

UNIVERSITY FOR DEVELOPMENT STUDIES

**THE ROLE OF CLIMATE CHANGE COMMUNICATION ON THE
ADOPTION OF CLIMATE-SMART AGRICULTURE BY SMALLHOLDER
FARMERS IN NORTHERN REGION OF GHANA**

MOHAMMED FUSEINI KASULI

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FACULTY OF AGRICULTURE, FOOD AND CONSUMER SCIENCES
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THE ROLE OF CLIMATE CHANGE COMMUNICATION ON THE
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FARMERS IN THE NORTHERN REGION OF GHANA

BY

MOHAMMED FUSEINI KASULI

(B.A Integrated Development Studies)

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DECLARATION

I, Mohammed Fuseini Kasuli, do hereby declare that this thesis does not incorporate any material previously submitted for a master’s degree, a degree or diploma in any University without acknowledgment, and that it does not contain any material previously published or written by another person, to the best of my knowledge and belief, except where due reference has been made in the text.

Candidate’s signature: Date:

Name: MOHAMMED FUSEINI KASULI

SUPERVISOR

I, JOSEPH AMIKUZUNO, do hereby declare that the preparation of this thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

Supervisor’s Signature: Date:

Name: Prof. JOSEPH AMIKUZUNO





ABSTRACT

Agriculture in Ghana is increasingly becoming vulnerable to climate change due to its dependence on rainfed. To tackle current food insecurity and climate change, the agricultural sector of Ghana must be transformed to become climate-smart. This requires reducing the vulnerability and enhancing the resilience of the sector to the changing climate. This involves the provision of access to and use of climate change information by smallholder farmers through climate change communication. The study looked at the role of Climate Change Communication (CCC) in the adoption of Climate-Smart Agriculture by smallholder farmers in the Northern Region of Ghana. Descriptive statistics were used to determine the role of climate change communication in the adoption of climate-smart agriculture by smallholder farmers. A multistage sampling technique was used to select the study population. Data was collected using a questionnaire. The data was imputed into STATA and analysed using descriptive statistics such as frequencies and percentages. Quantitative data was analyzed with the help of Computer Assisted Programmed Interviewing (CAPI) while qualitative data was analysed based on content analysis. The findings revealed that there is a high level of awareness of climate change among smallholder farmers in the region. Challenges smallholder farmers in the region face in accessing climate change information included discussions on climate change issues being too scientific, using the language the local people do not understand, lack of mobile network, poor radio network and lack of access to radio sets. The study recommends that the government of Ghana should include “youth in extension” as one of the flagship programmes to increase the number of extension agents in the country

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DEDICATION

I dedicate this work to my late father Mahama Nabila and the rest of the family.



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LIST OF ACRONYMS

- AAP- African Adaptation Programme
- AEA- Agricultural Extension Agent
- ALP- Adaptation Learning Program
- APF- Adaptation Policy Framework
- CARE- Cooperative for Assistance Everywhere
- CBA- Community-Based Adaptation
- CBEA- Community-Based Extension Agents
- CBO- Community-Based Organisation
- CCAFS- Climate Change Agriculture and Food Security
- CCC- Climate Change Communication
- CFTC- Canadian Feed The Children
- CGIAR- Consultative Group on International Agricultural Research
- CHANGE- Climate Change Adaptation in Northern Ghana Enhanced
- CIS- Climate Information Service
- CKDN- Climate Knowledge Development Network
- CRAFS- Climate-Resilience Agriculture and Food Systems
- CRED- Center for Research on Environmental Decisions
- CSA- Climate-smart Agriculture.
- CSIR- Council for Scientific and Industrial Research
- DA- District Assemblies
- EPA - Environmental Protection Agency

FAO – Food and Agricultural Organisation

FC- Forestry Commission

FGD- Focus Group Discussion

FRI- Farm Radio International

GDP – Gross Domestic Product

GHG- Green House Gas

GIDA- Ghana Irrigation Development Authority

GMet- Ghana Meteorological Agency

GSGDA- Ghana Shared Growth and Development Agenda

GSS- Ghana Statistical Service

ICT- Information and Communication Technology

IPCC- Intergovernmental Panel on Climate Change

KII- Key Informant Interviews

LPG- Liquefied Petroleum Gas

MDA- Ministries Departments and Agencies

MEST - Ministry of Environment Science and Technology

MESTI- Ministry of Environment Science Technology and Innovation

MMDA- Metropolitan, Municipal and District Assemblies

MoFA- Ministry of Food and Agriculture

MTS- Modified Tuangya System

NABCO- Nation Builder Corps

NADMO- National Disaster Management Organisation



NAPCDD- National Action Programme to Combat Drought and Desertification

NCCAS- National Climate Change Adaptation Strategy

NCCP- National Climate Change Policy

NDPC- National Development Planning Commission

NMC- National Media Commission

NOG- Non-Governmental Organisation.

NREG - Natural Resource and Environment Governance

PFAG- Peasant Farmers Association of Ghana

PSP- Participatory Scenario Planning

RAINS- Regional Advisory and Information Network Systems

SARI- Savanna Agricultural Research Institute

SDG- Sustainable Development Goals

SEND- Social Enterprise Development

SNC - Second National Communication

UKCIP- United Kingdom Climate Impact Programme

UN- United Nations

UNDP- United Nations Development Programme

UNFCCC- United Nations Framework Convention on Climate Change

VSLA- Village Savings and Loans Associations

WMO- World Meteorological Organisation

YEA- Youth Employment Agency



CHAPTER ONE

1.0 Introduction

This chapter comprises the background, problem statement, study questions, study objectives, justification of the study and organisation of the study. The background looks at climate change and its effects on agriculture in Ghana and climate change communication in Ghana among others. The problem statement looks at climate change information services and the adaptation of agriculture to climate change. The justification discusses the contributions that the study makes to agricultural productivity in Ghana, climate change policy formulation in Ghana and the literature on climate change.

1.1. Background

The best approach to improve the lives of many people who are suffering from poverty in developing countries is to support agriculture (Sara Boettiger, Nicolas Denis & Sunil Sanghvi, 2017). The same scholars also noted that the majority of the world poor are farmers most of whom are smallholders. These authors also note that the world's poor who are not farmers spend most of their earnings on food.

Climate variability and climate change are complicated factors that will likely worsen food insecurity in developing countries (UN 2015). According to Carter (2018), climate change is transforming agriculture and so adaptation of the sector to the impact of climate change must also be transformative. As climate change impacts intensify transformative adaptation in the agricultural sector may be the best method to



improve global food security, avoid maladaptation and reduce the ever-increasing risks (L. Ashley, R. Carter, T. Ferdinand, R. Choularton, N. Appadurai, N. Ginoya, & P. Preethan, 2018). These authors defined transformative adaptation for agriculture as the deliberate responses to climate change effects that significantly shift the locations of agricultural production systems and introduce new production systems.

