disseminating CSA information.

That notwithstanding, other background characteristics of the farmers comprising such as marital status of a farmer; educational status; ethnicity and religion of the farmer do not have any relationship with the farmers access to CSA information among the respondents. However, some studies such as Quisumbing & Pandolfelli (2009) found that the age of a farmer; marital status of a farmer; educational status; ethnicity, and religion of a farmers impacts on their accessibility of CSA information when they researched on approaches to addressing the needs of poor female farmers. Since majority of the farmers' spouse do not engage in farming, their access to CSA information did not depend on their spouse.

Other socioeconomic parameters such as number of years a farmer has engaged in farming and membership of farmer organisation organisations do not have an association with access to CSA information. Similarly, a significant proportion of the farmers did not belong to farmer organisations thus making it not have form of relationship with their access to CSA information. In sum, only two socio-economic characteristics of the farmers had an association with the farmer's access to CSA information. These variables are sex of the respondents where men

received the information more than women and faming type where the commercial farmers had more access to CSA practices relative to subsistence farmers. The implication is that there is the need for gender equality programs in the Pru District that aims at empowering the various sub-groups of women to be able to seek CSA information from diverse sources. There is also the need to train more female extension officers and send them to rural areas.

5.6 Farmers' access to extension officers

5.6.1 Farmer's knowledge of their extension officers

The farmers were asked about their knowledge of the existence of extension officers in the district. Up to, 53.3% of the respondents representing majority replied in the affirmative that they were aware of the availability of extension officers within the district. On the other hand however, 46.7% of the respondents who form minority indicated that they were not aware of the existence of extension officers in the district. As high as 95.2% of the farmers who were aware of the existence of extension officers in the district said the officers are government extension officers. The remaining 4.8% of the respondents said such extension officers belong to NGOs that are into agricultural development within the district.

Despite the fact that majority of the farmers reported that there exist extension officers within the district, a large proportion of them (59.5%) did not know these officers. They heard from their friends, family and from other sources that such officers exist within the municipality but have less information about them. 94.3% of the farmers who knew the about the existence of extension officers in their communities indicated that the officers are men while 5.3% of them said they were females. The respondents were further queried about their preference for the sex of their extension officer if placed in the position to choose between a man and a woman

extension officer. Majority (41.5%) of them reported that they were not concerned about the sex of the extension officer and prefer any of the two sexes. On the other hand, 38.5% of the respondents indicated that they prefer male extension officers while 20% of the respondents preferred female extension officers. A cross tabulation of the respondents sex against the gender preference of the extension officers revealed that male respondents preferred male extension officers and females also preferred female extension officers. This is attributed to the fact that female farmers feel comfortable discussing their problems with female extension agents. They feel the extension officer will understand them better because of the similar experiences they both share as women. The same applies to men.

5.6.2 Frequency of extension officers visits to the communities

The last visit by the extension officers was tabulated against the frequency of their visit. The findings revealed that most of the extension officers (42.5%) visited the communities within the past 3-5 months. About 31.3% of the farmers also revealed that the last time extension officers visited their communities was more than 9 months while 10.4% reported that extension officers visited their communities within a period less than three months. It is evident that extension officers seldom visit the farming communities. This can be attributed to the remote nature of some rural area, poor road networks, and inadequate extension logistics that characterise the Pru District. The frequency of visits by extension officers to communities has the potency of increasing the farmer's knowledge about CSA practices. This is because their visits offer them an opportunity to interact with the farmers and educate them on CSA practices. Therefore, how often an extension officer visits a community can have a direct bearing on the farmer's awareness of CSA practices.

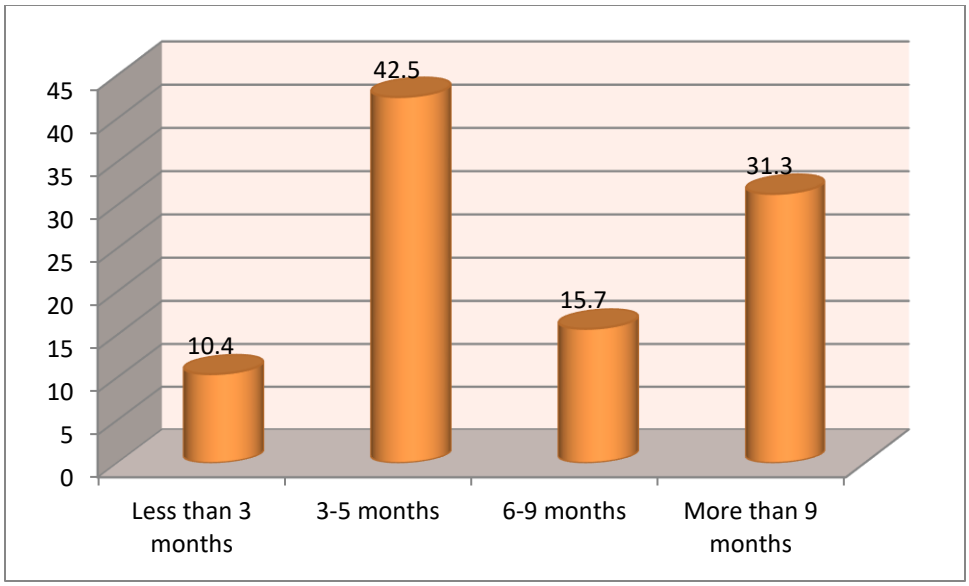

Figure 5.2: Frequency of extension officers visits to the communities.

Source: Field survey, 2019

5.6.3 Rate of CSA information receipt during the last farming season

The results show that during the last farming season, 45.8% of the farmers received CSA information twice from their extension officers. This is consistent with the fact that majority of the farmers indicated that extension officers visited them within the past 3-5 months. Interestingly, 16.9% of the farmers also indicated that they received information from extension officers concerning CSA practices more than three times over the course of the last farming season. Moreover, 9.9% and 4.9% of the famers received information on CSA practices once and trice respectively over the span of the last farming period. Contrary to the earlier findings however, 22.55% of the farmers reported that, they did not receive any form of farming information during the last farming season. This can be explained by the fact that up to 31.3% of the farmers earlier reported that the last time extension officers visited their communities was more than nine months ago. This implies that majority of them did not encounter extension

officers within their communities during the previous farming season thus making them not receive any information from the officers about CSA practices. Extension officers seldom visit the farming communities and as such farmers do not regularly receive information on CSA practices from the officers. This situation puts the farmers in a disadvantaged position as they strive to adapt to the negative effects of climate change as well as increase their production levels.

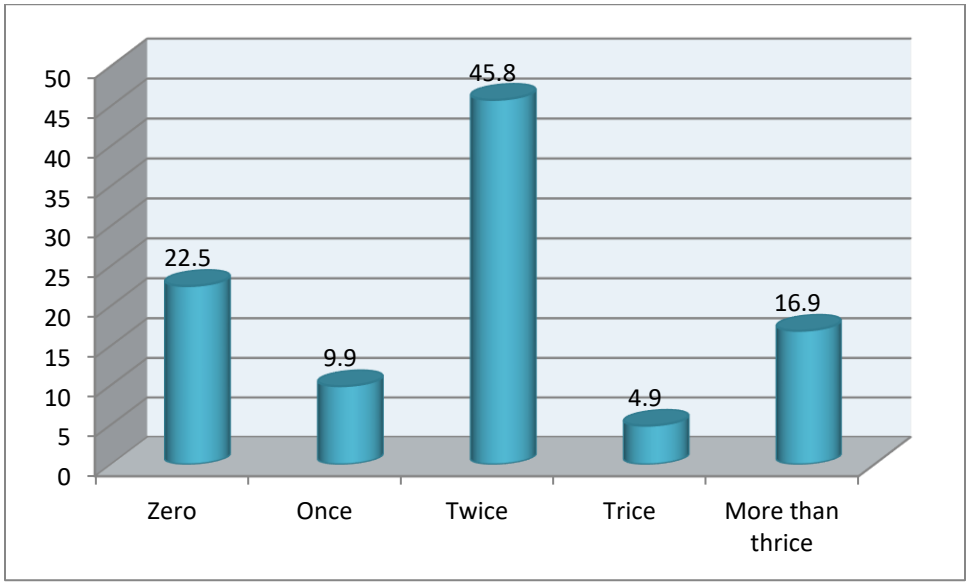

Figure 5.3: Frequency of CSA information receipt during last farming season

Source: Field survey, 2019

For better understanding and implementation of CSA practices by farmers, communication between extension officers and farmers ought to be interactive or circular. Having explored the frequency of farmers' contact with their extension officers during the last farming season, the study further explored how farmers give feedback to extension officers regarding information received on CSA practices. Feedback helps to determine whether the information got to its intendent recipients, whether farmers understood the message, and whether the message had the

intendent impacts on farmers. From the results, 53.5% of the farmers who received information on CSA practices provided feedback to the extension officers. 45.1% of them revealed that the feedback was given when extension officers visited them in their homes or on their farms. The study earlier found out that the major channel through which extension officers transfer CSA information to farmers is *farm visit by extension officers* (see Table 4.4). Again, the study revealed that farmers' preferred channel of CSA information is through farm visit by extension agents (see figure 4.5 for details on farmers' preferred channels). The conceptual framework identifies that when farmers receive CSA information through their preferred channel, they give feedback to extension agents. In line with the conceptual framework, extension agents' visits to the farms of the respondents might have influenced them to give feedback to extension agents. Through the extension officer's visit, the farmers offer feedback to the officers about their implementation of the practices and the possible challenges that confront them. Other farmers provided feedback to the officers through visit to the officer's office. 42.3% of the farmers used this feedback channel. The other means of providing feedback to the officers is by way of phone calls and text messages. Only 9.9% and 2.8% of the farmers adopt this approach respectively. On the contrary, 46.5% of the farmers do not provide feedback to the extension officers. This implies that extension officers will not be able to tell whether these farmers received understood the information or adopted the CSA practices in question.

5.6.4 Attendance of agricultural extension programmes

Agricultural extension programmes serve as an important source of CSA information owing to the fact that extension officers cannot always move from one farmer's house to the other or from one farmer's farm to the other explaining such practices to them. Agricultural extension programmes become the platform where information on CSA practices can be disseminated to

many farmers at the same time. Contingent on this, the study explored the level of farmer's participation in these programmes. The survey revealed that majority of the farmers (86.7%) do not participate in agricultural extension programmes. This can partly explain the limited information these farmers have on climate smart agricultural practices. Only 13.3% of the farmers attend agricultural extension programmes.