Reduction in the vulnerability and enhanced resilience of agriculture to the continuously changing climate among smallholder farmers will, therefore, require access to and use of climate change information (WMO, 2012). Climate change information forms the fundamental basis upon which many agricultural decisions are made. (Isaac Wafula, Wamalwa, Benson K. Mburu & Daniel Gathuru M., 2016). These decisions according to these scholars include; what crop and variety to grow, when to grow and when to apply fertilizer and pesticides among others. Appropriate climate information enhances the ability to adapt and reduce the adverse effects of climate change (World Bank, 2008). Together with the traditional economic development and poverty reduction goals, governments in developing countries are concentrating their agricultural transformation plans on the Sustainable Development Goals (SDGs) by adopting climate-smart agricultural strategies (Sara et al, 2017).

In Ghana agriculture remains one of the major drivers of the economy. The sector contributed 18.3% to the Gross Domestic Product (GDP) in 2017 (world Bank 2018). However, sustained productivity of the agricultural sector in Ghana like any other developing country is being threatened by climate change. The impact of climate change including erratic rainfall, rising temperatures and sea levels are already evident



in Ghana, especially in the Northern part. Drought in Northern Ghana is slowly becoming a common phenomenon and this can cause food insecurity in the country (Amikuzuno and Donkoh 2012). Since agriculture continues to be the main source of livelihood for most rural communities in Ghana, the increasing threat of production failures associated with climate change presents a serious threat to food security and poverty reduction in the country (FAO, 2014).

To successfully tackle current food insecurity and climate change, the agricultural sector of Ghana must be transformed to become climate-smart. The FAO (2011) defined Climate Smart Agricultural (CSA) practices as those practices that increase the adaptive capacity and resilience of farm production in the face of climate shocks thereby improving food security and also mitigating GHG emissions through increased carbon sequestration in soils. CSA is different from conventional approaches by emphasizing the capacity building of actors in the agricultural sector to implement flexible context-specific solutions supported by innovative policy and financial actions (Leslie Lipper, Philip Thompson & Bruce M. Cambell, 2014).

In response to the UNFCCC requirements, Ghana has developed and adopted three key climate adaptation policies from the national level to the local level. These are Ghana's Second Communication to the UNFCCC (2011), the National Climate Change Adaptation Strategy (NCCAS 2012) presented in 2012 from 2010 to 2020 and the National Climate Change Policy (NCCP) launched in 2013 from 2015 to 2020 (Lowder S. K., Skoet J. & Singh S., 2014).

Studies showed that apart from the efforts made by the government to provide climate information to Ghanaians through these policies, civil society organizations have also taken actions aimed at providing smallholder farmers with climate information. In the year 2012, the Cooperative for Assistance Everywhere (CARE), introduced an integrated community-based adaptation method to Climate Information Service (CIS) in Ghana with the introduction of Participatory Scenario Planning (PSP) and the provision of rain gauges in northern Ghana (Gbetibouo et al., 2017). Also, between 2011 and 2017, the Climate Change Agriculture and Food Security (CCAFS) in its attempt to help Ghanaian farmers avert the threat associated with climate change and variability, implemented the Climate Information Service (CIS) in the country (Fugar, 2019). The CIS according to Fugar, 2019), was implemented through a partnership with an information and communication technology company called Esoko and the Ghana Meteorological Agency (GMet). During the implementation of the CIS, Esoko provided processed information obtained from (GMet) and other sources to farmers using mobile phone platforms (Fugar, 2019). The Esoko platforms also allow smallholder farmers to access call centers where CIS is delivered to them vocally in their local language. The information included the onset and end of the rainy season and total rainfall for the year and the farmers also received market alerts and agro-advisories that were meant to assist them to understand and apply the information received (Samuel T. Partey, Gordon K. Nikoi, Mathieu Ouedraogo, Robert B. Zougmore, 2018 & Fugar, 2019).

Studies have revealed that effectiveness in climate change communication must move beyond simply providing information to include raising awareness and promoting active public engagement (CRED, 2009, Corner, 2011, Corner A., Shaw C. & Clarke J. 2018 & Mairi Dupar, Lisa McNamara & Maria Jose Pacha, 2019). For climate change communication to be effective, climate change information should be packaged in a way that is easily accessible to communities and it should encompass traditional and historical observations together with science-based measurements (Gbetibouo et al., 2017). Communication approaches that foster dialogue and public engagement with stakeholders can both enhance the understanding of climate change and adaptation solutions and improve the likelihood of behavioral change (C. Lumosi & D. McGahey, 2016). By engaging local communities and focusing on their needs, climate change information can be co-generated and can become usable and relevant (Lumosi et al., 2016). This will in turn help to create and achieve specific goals for adaptation. Much of the climate change communication that happens in Ghana is linear, providing information through radio and television while doing little to engage the public in a discussion on the issues and solutions. This situation creates a gap in knowledge and access to information on climate change among different stakeholders in the country.

This study will enable me to allow the local people to express their opinions on the most appropriate channels to communicate climate change in Ghana. This will make climate change communication reach the local people in the communities who are mostly farmers and enhance the co-generation of climate information among relevant stakeholders. Furthermore, the study will review relevant literature on the best

strategies to use when communicating climate change to make it effective. This will inform Ghanaian policymakers of the best strategies to adopt in the country's climate communication strategy so that climate change communication in Ghana can be fashioned out to make it reach the local farmers who are the most affected by climate change.

1.2. Problem statement

In Ghana, agriculture remains a significant sector of the economy. The sector employs about 25.8% of the total labour force accounting for about 18.9% of GDP in 2016 and 18% of GDP in 2017 (Lowder et al., 2014; World Bank, 2018). Like other African countries communities in Ghana are increasingly becoming vulnerable to climate change because of the dependence on rain-fed agriculture among others Gbetibouo et al., (2017). Challenges associated with climate change such as land degradation, crop failures due to unpredictable weather and decreasing arable land for coastal communities due to sea erosion will further affect the livelihoods of many Ghanaians especially those in rural communities (C. Kye-Mensah, R. Kyeremanteng & S. Adu-Ahampong, 2016).

What we need in Ghana in terms of climate change adaptation is transformative adaptation. Transformative adaptation is the fundamental systems changes that address the root causes of vulnerability to climate change (G. Fedele, C. I. Donattia, C. A. Haeveya, L. Hannah & D. G. Holea, 2019). These scholars believe that using transformative adaptation to navigate changes driven by climate change can increase the efficiency and sustainability of climate solutions. The advancement of Climate



Smart Agriculture as a form of transformative adaptation spearheaded by the FAO and the Consultative Group on International Agricultural Research (CGIAR) is an initiative in this regard (Rahina S.A., Erasmus H. O. & Kwadwo O., 2018).

Effective adaptation of agriculture to climate change depends on access to climate information by smallholder farmers on a timely basis Gbetibouo et al., (20017).

According to UNFCCC (2007), climate information and forecasting services are useful in understanding the dynamics of the climate system, providing input in climate models and thus planning for adaptation options. This information is also useful in the diversification of livelihoods and managing risks and mitigating the adverse effects of climate change (FAO, 2010, & FAO, 2017). Research has shown that one key ingredient for providing access to climate information and the adaptation of climate CSA and other transformative adaptation practices by smallholder farmers is climate change communication. Effective communication among stakeholders facilitates problem identification, raises awareness, encourages dialogue and influences behavioral change (Johnson 2011, Moser 2010 & W. Pearce, B, Brown, B. Nertlich & N Koteyko 2015). Studies show that the government of Ghana and civil society organizations have implemented policies and strategies aimed at communicating climate information to Ghanaians that will help them adapt to the adverse effects of climate change. As a signatory to the international requirement of the UNFCCC and the Kyoto Protocol, Ghana is committed to taking appropriate measures to respond to these risks associated with climate change through national policies and programmes (W. Pearce, B, Brown, B. Nertlich & N Koteyko 2015).



The country has developed and presented to the UNFCCC three key climate change adaptations. Together with the adoption of the policies by the government civil society organizations have implanted strategies meant to communicate climate change information to Ghanaian farmers. The introduction of the integrated community-based adaptation approach to climate information Services (CIS) by CARE in the Northern Region of Ghana in 2012 is a case in point. The CCAFS implemented the CIS between 2012 and 2017 in the Northern Region through collaboration between a private ICT company (Esoko) and the Ghana Meteorological Agency (GMet). The implementation of the CIS through the advisories, rain gauges and the PSP by CARE and CCFAS served as a platform through which climate change information is shared and interpreted in Ghana. Through the CIS and the advisories regarding different scenarios, appropriate climate-smart agricultural practices are generated and disseminated through various channels such as radios and extension agents. However, very little is known about the extent of access, to this information by smallholder farmers and the implication in terms of the adoption of climate-smart agricultural practices in the Northern Region of Ghana.

The purpose of the study is to examine the extent of climate information dissemination and its implication for the adoption of climate-smart agricultural practices in the Northern Region. It will identify the main climate change communication strategies used to provide climate change information in Ghana and determine the best CCC strategies used for the promotion of CSA adoption in the Northern Region. This will promote the adoption of CSA by farmers in the region. By so doing, agriculture in the

region will be made attractive since farm output and the profitability of farm incomes will be increased. This will lead to the enhancement of the quality of life of farm families and communities. It will also lead to the protection of the environment thereby promoting environmental stewardship in the region. This is crucial in Ghana's quest to end hunger, ensure food security and improve the nutritional status of Ghanaians. It will also ensure healthy lives and promote the well-being of the people. This is essential for the attainment of sustainable development goals in Ghana.

1.3 Research questions

The main research question is;

What role does climate change communication play in the adoption of climate-smart agriculture by smallholder farmers in the Northern Region of Ghana?

The specific questions are;

1. What are the channels through which climate change information is communicated to smallholder farmers in Ghana?
2. How effective are the channels in communicating climate change information to smallholder farmers in the Northern Region?
3. What are the challenges smallholder farmers in the Northern Region face in accessing climate change information?
4. What are the effects of existing climate change communication strategies on the adoption of CSA by smallholder farmers in the Northern Region?



1.4 Research objectives

1.4.1 Main objective

The main research objective is;

to determine the role of climate change communication in the adoption of climate-smart agriculture by smallholder farmers in the Northern Region of Ghana

1.4.2 Specific objective

The specific objectives are;

1. to identify the channels through which climate change information is communicated to smallholder farmers in Ghana
2. to explore the effectiveness of the channels in communicating climate change information to smallholder farmers
3. to identify the challenges smallholder farmers in the Northern Region faced in accessing climate change information.
4. to examine the implications of CCC for the adoption of CSA by smallholder farmers in the Northern Region.

1.5 Justification of the study

Although research on climate change adaptation appears to be on the increase, not much has been done on the role of climate change communication in the adoption of CSA by smallholder farmers. There is, therefore the need to conduct this study to enable the sharing of information on the different climate change communication strategies for the adoption of CSA practices.



The study will inform the formulation of the climate change communication policy by the government and other policymakers. Policymakers will not be able to know what climate change adaptation policies are best for a given locality without evidence provided by research. The research will enable policymakers to make climate change policies that are effective in responding to existing reality.

The issues that will be discussed in the study will be made accessible to state institutions such as MoFA and other state agencies on request, which will make use of the findings in many ways. This will help climate change communicators, government and scientists understand where the knowledge gaps in the provision of climate change information services exist and make it possible for them to formulate and implement effective CCC and adaptation strategies that will bridge the gap and help reduce the negative effects of climate change on farming communities. This will also assist them to formulate and implement effective CCC strategies for providing relevant climate change information and CSA adoption strategies that will help reduce the negative effects of climate change on rural farming communities in Ghana especially those with similar environmental characteristics. By this, Ghana will be well-positioned to be able to formulate and implement proactive and more effective climate change communication policies and programmes to the UNFCCC and other international climate change agencies. This will help Ghanaians in general and farmers, in particular, to cope with the effects of climate change and reduce the negative effects of climate change on the socio-economic development of Ghana. Moreover, the study will help improve the quality of the environment and ensure sustainable agricultural



productivity in the country. Agriculture productivity depends on the quality of the natural resources of the environment. This is because agriculture is a major user of land and water resources and as such agricultural practices need to maintain the quantity and quality of those resources if sustained productivity in the agricultural sector is to be achieved. Unfriendly agricultural practices such as the shifting cultivation and the use of pesticides can degrade environmental resources such as land, water and biodiversity. The study will highlight the various climate change communication strategies that are suitable for enhancing the adoption of CSA practices by smallholder farmers in the region. It will also present the challenges farmers in the region face in accessing climate change information that will assist them to adopt CSA practices. This will enable climate change communicators and agricultural scientists in Ghana to come up with ways to overcome these challenges and improve climate change communication. This will contribute to enhancing the adaptive capacity of the farmers and their practicing of CSA strategies. CSA strategies such as agroforestry and composting will improve the quality of the environment. Therefore, if smallholder farmers adopt CSA practices in their farming activities, there will be a sustainable increase in the quality of the environment to support future demands for food in Ghana. This is crucial in ensuring self-sufficient food production in Ghana and poverty reduction because it will increase the income level of poor farmers.