For a significant proportion of the farmers, their inability to attend such agricultural extension programmes is because they are usually not aware of such programmes. As high as 58.5% of the farmers indicated that, lack of awareness about such agricultural extension programmes was the reason they do not participate. Similarly, 28.6% of the farmers indicated that agricultural extension programmes were not held in their communities. Other farmers (12%) who did not participate in agricultural extension programmes and shows attributed it to their work burden which does not permit them to participate. The demographic characteristics of the farmers revealed that, some of them engaged in other alternative economic activities thus they could not find time to participate in the programmes. The farmers whose work burden does not permit them to attend these programmes were asked to indicate the convenient time their work burden will allow them to participate. Majority of them indicated that, if the programmes were held in the evening, it would be of much convenience to them since they would have returned from their work places.

For those who participated in the programmes, majority (45.7%) of them revealed that such programmes were held in the morning while 41.3% of them said such programmes were held in the afternoon. They were further asked to indicate their preferred time they wish such agricultural programmes should be held. Up to 59.5% of the farmers, mostly men, reported that such programmes should be held in the evening when they have return from work. On the other

hand, 31% of the farmers said they preferred such programmes to be held in the morning before they go to the farm or other economic endeavours. The female farmers indicated that it will be very difficult for them to attend extension programs in the evening because they are always preoccupied with household duties once they return from farm. Thus, they prefer the programs to be held early in the morning before they leave for farm.

5.7 Challenges of accessing CSA information by rural female and male farmers

The *last objective* of the study was to assess the challenges of accessing CSA information by rural female and male farmers and suggest possible solutions to address the challenges. Owing to a significant proportion of the farmers reporting that they do not have access to CSA information coupled with the little information received by those who received some sort of information from varied sources, the study now delves into the challenges that inhibits the farmers from accessing CSA information. The essence of this discourse is to help find solutions that address the shortcomings of CSA information dissemination within the communities. A significant percentage (72.3%) of the female farmers indicated that they encountered several difficulties in their efforts to access CSA information. 73.2% of the men also indicated that they face difficulties accessing CSA information. In general, a significant number (72.7%) of the farmers affirmed that there exist challenges that limit them from accessing CSA information. In the *qualitative* interviews, *two* main themes were identified; namely *individual* and *institutional* challenges.

The prime challenge that most of the respondents listed as militating against accessing CSA information within the communities is limited information dissemination about CSA practices. Some of the farmers reported that accessing CSA information from sources such as extension

officers (both from the government and NGOs) was difficult thus making them receive minimal information on CSA practices. They indicated that the officers do not frequently visit their communities. What compounds this situation is that, the female farmers are not always able to visit the extension officer's office or house. However, it is important to note that different sub-groups of women will have different challenges because of their differential needs and challenges. A respondent at Buipe said this in affirmation of the above challenge.

''It has been more than a year since an extension officer visited our community. I on the other hand have not been able to visit his office because of my work burden as a farmer and a mother. My knowledge on CSA practices is low because of the limited information I received from a friend''. (Female farmer, Buipe).

The Pru District is basically rural (GSS, 2014). It is characterised by poor road networks and network connectivity. Coupled with inadequate logistics at the disposal of the extension officers, it is difficult for extension officers to regularly visit rural areas. Higher poverty levels also prevent the farmers from regular visiting the officer's office to enquire about CSA practices. It is important to note that, broadcasting CSA information through the radio by extension officers is not common in the Pru District. Thus, even farmers who own radio sets still find it difficult accessing CSA information.

The second factor that militates against access to CSA information among both male and female farmers is the unfavourable times that agricultural extension programmes were held. A significant proportion of the farmers revealed that such programmes were held at times that were inconvenient for them. The findings showed that these programmes were primarily held in the morning to the inconvenience of some of the farmers. This disadvantaged farmers find it difficult

to obtain proceeding of the agricultural programs and are compelled to rely on their friends and colleague farmers for CSA information. This is evident in a statement made by a farmer when queried about the challenges of accessing CSA information.

''I am a farmer and a teacher. In the morning, I always go and teach as expected of me as a teacher and unfortunately, agricultural programmes are held in the morning. I have no option but to always skip such shows where vital CSA information may be communicated. In the end, I am forced to rely on the scanty information my colleague farmers give me''. (Male farmer, Kumfourkrom).

A farmer and trader also had this to say about the challenges facing CSA information dissemination in the community.

As a trader, I am always engaged on week days. But what the extension officers have done consistently is that, they hold these shows on week days. It disadvantages some of us from the onset and as such we are unable to participate and in the end, we have limited information about such vital agricultural practices. (Female farmer, Kobre).

The numerous farm and off-farm works that women perform clearly had an effect on their access to extension officers as pointed out in the assertion above. This agrees with Protz (1997) who revealed that rural female farmers participate in both farm and off farm activities that prevent them from participating in extension programs.

The study revealed that female farmers are usually not involved in deciding meeting schedules with extension officers. This situation, according to the women, hinders them from learning about innovative farm practices from extension officers because their numerous household chores and business activities usually conflict with periods of

extension programs. This agrees with the assertion of FAO (1998) that rural females miss extension training programs because they are burdened with so many domestic duties that keep them away from home. However, different sub-groups of the women in the study had different challenges. For instance, the widowed farmers stressed that they are more disadvantage than the married women because the married women can get information from their husbands.

''I am a widow, childless, illiterate, and poor. I have been farming for years without help from anyone. Even where to get information about market price is difficult for me because I don't have a husband or children to enquire from them'' (widowed farmer from Ajaraja).

Women are made up of several sub-groups such as widows, married, migrant, single women etc. These sub-groups have differential challenges and as such intervention programs need to be sensitive to their peculiar situations. Widowhood is common among women in the Pru District. These widows are characterised by poverty and illiteracy. For instance, a respondent had this to say:

''I do not have electricity in my house talk less of television or radio. I cannot afford these things because I have not been able to get enough money from my farm'' (widowed farmer from Kamampa)

Sub- groups like widows face a lot of challenges in their efforts to access CSA information as revealed by the study. Perhaps it will be important to highlight that, the level of *literacy* or *illiteracy* might be one of the core individual barriers to CSA information in the sampled communities. This is because, illiteracy has been found as an important predictor to CSA

information access (Van & Fortier 2000). For instance, as information is mostly stored online and in document forms, it becomes very difficult for farmers to access such information considering their backgrounds characteristics like high illiteracy and poverty levels. Although the Chi- Square test from this current study did not indicate a significant association between educational status and CSA information access, (*see p-value for educational status in* Table 5.4), the general educational background in the study communities (as evident in Table 4.1) suggests that low educational status or illiteracy maybe serve as a possible factor and demands further research to understand such dynamics holistically as majority of the farmers have "no form" of education,

Nonetheless, 27.7% of the female farmers and 26.8% of male farmers reported that there are no challenges impeding their access to CSA information. The reason for such position by these farmers is attributed to the adequate, timely and regular information they receive from varied sources about CSA practices. These farmers are able to access CSA information from various sources partly because of their high educational and income levels relative to other farmers.

Table 5.5: Gender by whether farmers faced challenges or not

Challenges faced	**Female**	**Male**	**Total**	**p-value**
Yes	99 (72.3%)	90(73.2%)	189(72.7%)	0.027*
No	38(27.7%)	33 (26.8%)	71(27.3%)	
Total	137(100%)	123(100%)	260(100%) **	

*Chi Statistic significant at 0.05, ** $N < 272$ due to missing values; N = Number

Source: Field Survey, 2019

5.8 Farmers appraisal of CSA information dissemination in the communities

Having fully digested the level of farmer's access to CSA information, the study now examines farmer's appraisal of CSA information dissemination in the communities. The rate of CSA information dissemination in the communities was rated on the scale 1-4 corresponding to very poor to excellent respectively. On the whole, most of the farmers (43.7%) ranked the level of information dissemination about CSA practices as very poor. The result among both sexes revealed that 24.1% of the females and 19.6% of the males rated the information dissemination as very poor. The reason for ranking the information dissemination as very poor is that they do not receive any form of information on CSA practices. Also, 27.4% of the farmers said the level of information dissemination of CSA practices is poor. They attributed this to the fact that they received minimal information primarily on only some CSA practices from their extension officers and from other information sources.

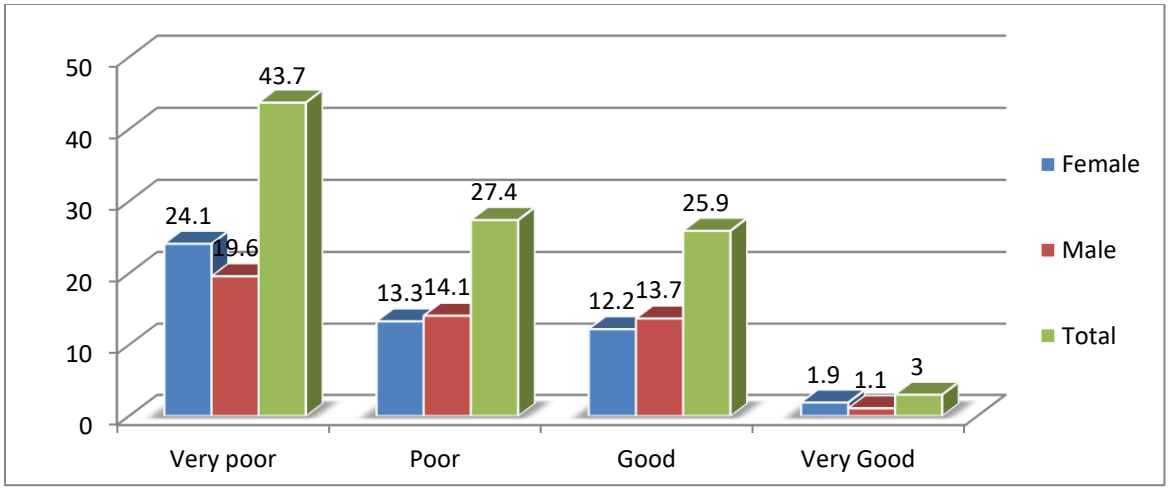

Figure 5.4: Farmers appraisal of CSA information dissemination in the communities

Source: Field survey, 2019

Contrary to the ranking of CSA information dissemination by majority of the farmers as very poor, 25.9% of the farmers indicated that the level of CSA information dissemination in the communities was good. This is because they received adequate information from varied sources concerning CSA practices at regular intervals. This regular dissemination of CSA information increased their knowledge of CSA practices. Only 3% of the farmers ranked the level of CSA information dissemination in the communities as very good. To this minority section of farmers, they received information from all the various sources about all the listed CSA practices at periodic intervals.