Furthermore, the study has the potential to contribute to increasing agricultural productivity, poverty reduction and ensuring food security in Ghana. The study will

enhance the adaptive capacities of smallholder farmers in Ghana. It will discuss and present sufficient location-specific knowledge about the choice and practices of adaptation approaches of various communities. This will help local farmers to understand the fact that challenges associated with climate change differ spatially and as such adaptation strategies must also differ. This will enhance the adaptive capacity of smallholder farmers in the region. This is because the adaptive capacity of smallholder farmers can be increased by improving their understanding of adoption challenges and raising their awareness of different adaptation strategies. The adoption of some of the CSA practices such as dry season farming and agroforestry will help reduce seasonal unemployment among the people. Destructions from natural disasters such as storms will also be reduced. As more farmers adopt CSA practices in the region, their farm productivity will be improved enabling the country to be food sufficient. This will result in poverty reduction and improvement in the living standards of the people. This is crucial in the country's quest to achieve goals one (1), two (2) and three (3) of the United Nation Sustainable Development Goals.

Additionally, the study will contribute to the growing literature on climate change communication and CSA adoption strategies. It will help these researchers in their quest to research areas related to climate change communication and the CSA adoption strategies. The study will provide information on the various pathways and channels through which climate change information is communicated including the best practices in the field of climate change communication. The challenges of climate change communication concerning both provision and access to information will be

looked at. The effectiveness of the various channel of communicating climate change information will also be considered. This will help me to come out with the best channels to communicate climate change to make it effective. The knowledge gap that exists between producers and users of climate change information will also be exposed. Findings of in-depth interviews with relevant stakeholders and interest groups on the above issues will help in identifying those issues. The study will explain all these critical issues. This will contribute to the growing literature on climate change communication and CSA adaptation strategies which will be useful for future researchers who may want to focus their studies in this area.



CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This part of the study offers a review of the relevant literature. It comprises definitions of major terms and concepts, climate change, Ghana's efforts towards climate change adoption, climate change communication strategies in Ghana and the Northern Region, climate-smart agricultural adoption strategies in Ghana and the Northern Region of Ghana, (agroforestry, and dry season farming).

2.1. Definition of terms and concepts

2.1.1. Climate

According to the Intergovernmental Panel on Climate Change IPCC (2018), the climate is narrowly defined as the average meteorological conditions or the numerical description in terms of the mean and variability of appropriate quantities such as temperature, rainfall, and wind over a period of time. For this study, Climate is defined as the average weather or as the statistical description in terms of the mean and variability of relevant variables such as temperature, precipitation, and wind over a period of time. The period is normally 30 years.

2.1.2 Climate change

This is the alteration in the normal weather of a place. It may well be changed in how much rainfall an area gets within one year or a change in the usual temperature of a place.



Rahman (2012), defined climate change as the long-term change in the statistical distribution of weather patterns (temperature, precipitation, etc) over decades to million years. The UNFCCC (2012) defined climate change as any variation of climate that can be directly or indirectly attributed to human actions which change the structure of the total atmosphere and are observed over a particular period. The IPCC (2001) defined climate change as any change in the climate over time whether due to natural variability or as a result of human activity.

It is important to note the similarities in the definitions of climate change by the well-known global agencies on climate change. Thus, the UNFCCC and the IPCC. The UNFCCC in its definition makes a distinction between climate change which is attributable to human activities altering the atmospheric composition of the globe and climate variability that is attributable to natural causes. Similarly, the IPCC in its definition takes a broader look at climate change and states that climate change can occur as a result of natural variability and human activity

In this study, climate change will define as a change of climate of a place that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods. Climate change is also defined as the rise in the average weather of a place.



2.1.3. Adaptation

This is the process through which organisms make behavioral changes or adjustments that will facilitate their reproductive success and survival in their environments (Bate 2005). According to the natural sciences, adaptation generally refers to the change of genetic or social features that makes an organism or a system deal with ecological or environmental changes to survive and also reproduce (Futuyama, 1979, Winterhalder, 1980 & Kitano, 2002).

2.1.4. Climate change adaptation

According to the United Kingdom Climate Impact Programme (UKCIP 2003), climate change adaptation is the procedure or outcomes of a procedure that reduces the harm or risk or leads to the realisation of benefits that accompanies climate variability and climate change. The United Nations Development Programme UNDP (2005) defined climate change adaptation as a process by which strategies to moderate, cope with, and take advantage of the consequences of climatic events are enhanced, developed, and implemented. The IPCC described climate change adaptation as the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploit beneficial opportunities Corner & Clarke (2018).

The IPCC classified adaptation into several types; anticipatory (proactive) adaptation, autonomous adaptation, planned adaptation, private adaptation, public adaptation, and reactive adaptation Corner & Clarke (2018).

Anticipatory (proactive) adaptation according to the IPCC is the adaptation that is done before the observance of the impacts of climate change Corner & Clarke (2018). The IPCC described reactive adaptation as the adaptation that is done after the effects of climate change have been already been felt Corner & Clarke (2018). The IPCC explained that autonomous adaptation is the which is created by a conscious response to climatic stimuli but is caused by environmental changes in natural systems (Corner & Clarke 2018). According to the IPCC, the adaptation that results from the deliberate policy outcome is due to a recognition that circumstances have changed or are about changing and so action needs to be taken to achieve the desired condition Corner & Clarke (2018). The IPCC explained that private adaptation is where an individual, a household, or a company initiates and implements an adaptation based on self-interest (Corner & Clarke 2018). Public adaptation according to the IPCC is where the central government initiates and implements adaptation measures from the national to local levels noted that public adaptation is generally motivated by shared needs Corner & Clarke (2018).

This study will adopt the NCCP (2013) definition of climate change adaptation which states that; ‘climate change adaptation is the adjustment in natural or human systems as a result of the real or anticipated climatic stimuli or their effects, which controls harm and exploits useful opportunities with a dynamic process of economic development’ (NCCP, 2013).

2.1.5 Climate change communication

Climate change communication is a science that seeks to engage people through information sharing and deliberations to enhance the behavioral changes required to reduce and adjust to cumulative climate variability Harvey et al., (2012). Climate change can be communicated in such a way that it will be easier for people who are not a scientist to understand the message (Corner A., Shaw C. & Clarke J., 2014 & Corner & Clarke, 2018).