Overall, the ranking of the farmers depicted a poor level of CSA information dissemination within the communities. There was no significant difference between gender and the ranking of CSA information dissemination levels within the communities. This is because an overwhelming majority of the farmers (both female and male) find CSA information dissemination in their communities to be ineffective.

5.9 Summary

The chapter analysed farmers' access to CSA information. It was revealed that there is low level of access to information on CSA practices among farmers in the Pru District as indicated by the Chi-square test. Chi-square test was conducted to establish whether there was a relationship between gender and access to CSA information sources. The test revealed that there exist a relationship between sex of the farmer and information received from government extension officers and NGOs. However, female farmers had more access to these information source relative to their male counterparts. The results also showed that famer's sex has an association with information receipt from farmer organisations and input sellers. Men received more information from these

sources than their female counterparts. The Chi-square test conducted to establish the relationship between farmers' sex and access to CSA information revealed that male farmers have more access to CSA information than female farmers. The study identified that certain factors impede both male and female farmers from accessing CSA information. The farmers revealed that there is limited information dissemination regarding CSA practices in the district because extension officers seldom visit the farmers. This is compounded by the fact that the female farmers could not regularly visit the extension officer's office because they did not have money for transport. Again, unfavourable meeting times with extension officers limited the participation of some of the farmers, especially women. The study revealed that women are not involved in deciding meeting schedules and as such the meeting schedules always conflicted with their numerous household and farm responsibilities.

CHAPTER SIX

SUMMARY, CONCLUSION, AND RECOMMENDATION

6.1 Introduction

This chapter presents the summary, conclusions and recommendations in relation to the problem investigated and the findings. The chapter has been organized into four sections. Section one entails the introduction of the chapter, the second section presents the summary, third section gives the conclusions, and the last section contains the recommendations.

6.2 Summary

Access to climate and farm related information is low in rural areas in Ghana. Several rural areas do not have communication infrastructures that ease the transfer of information to farmers, compounded by low number of agricultural extension agents who could teach farmers about CSA practices. Globally, evidence exist that there is gender gap in agriculture where women are characterised by less access to extension services. However, an essential area that has not been given due exploration is a comparison of rural female and male farmers' access to information in order to ascertain whether they have equal access to climate and agricultural information or there is a gender differential in this regard. Using a sample of 272 rural farmers in the Pru District of Ghana, the research investigated access of rural farmers to CSA information and whether rural female and male farmers have equal access to CSA information.

6.2.1 Socio-economic traits of the farmers

Majority of the farmers were females (sub-groups included married, single, divorced, and widowed farmers) who had primary education while the males were in minority with most of them haven attained tertiary education. A major divergence in the educational attainment of both sexes is that fewer numbers of the women had tertiary education relative to the men while more women had no formal education comparative to the men who had no formal education. More married women were aware of CSA practices compared to sub-groups like single women, divorced, and widowed farmers. A significant proportion of the farmers are 35 years and above and married while a large majority of them belong to the Mole-Dagbani ethnic group with Islam as their religious belief. The Akan ethnic group dominates among the Christian faith while the Traditional African Religion was more profound among the Konkombas.

Subsistence farming on small parcels of land up to 3 acres was the common farming type the farmers practiced with most of them cultivating on multiple farms. However, the commercial farmers primarily cultivated on large single farms because such farmers cultivated single food crop and as such they have access to large farmlands. The subsistence farmers cultivated multiple food crops that thrive under varied conditions. Staple food crops like maize, yam, groundnuts and beans were the most extensively cultivated by the farmers. Significantly, the income earned from farming by a large proportion of the respondents who engaged in farming as their primary economic activity is meagre compared to the large majority of the respondents whose much income come from other economic activities like trading, teaching, and driving among others.

6.2.2 Rural female and male farmers' sources of CSA information.

Largely, an appreciable number of the farmers who participated in this study were aware of CSA practices but fewer numbers of them received information about these practices. The reasons for not receiving information about CSA practices was largely due to inaccessibility of agricultural extension officers as well as limited information dissemination about the concept. Other farmers also indicated that they did not participate in programmes due to the unfavourable meetings thus making them not receive information on CSA practices. Government extension officers constitute the largest source of CSA information for both female and male farmers. The information was received through farm visit by extension officers, home visit by extension officers, agricultural shows, and visit to the extension officers' office. Other vibrant sources include NGOs, friends, colleague farmers, and family members.

The CSA practice on which information was received predominantly by the farmers was fertilizer application where information received was on how they are expected to apply it (the timing of application, the type of fertilizer to apply, and the quantity to apply). Another CSA practice that the respondents received was high level of information about weather forecast where disseminated information was on rainfall and temperature trends as well as where variations will occur. This information helped them to know when to plant their crops so as to make the most yields out of them. Other climate smart agricultural practices the respondents reported included market information, agroforestry, water harvest, and minimum tillage.

6.2.3 Rural female and male farmers' channels and preferred channels of CSA information

Majority of the farmers (both male and female) received their CSA information through conversation or interactions with colleague farmers, friends, spouse, and family members. A significant fraction of the farmers heard about CSA practices through farm visits by the extension officers and visit to the extension officer's office. The major channel used by extension officers to transfer CSA information to female farmers was *farm visit* whiles the major channel used for male farmers was *visit to extension officers' office*. The least channel by which male farmers received information about CSA practices is home visit by extension officers while radio was the least channel by which females received CSA information. The preferred channel through which majority of both male and female farmers preferred to receive information about CSA practices is farm visit by extension officers. The reason for which they attached much prominence to this channel of information dissemination is that, it offers them opportunity to interact with the extension officer, ask as many questions possible, and inquire about other agricultural practices. None of the female farmers wished or preferred to obtain CSA information through home visit by extension officers. They attributed this to the fact that, they are always engaged in the house thus making them have little time to actually engage the extension officers when they visit them at home.

Conversations or interactions with spouse, colleague farmers, friends, and family members also constitute the second highest preferred channels of CSA information by farmers. The least preferred channels were internet and radio. The reason being that, the farmers spend much time on the farm and on other economic activities such that, they have little time listening to radio. With this occurrence, it becomes difficult for the farmers to receive information about CSA practices through radio. On their non-preference for internet sources, they indicated that such

sources are not trustworthy likewise most of them could not read nor write; thus hampering their ability to obtain information from internet sources.

6.2.4 Gender differentials in accessibility of CSA information

The Chi-Square independent test conducted to establish a relationship between gender and accessibility to sources of CSA information revealed that there exist a relationship between sex of the farmer and information receipt from government extension officers and NGOs. Significantly, female farmers had more access to these information sources relative to their male counterparts. While this finding contradicts several studies, a justification for this occurrence can be that although the intensive nature of women's domestic and farm roles do not permit them to attend village meetings, their extensive reliance on farm and home visits by extension officers makes them access a lot of information from this sources.

Information received from friends has a relationship with sex of the respondent, in that the males had greater access to CSA information than the females had from their friends. This might be due to the regular discourse between male farmers and their friends on agricultural practices thus disposing them to varied CSA practices compared to their female counterparts. The results also showed that famer's sex has an association with information receipt from farmer organisations and input sellers. Male farmers in both instances received more information from input sellers and farmer organisations relative to the female farmers. This might be because males had more access to input sellers relative to females. Likewise, majority of the male farmers are members of farmer organisations.

6.2.5 Challenges of accessing CSA information by rural female and male farmers.

Overall, the farmers revealed that there is a poor level of CSA information diffusion within the communities and this does not auger well for the promotion of sustainable farming, particularly among rural farmers. The non-availability of information on CSA practices have grave consequences for food and nutrition security considering the increasing threats of climate change and its attendant consequences. The farmers identified a number of challenges that militate against effective information dissemination within the communities. Paramount among such challenges is limited information dissemination about such strategies. Accessing CSA information from sources such as extension officers (both from the government and NGOs) is difficult thus making them receive minimal information on CSA practices since the officers do not frequently visit their communities. The second factor that militates against access to CSA information among the farmers in the selected communities is the unfavourable times within which agricultural extension programmes were held. A significant proportion of the farmers, especially female farmers, revealed that extension programmes are held at times that are inconvenient for them. They bemoan that they are not involved in deciding meeting times with extension agents.

6.3 Conclusion

This study performed an analysis to assess rural female and male farmers' access to CSA information and ascertain whether rural female and male farmers have equal access to CSA information in the Pru District of Ghana. The literature review established the fact that farmers' access to information regarding rainfall and temperature patterns, which crops to plant, where to sell farm produce, where to buy farm inputs, where to get credit, how to operate farm tools, how

to apply fertilizer etc. are very crucial in enhancing farmer' output levels and resilience to climate change.

The survey revealed that there are gender differences in the accessibility of CSA among farmers such that males had more access than females. Nonetheless, contrary to the findings of many studies, female famers had more access to CSA information from government extension officers than their male counterparts. Overall, the ranking of the farmers' access to CSA information in the communities revealed poor level of CSA information dissemination within the communities. Limited access to information on CSA practices is a danger to food and nutrition security in the Pru District considering the increasing threats of climate change on food production. Attempts must therefore be made at revitalizing CSA information dissemination among farmers in the communities of the Pru District. It is by this that the impacts of climate change on the productivity and livelihoods of farmers would be mitigated.

6.4 Recommendation

Evidence from the findings proves that information dissemination on CSA practices is low in the Pru District. There are gender differentials in access to CSA information in the Pru District which does not auger well for the fight for equality and equal opportunities for both female and male farmers. Lack of vital climate and agricultural information reduces farmers' production levels and this has the potential of disrupting rural economy because most rural dwellers in Ghana depend on agriculture as their main source of livelihood and income. The study therefore recommends the following;

- **Increase the number of extension officers**

Majority of both male and female farmers get CSA information from government extension officers. However, quite a remarkable proportion of the farmers reported that the extension officers do not visit their communities regularly and by that, they did not encounter extension officers within their communities during the previous farming season thus making them not receive any information from them about CSA practices. Contingent on this, MoFA as well as the District MoFA authorities must reinforce its extension department by increasing the number of officers and providing the available extension officers with running motorbikes that will help them access rural communities and farms on regular basis to raise awareness of CSA practices.