2.1.6. Climate-Smart agriculture

The FAO (FAO, 2017) defined Climate-Smart Agricultural (CSA) practices as agricultural practices that increase the capacity and resilience of farm production to adapt to climate shocks. They are the agricultural activities that increase agricultural production while minimizing the emission of greenhouse gas. Climate-Smart Agriculture is the agricultural activities that bring about a sustainable increase in agricultural production and structural resilience and also reduces the emissions of greenhouse gases (A. Sullivan, S. Mwamakamba, A. Mumba, S. Hachigonta & L. M. Sibanda 2012 & World Bank, 2018).

The study will take the FAO 2010 definition of CSA as the agricultural practices that sustainably increase productivity, resilience to climate change, reduces or removes greenhouse gases (mitigation) and enhances the achievement of national food security and development goals. Local CSA strategies including dry season farming/ irrigation, mulching, composting, mixed cropping, agroforestry, etc will be considered to be the CSA approaches implemented by farmers in the Northern Region.

2.2. THEORIES OF BEHAVIURAL CHANGE

2.2.0. Introduction

This part of the work looks at some of the theories that explain how the behaviour of individuals changes towards the adoption of new technology. These theories include the theory of reasoned action, the theory of planned behaviour, the technology acceptance model and the diffusion of innovation theory.

2.2.1. The Theory of Reason Action (TRA) (Ajzen and Fishbein, 1980)

The TRA posits that an individual's behaviour is directed by his or her intentions. As one's intentions to perform a particular behaviour increase, they are likely to perform that behaviour (Mary J. Ryan & Albert K. Worthington, 2021). They added that an individual's intentions are directly predicted by his or her attitudes toward the behaviour and the subjective norms. According to TRA, the individual's behaviour is motivated by behavioural objectives and this is a function of the individual's attitudes towards the behaviour and subjective norms surrounding the performance of the behaviour (Surendran, 2012). Behavioural intention which is defined as people's readiness to perform a given behaviour is the most immediate determinant of behaviour (Marco Yzer, 2013).

One's attitude can be defined as his or her evaluation of a given behaviour and the attitude can be positive, negative, or neutral about a given behaviour (Mary et al., 2021). As an individual's attitude towards a given behaviour becomes more positive, their intention to perform the behaviour will increase and vice versa (Mary et al., 2021). Subjective norms according to (Mary et al., 2021), are an individual's beliefs



about the importance others place on them performing a given behaviour. Thus, the subjective norm is the degree to which the individual perceives how other people want them to engage in the behaviour. As an individual's subjective norms increase, their intentions to perform the behaviour will also increase and vice versa (Mary et al., 2021).

2.2.2. The Theory of Planned Behaviour (TPB) (Ajzen 1991)

The Theory of Planned Behaviour (TPB) states that an individual's behaviour is directly determined by his or her intentions and perceived behavioural control (Mary J. Ryan & Albert K. Worthington, 2021 & Matthew Asare, 2015). Perceived behavioural control (self-efficacy) according to Mary et al., 2021), encompasses the extent to which an individual believes they have control over performing that behaviour. The authors added that an individual's intentions are directly predicted by their attitudes towards the behaviour, subjective norms, and perceived behavioural control. The theory state that behavioural intention is the motivation factor that influences behaviour (Matthew, 2015). Matthew (2015) noted that the stronger the intention to engage in a behaviour, the more likely it is to perform the behaviour. Attitude according to (Matthew, 2015), is the extent to which a person has a favourable or unfavourable appraisal of a given behaviour. Subjective norm is the social pressure exerted on the individual to perform or not perform a given behaviour (Matthew, 2015).

The TPB posits that an individual perceived behavioural control of a given behaviour is a joint function of their assessment of the likelihood or frequency that a specific



control factor will occur and the potential of the control factor to impede or facilitate the behaviour (Mary et al.,) Mary et al., however, noted that the attitudes, subjective and perceived behavioural control do not always contribute equally to predicting intentions. They argued that sometimes an individual's intention may be determined largely by attitudes and subjective norms may have little or no influence while at another time individuals' intentions may be determined largely by subjective norms and attitudes and intentions may have little or no influence.

2.2.3. The Technology Acceptance Model (TAM) (Davis 1989)

Technology Acceptance Model (TAM) is one of the most popular research models used in predicting the use and acceptance of information systems and technologies by individual users (Surendran 2012). TAM theorises that the acceptance of technology by an individual is determined by their intention to accept the technology (Mary et al., 2021). As the individual's intentions to accept the technology increase they are more likely to accept the technology (Mary et al., 2021). The individual's attitude to using the technology has to do with their evaluation of the desirability of employing the technology while their behavioural intention is a measure of the likelihood of them using the technology (Surendran 2012).

Two factors are relevant to the individual's use of technology. These are perceived usefulness and perceived ease of use (Surendran, 2012). Perceived usefulness according to (Surendran 2012) is the individual's subjective probability that using a particular technology will enhance their life performance. Perceived ease of use is the degree to which the individual expects the target technology to be free of effort (Mary



et al., 2021, Surendran 2012). Perceived usefulness is the degree to which an individual believes that using a particular technology would be beneficial to them (Mary et al., 2021). As the individuals perceived usefulness of technology increases, their intention to use the technology will also increase and the reverse is true (Mary et al., 2021). Also as the individuals perceive the ease of use of a given technology increases, their intentions to use the technology will increase and vice versa (Mary et al., 2021). Ease of use and perceived usefulness are the most important determinants of the actual use of the technology by an individual (Surendran, 2012). These two factors are influenced by external factors such as social, cultural, and political factors (Surendran 2012).

2.2.4. Diffusion of Innovation Theory (Rogers)

The diffusion of innovation theory seeks to explain how people adopt innovation. This theory takes a different approach from the other theories of change (Robinson, 2009). Instead of focusing on persuading individuals to change, the theory sees change as primarily being about the evolution of products and behaviours so they become fit for the needs of individuals (Robinson, 2009). Experts of the diffusion theory have identified five qualities of an innovation that will determine its success (Robinson, 2009). These are; relative advantage, compatibility with the existing values and practices, simplicity and ease of use, trialability, and observable results (Robinson, 2009). Relative advantage is taking about the degree to which an innovation is perceived by a social group to be better than the old idea the innovation seeks to replace (Robinson, 2009). This according to (Robinson, 2009) is measured in terms of what matters to the social group like an economic advantage, prestige, convenience,



etc. The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption is likely to be (Robinson, 2009).