- **Programme times should be convenient to the farmers**

The study revealed that female farmers in particular are not involved in decision making regarding meeting times with extension agents. Hence, women should be actively involved in deciding meeting times with extension agents. Although it is difficult to promote the Athenian participation where all individuals (stakeholders) meet to deliberate on issues, the extension officers and other NGOs can facilitate a more comprehensive participation through ensuring that they have mechanisms in place to ensure meeting times are convenient to a lot of the farmers.

- **Recruitment of female extension officers**

A significant proportion of the farmers preferred having extension officers from their sex. That is to say that male respondents preferred male extension officers and vice versa. Considering the lack of female extension officers in the Pru District, officials of MoFA at the District level should take ardent steps to ensure that female extension officers are trained and recruited.

- **Empower rural female farmers**

Overall, access to CSA information in the Pru District is low but female farmers have less access than male farmers. Considering the low literacy and income levels among the farmers, especially female farmers, there is the need for adult education and poverty alleviation programs among the farmers to raise their income levels and their ability to search for CSA information from diverse sources.

- **Other sources of information should be strengthened**

Majority of both male and female farmers get CSA information through interactions with their neighbours, colleague farmers, friends, spouse, and family members. There should be Community based extension agents who must undergo periodic training in extension services so that they can augment the efforts of the Ministry of Agriculture by regularly visiting farmers and briefing them on CSA practices in the absence of extension officers. This decentralized system would not only reduce the workload of the extension officers but will also increase the rate of CSA information diffusion. This can also be done through partnership with religious bodies and farmers organisations.

- **Embed relevant traditional knowledge of farming into agricultural service delivery**

With majority of the farmers receiving CSA information through the traditional way of interacting among themselves, some relevant traditional farming practices should be tapped and embedded into the current formal agricultural extension service delivery. Extension agents should advance their knowledge on traditional farming practices. Traditional knowledge of farming has been a major part of farming in Ghana and may be vital to food security. Thus, there

is the need to incorporate the traditional farming practices that have proven to be crucial to food production into extension service delivery. This could ease farmers' adoption of CSA practices.

6.5 Areas that could be studied further

The research found that female farmers have less access to CSA information than male farmers. Thus, an area that could be explored further is access to CSA information by different sub-groups of women like widowed farmers, married farmers, and female migrant farmers with an intention to ascertain whether these sub-groups have equal access to CSA information or there are intra-gender inequalities in this regard. A similar research could also be carried out among the different sub-groups of men to ascertain whether they have equal access to CSA information.

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APPENDIX I

QUESTIONNAIRE FOR FARMERS

THESIS TOPIC: RURAL FARMERS' ACCESS TO CLIMATE SMART AGRICULTURAL (CSA) INFORMATION IN GHANA: EVIDENCE FROM PRU DISTRICT.

QUESTIONNAIRE IDENTIFICATION

(A) Questionnaire number……. (B) Date of interview…….....(C) Name of interviewer….....(D) Name of study community……..

QUESTIONNAIRE

(Enter, circle or check your response appropriately)

SECTION 1: Demographic and socio-economic characteristics of respondent

1. Gender (a) Female (b) Male
2. Which age group are you in?

   (a) 18-24 (b) 25-30 (c) 31-34 (d) ≥35
3. Marital status

   (a) Married (b) Single (c) Divorced (d) Widowed
4. What is your educational level?

   (a) I never attended school (b) Primary school (c) Secondary school (d) Tertiary school
5. What is your ethnic group?

(a) Konkomba (b) Mole-Dagbani (c) Akan (d) Dagaaba/Frafra/Kusasi (e) Other (specify)……

6. What is your current religious affiliation?

(a) African tradition (b) Christianity (c) Islam (d) Other (specify)……

7. How long have you been farming?

(a) Less than 4 years (b) 4-9 years (c) 10-15 years (d) 16-21 years (e) More than 21 years

8. Is your spouse also a farmer? (a) Yes (b) No

9. Do you farm on the same land or separate land (a) Same land (b) Separate land

10. Do you help your spouse on his/her farm? (a) Yes (b) No

11. Do you own more than one farm? (a) Yes (b) No

12. Do you farm for subsistence or commercial? (a) Subsistence (b) commercial

13. What food crop/s do you cultivate?

(a) Groundnut (b) Maize (c) Yam (d) Cassava (e) Rice (f) Beans (g) Other (specify)……..

14. What is the size of your farm/s?

(a) 0-3 acres (b) 4-7 acres (c) 8-11 acres (d) More than 12 acres

15. What are your other livelihoods?

……..

16. What is your main source of income?

(a) Farm (b) Salary (c) Business (d) Spouse (e) Other (specify)……..

17. What are your other sources of income?

    (a) Farm (b) Salary (c) Business (d) Spouse (e) Other (specify)……

18. What is your annual level of income from farm?

    (a) Less than GHS 500 (b) GHS 501-GSH 1,000 (c) GHS 1,001-GHS 1,500 (d) GHS 1,501-GHS 2,000 (e) More than GHS 2,000

19. What is your annual level of income from other livelihoods?

    (a) Less than GHS 500 (b) GHS 501- GHS 1,000 (c) GHS 1,001-GHS 1,500 (d) GHS 1,501-GHS 2,000 (e) More than GHS 2,000

20. Do you belong to a farmer organisation?

    (a) Yes (b) No

SECTION 2: Farmers' CSA information sources, channels and preferred channels, and level of access to CSA information.

1. Are you aware of CSA practices? (a) Yes (b) No
2. If Yes, do you receive information on CSA practices? (a) Yes (b) No
3. If NO, why ?.....

4. If YES, which of the following CSA practices do you receive information on? (choose as many as may apply) (a) Weather forecast (b) Water harvest (c) Fertilizer application (d) Minimum tillage (e) Agroforestry (f) Market information

5. Which source/s do you receive the information from?

(a) Government extension officers (b) NGOs (c) Spouse (d) Friends (e) family members (f) Colleague farmers (g) Religious groups (h) Farmer organisations (i) Input sellers (j) Other (specify)……

6. Through which channel/s do you get the information from?

(a) Home visit by extension officers (b) Agricultural shows (c) Farm visit by extension officers (d) visit to extension officer's office (e) Conversations with spouse, colleague farmers, family members or friends (f) Religious gatherings (g) Farmer organisation meetings (h) Radio (i) Television (j) Phone (k) Newspapers (l) Internet (m) Email (n) Other (specify).....

7. From the above channels, which one do you prefer?

(a) Home visit by extension officers (b) Agricultural shows (c) Farm visit by extension officers (d) visit to extension officer's office (e) Conversations with spouse, colleague farmers, family members or friends (f) Religious gatherings (g) Farmer organisation meetings (h) Radio (i) Television (j) Phone (k) Newspapers (l) Internet (m) Email (n) Other (specify).....

8. How will you describe your level of access to information on the following CSA practices?

a. Weather forecast (a) High (b) Moderate (c) Low (d) No access

b. Water harvest (a) High (b) Moderate (c) Low (d) No access

c. Fertilizer application (a) High (b) moderate (c) Low (d) No access

d. Minimum tillage (a) High (b) Moderate (c) Low (d) No access

e. Agroforestry (a) High (b)Moderate (c) Low (d) No access

f. Market information (a) High (b) Moderate (c) Low (d) No access

9. How will you describe your level of access to the CSA information sources?

a. Government extension officer (a) High (b) Moderate (c) Low (d) No access

b. NGOs (a) High (b) Moderate (c) Low (d) No access

c. Spouse (a) High (b) Moderate (c) Low (d) No access

d. Friends (a) High (b) moderate (c) Low (d) No access

e. Family members (a) High (b) Moderate (c) Low (d) No access

f. Colleague farmers (a) High (b)Moderate (c) Low (d) No access

g. Religious groups (a) High (b) Moderate (c) Low (d) No access

h. Farmer organisations (a) High (b) Moderate (c) Low (d) No access

i. Input sellers (a) High (b) Moderate (c) Low (d) No access

j. Other (specify)…….... (a) High (b) Low (c) Moderate (d) No access

SECTION 3: Farmers' access to extension service.

1. Are you aware of the presence of extension officers in the district? (a) Yes (b) No
2. If Yes, are they government or NGO extension officers? (a) Government (b) NGO
3. Do you know your extension officer? (a) Yes (b) No
4. If Yes, is the officer female or male (a) Female (b) Male
5. If you could choose would you prefer a female or male extension officer?

   (a) Female (b) Male (c) It does not mater

6. When was the last time the extension officer visited your community?

   (a)Less than 3 months ago (b) 3-5 months ago (c) 6-9 months ago (d) more than 9 months ago
7. During the last farming season how many times did you receive information regarding CSA practices from the extension officer?

   (a) Zero (b) Once (c) Twice (d) Thrice (f) More than thrice
8. Do you give feedback to the extension officer when you receive CSA information?

   (a) Yes (b) No

9. If Yes, through which channel/s do you give the feedback? (a) Phone call (b) Visit to extension officer's office (c) Home/farm visit by extension officer (c) Text message
10. Are you always able to attend agriculture extension programs?

    (a) Yes (b) No
11. If YES, skip to question 14
12. If No, why ?

    (a) My work burden does not allow me (b) I am not aware of such programs (c) culture norms do not permit me to attend such meetings (d) Extension programs are not held in this area (e) other (specify)……..
13. If your work burden does not allow you, what is your convenient time?.....
14. What time is the program held? (a) Morning (b) Afternoon (c) Evening (d) Any time
15. What time would you prefer it to be held? (a) Morning (b) Afternoon (c) Evening (d) Any time
16. How would you rate CSA information dissemination in your community?

    (a) Very poor (b) Poor (c) Good (d) Very good (e) Excellent

SECTION 4: Challenges of accessing CSA information and suggested solutions.

1. Do certain factors impede you from accessing CSA information from the government extension officer or NGOs?

   (a) Yes (b) No
2. If No, why……..

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3. If Yes, please list the challenges you encounter in accessing CSA information.

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4. Please list the solutions to the above challenges you have identified.

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