Compatibility with existing values and practices talks about the degree to which an innovation is perceived by the social group as being consistent with the values, past experiences, and needs of the group (Robinson, 2009). If innovation is incompatible with the norms, values, and practices of the social group, it will not be adopted as quickly as the compatible one (Robinson, 2009).

Simplicity and ease of use deal with the degree to which an innovation is perceived by the social group as being easy or difficult to use (Robinson, 2009). Innovations that are simpler or easier to use are more easily adopted than those that are difficult to use (Robinson, 2009). Trialability of an innovation deals with the degree to which the innovation can be experimented with on a limited basis. An innovation that is trialable has less uncertainty for the social group than one that is not (Robinson, 2009). Observable results deal with the extent to which the results of the innovation can be seen by the social group (Robinson, 2009). If the social group can see the results of the innovation, they are more likely to adopt it than if the results cannot be seen (Robinson, 2009). Visible results according to Robinson (2009) lower uncertainty and encourages peer-to-peer discussion as friends and neighbours of an adopter often request information about it.

From the foregoing literature, it is clear that the better one understands which beliefs or attitudes cause behavioural change and by what process, the better one can design messages that seek to enable individuals to adopt a particular technology. These



theories can be applied by climate change communicators to design climate change communication messages to persuade smallholder farmers in the region to adopt some of the CSA practices. A persuasive message meant to increase farmers' intention to adopt some of the CSA should be designed in a way that will influence attitudes, subjective norms, or persuasive behavioural control.

2.3. INTERNATIONAL PROTOCOLS AND CONVENTIONS ON CLIMATE CHANGE

2.3.0. Introduction.

This part of the work looked briefly at some of the international protocols and conventions on climate change. These include the intergovernmental panel on climate change, the united nations framework convention on climate change, the Kyoto protocol and the Paris agreement.

2.3.1. Inter-Governmental Panel on Climate Change (IPCC)

The World Metrological Organisation and the United Nations Environment Programme established the Intergovernmental Panel on Climate Change (IPCC) in 1988 (UN 2006). This, according to the UN (2006), came after climate change was recognised by the UN as a common concern for humankind.

Objectives of the IPCC

According to the UN (2006), the objectives of the IPCC include the following.

1. To assess the magnitude and timing of global climate changes
2. To estimate the impact of global climate changes
3. To present strategies for how to respond to global climate changes.



The IPCC climate change adaptation to climate change

Climate change adaptation planning and implementation have continued to increase across all regions and there is growing public and political awareness of climate change impacts and risks (Pörtner et al., 2022). Over 170 countries including Ghana have adaptation in their climate policies and planning processes (Pörtner et al., 2022). These authors noted that despite the progress made in climate change adaptation, there are still gaps in the current level of adaptation and the levels needed to respond to the impact and reduce climate risks. They added that long-term planning and accelerated implementation are needed in the next decade to close the gaps.

2.3.2. United Nations Framework Convention on Climate Change (UNFCCC).

The UNFCCC which was formed in 1994 has now been ratified by 198 worldwide including Ghana (UNFCCC, 2006). The main aim of the convention, according to the UNFCCC (2006), is to prevent dangerous human interface with the climate system. The supreme decision-making body of the UNFCCC is the Conference of Parties (COP) (UNFCCC, 2006).

Objective and principles of the Convention.

The main objective of the UNFCCC is to stabilise greenhouse gas concentration at a level that will prevent dangerous anthropogenic interference with the climate system (UNFCCC, 2006). This level of concentration should be achieved within a time frame that is sufficient to allow ecosystems to adapt to climate change naturally (UNFCCC, 2006). This according to the (UNFCCC, 2006), is to ensure sustained food production and socioeconomic development. The guiding principles of the Convention are



specified in Article 3, of the convention (UNFCCC, 2006). The specific clauses of article 3, according to the (UNFCCC, 2006), are

3.1 “stresses the principles of equity and common but differentiated responsibilities”.

3.2 “addresses the different degrees to which Parties will be affected by climate change and by measures to implement the Convention”.

3.3 “refers to the precautionary principle, which is widely reflected in environmental law and environmental agreements”

3.4 “lays down the right, and obligation, to promote sustainable development”.

3.5 “upholds the principle of free trade”.

The UNFCCC on mitigating and adaptation to climate change

Adaptation to and mitigation of climate change and its impacts are the pivot of the convention’s objectives. The commitments of Parties to climate change adaptation and mitigation are captured in Article 4 of the convention (UNFCCC, 2006).

Article 4.1(b) requires Parties to “formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change”

4.1(e) calls on Parties to “cooperate in preparing for adaptation to the impacts of climate change; develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and



rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods”

Article 4.1(f) calls on Parties to “take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions”.

2.3.3. The Kyoto Protocol

At the third Conference of Parties (COP 3) of the UNFCCC in Kyoto, Japan, in 1997, parties adopted the Kyoto Protocol (UNFCCC, 2007). The major difference between the UNFCC and the protocol is that while the convention encourages industrialised countries to stabilise the emission of greenhouse gases, the protocol commits them to do so (UNFCCC, 2007). The protocol which came into force in 2005 places a heavy burden on developed nations under the “common but differentiated responsibilities” (UNFCCC, 2007). According to the (UNFCCC, 2007), the protocol has been ratified by 192 parties of which 37 industrialised countries and the European Community have committed to reducing their emission by an average of 5% over five years (2008-2012).

Kyoto Protocol on adaptation and mitigation of climate change

The protocol is designed to assist countries in adapting to the effect of climate change and facilitate the development of techniques that can help increase resilience to climate change impacts (UNFCCC, 2011). The protocol established a clean Development mechanism. This mechanism which is operated under the COP is meant to mitigate the effect of climate change (Anderson, 1998).



2.3.4. The Paris Agreement

At the 21st session of the Conference of Parties (COP21) in 2015, the parties adopted the Paris Agreement (UNFCCC, 2016). The agreement was opened for signature and came into force in 2016 (UNFCCC, 2016). The Paris Agreement requires parties to put forward their best efforts through “nationally determined contributions” (NDCs) and to strengthen these efforts in the years ahead (UNFCCC, 2016). The agreement according to (UNFCCC, 2016), demands that all parties report their emission and implementation efforts on regular basis.

The Paris Agreement on adaptation and mitigation of climate change

Article 7 of the agreement establishes a global goal to significantly strengthen national adaptation and mitigation efforts (UNFCCC, 2016). This goal, according to the (UNFCCC, 2016), will be achieved by enhancing adaptive capacity and strengthening the resilience and reduction of the vulnerability of climate change of member countries through international cooperation. Parties to the agreement are expected to submit and update their adaptation communication strategy periodically.

2.4. Channels of communicating climate change information to smallholder farmers in Ghana

Introduction

This part of the literature looks at the various channels through which climate change information is communicated to smallholder farmers in Ghana. It presents an overview of the policies and strategies put in place by the government of Ghana in its attempt to advance climate change adaptation efforts in Ghana. It includes general adaptation

plans and strategies formulated that show the vision and goals of the country. It will also include the contribution of civil society in promoting communication of climate change in Ghana and the Northern Region. The principles of climate change communication and the various CSA adopted by smallholder farmers in Ghana is also considered.

2.4.1. National Level Climate Change Adaptation Efforts

Ghana's climate change adaptation efforts are outlined in her vision 2020 document which set out the development objectives of the country in five key areas. These are agriculture, forestry, and environmental sustainability (Angei et al., 2016). Ghana has prepared several development plans and strategies to guide the implementation of the action towards these areas. The most recent one is the second Ghana Shared Growth and Development Agenda (GSGDA II) (Angei et al., 2016). According to the authors, GSGDA II described climate change as a threat to national development and identified several strategic directions to address climate change including an accelerated transformation of the agricultural sector and sustainable management of the natural resources. GSGDA II identified specific objectives for minimizing the impact of climate change on areas such as agriculture. These objectives include early warning systems, intensification of research and raising awareness of climate change (Angei et al., 2016). The main climate change adaptation policy document in Ghana includes Ghana's second National Climate Change Communication to the UNFCCC, the National Climate Change Policy (NCCP) and the National Climate Change Adaptation Strategy (NCCAS).



2.4.2. Ghana Shared Growth and Development Agenda (GSGDA II).

Ghana's climate change adaptation efforts started with the Ghana Shared Growth and Development Agenda (GSGD II). Due to the decline in precipitation and increase in floods in the country, the GSGDA II recognized Climate Change and variability as a major threat to national development (GNPC 2014). The GSGDA II further noted that the increasing level of desertification in the Northern Savanna is the manifestation of climate change which is said to be undermining the agricultural potential of the country (GNPC 2014).

The GSGDA II stated emphatically that 'government policy will focus on improving upon the capacities of the relevant stakeholders to adapt to climate change impact, alleviate the impact of climate variability and generally enhance a green economy' (GNPC 2014). The GSGDA acknowledged the various approaches to be adopted to facilitate national response to climate change and boost adaptation to climate change impact using early warning systems by establishing a national climate change center (GNPC 2014).

The GSGDA II outlined some priority interventions for the sustainable management of the country's natural resources (GNPC 2014). These include the following;

1. Ensure compliance with appropriate regulations and guidelines on small-scale mining.
2. Vigorously pursue land reclamation and afforestation in degraded areas.
3. Increase investment in infrastructure for waste management through a public-private partnership

4. Enforce the regulation and bye-laws restricting the development of structures in floodplains, waterways and wetlands.
5. Improve the resilience of the national capital to natural disasters especially flooding.

2.4.3. Ghana's Second National Communication to the UNFCCC 2011

In furtherance to meeting her obligation to the UNFCCC, Ghana prepared and submitted to the UNFCCC her Second National Communication (SNC II) in 2011. The main objective of the SNC II was to communicate to the conference of parties, what policies and measures Ghana has taken and envisaged to implement the convention. The SNC II particularly highlighted the efforts Ghana has made in the area of mitigating climate change and adaptation to the impacts (SNC 2011). The SNC II was considered Ghana's flagship programme to shape the country's climate change policy development.

The SNC II consisted of eight interrelated chapters comprising the major reporting elements as established by Article 4 (1) and 12 (1) of the convention and the UNFCCC guidelines for nations. The SNC provides information on the steps taken or envisaged to implement the convention in Ghana. The Ministry of Environment, Science and Technology (MEST) was recognized by the SNC II as the lead institution for climate change and the UNFCCC activities in the country (SNC, 2011).

Chapter four of the SNC recognized that climate change is gaining momentum in Ghana and as such, is acknowledged as one of the critical areas that are receiving support from the Natural Resource and Environment Governance (NREG). The same

chapter recognized the Environmental Protection Agency (EPA) as the lead institution for climate change and UNFCCC activities in the country. According to the SNC, the EPA collaborates with the National Development Planning Commission (NDPC) and the National Disaster Management Organisation (NADMO) to mainstream climate change and disaster risk reduction into national development at all levels of planning and its implementation was piloted in the ten (10) selected districts across the country (SNC 2011).

The development of climate scenarios for various climatic variables and mitigation scenarios is captured in chapters five and six respectively of the SNC. Climate change scenarios for rainfall and temperature were constructed to cover the entire country for the years. 2030, 2050, and 2080 and various models and projections were applied. Although the conclusions of the scenarios and the models varied, they showed clear signs of climate change and confirmed that Ghana is vulnerable to climate change. As part of the mitigation strategy, the SNC considered four abatement scenarios in the energy sector with anticipation that there will be a greater increase in the usage of renewable energy sources. These included the replacement of firewood and charcoal with Liquefied Petroleum Gas (LPG) at the rate of 10% a year from 1995 to 2020, replacing biomass with biogas and LPG from 2010 to 2015, gradual penetration of biogas for cooking at the rate of 10% of households per year from 2010 to 2020 and massive afforestation or reforestation projects to rehabilitate degraded lands (SNC 2011).



Education training and awareness creation among the general public are captured in chapter seven (7) of the SNC. The SNC recognized the importance of education, training and public awareness in capacity building in climate change. Ghana recognized the fact that the successful implementation of her environmental policy including climate change depends on the understanding of the citizenry of the functioning of the environment to contribute to its protection. On awareness creation, the SNC indicated that the general view of Ghanaians on climate change is clear and that most of their observation about climate change occurred within the last half-decade. Regarding the capacity of Ghanaians to access climate change information, the SNC noted that access and availability of climate change information were very low in the country with major information sources being the mass media. The SNC also recognized stakeholder training as the mainstay to sustaining actions regarding climate change and directed that the organisation of stakeholder training must be done from the local, regional, and national to the international levels. Tailored workshops and other similar programmes were therefore well-thought-out as very vital forms of stakeholder training (SNC II 2011).

2.4.4. National Climate Change Adaptation Strategy (NCCAS 2012)

Developing a National Climate Change Adaptation Strategy (NCCAS) was recognized as a trigger under the natural resource and environmental management programme. The NCCAS noted that adopting a more proactive and targeted method will be more effective and efficient than reacting to the impacts of climate change when they occur (NCCAS 2012).

According to the government, the preparation of the NCCAS was informed by several factors. In the first place, one of the obligations under the UNFCCC is the essential role parties are expected to play to ensure that climate change issues are at the center stage of national development planning. Moreover, the Ghanaian economy is deeply reliant on sectors that are sensitive to climate change like agriculture, energy and forestry. Finally, the climate forecast and climate change scenarios of Ghana all forecast severe and recurrent patterns like floods and droughts among others. The NCCAS is expected to operate for ten years (2010 to 2020) but it is expected to be studied and used by the relevant agencies (NCCAS 2012).

The NCCAS seeks to increase the country's resilience to the impact of climate change. This, the NCCAS envisaged, will be achieved by building the country's capacity in areas of infrastructure and the expertise to deal with climate change impact and reduce vulnerability in other key sectors like agriculture. Specific objectives the NCCAS seeks to achieve include the following;

1. Improve public awareness and readiness to deal with future climate change
2. Improve the mainstreaming of climate change into national development plans and reduce the risk associated with climate change.
3. Increase the robustness of infrastructure development and long-term investment
4. Improve the adaptability of vulnerable natural and social systems by increasing the flexibility and resilience of those systems.
5. Foster competitiveness and promote innovation in the area of technology.



To ensure strict adherence and avoidance of deviations, the NCCAS came out with specific guidelines and principles. The following were some of the principles;

- I. Adaptation policies to be addressed as part of a broader context of the National Development Policy Framework
- II. Stakeholder participation is central to the formulation and implementation of the NCCAS to ensure ownership.
- III. The promotion of sustainable development and poverty reduction are the focus areas of the adaptation strategy.
- IV. Long term impact of climate change is the principal means for considering adaptation.
- V. Gender sensitivity and reduction of vulnerability are extensively adopted
- VI. Flexible and iterative
- VII. Cross-sectorial and integrative but not necessarily sector-wide.
- VIII. The implementation of the document must ensure learning by doing.

As a national policy, the NCCAS touched on all the sectors of the Ghanaian economy. Specific to the agricultural sector alone are seven strategies (NCCAS 2012). These are;

1. Build and strengthen the capacity of local farmers to increase agricultural productivity and awareness about climate change.
2. Build and strengthen the capacity of extension officers in new farming technologies to enhance their support for farmers



3. Enhance the living standards of vulnerable groups through the acquisition of alternative livelihood skills
4. Protect the environment through the promotion of agricultural biodiversity
5. Promote the cultivation and rearing of animals adapted to harsh climatic conditions
6. Document existing indigenous knowledge and best practices
7. Train trainers to promote post-harvest technologies to minimise loss of farm produce.

2.4.5. National Climate Change Policy (NCCP 2012).

Ghana came out with the National Climate Change Policy (NCCP) in 2012. Recognized as the country's joined response to climate change, the NCCP was prepared and designed in line with national development priorities. The NCCP seeks to ensure that the Ghanaian economy becomes climate-resilient whiles achieving sustainable development with a low carbon footprint. Three areas of concern to the NCCP are an effective adaptation to climate change, social development and mitigation of climate change. To address adaptation issues in the country, the NCCP (2012) identified four thematic areas. These are;

1. Energy and infrastructure,
2. Natural resource management,
3. Agriculture and food security and
4. Disaster preparedness and response.



Regarding agriculture and food security, the focus of the NCCP is to develop climate-resilient agriculture and food systems. The key principles in this area are;

1. Understanding that the sustainability of natural resources including land, forest, water and genetic biodiversity is significantly influenced by agricultural practices.
2. Need for sustainable agricultural systems as a fundamental basis for achieving national food security and poverty reduction.

The specific objectives in the area are;

1. Develop climate-resilient agricultural and food systems for all agroecological zones.
2. Develop human resources capacity for climate-resilient agriculture.

The NCCP has over fifteen (15) policy actions for the achievement of the objectives out of which five (5) relate to climate-smart agricultural practices. These are;

- i. Improve and harmonise research activities in climate-smart agriculture.
- ii. Build and strengthen the capacity of extension officers in climate-smart agriculture to enhance support to farmers and fishermen
- iii. Promote diversified land-use practices, including agroforestry, dryland farming, and urban-backyard vegetable production to reduce risk and increase the capacity of farmers to cope with drought and floods.
- iv. Promote sustained support in the use of simple agronomic soil and water conservation measures (eg agroforestry, crop rotation, tied ridging, mulching, contour earth moun, vegetative barriers and improved fallows)



- v. Promote appropriate technologies for small-scale irrigation, water re-use and water harvesting (water recycling or rainwater harvesting, etc)

2.4.6. Tabular presentation of Ghana's climate change adaptation plans

After reviewing various national policies and programmes on climate change adaptation, the observations made are summarized in a tabular for easy understanding.



Table 1: Ghana's climate change adaptation plan with progress as of May 2015.

Number	Indicator	Progress made as of May 2015.
1.	Climate change recognized in Ghana's development vision	Yes, climate change is visible in GSGDA II
2.	National level climate change coordinating entity has been established and is active.	Yes, There a national climate change committee established
3.	Climate change policy or law that regulates issues about climate change in place	Yes The National Climate Change Policy
4.	National climate change strategy published	Not present
5.	National climate change action plan published	Not present
6.	A national plan adaptation of climate change published.	Yes, A national strategy on change adaptation (NCCAS) for 2010 -2020.
7.	A national fund on climate change adaptation which is operational	Not in existence
8.	A well-established climate change unit established in related ministries	Some ministries

Source: Collaborative Adaptation Research Initiative for Africa and Asia (CARIIA) (2016).

2.4.7. Climate Information Services delivery and Agricultural Policies in Ghana

Since 1991, Ghana has made several efforts at responding to the impacts of climate change on several sectors of the economy when she adopted the Environmental and



climate change policy (MESTI, 2013). The country published her first national communication to the United Nations Framework Convention on Climate Change in 2000 as part of her mandate for being a party to the Kyoto Protocol (Naab, F.Z., Abubakari, Z. & Ahmed, A., 2019). Despite the effects of climate change on agriculture productivity in Ghana, climate change information is hardly mentioned in the country's agriculture-related policy documents (Naab et al., 2019). After a review of 17 agricultural-related policy documents in Ghana, the authors realized that even though climate change is stated in fourteen (14) of those policy documents, climate information services or its associated terms are scarcely stated. After a painstaking word counting of the main climate services terms in the 17 documents, the authors realized that the National Integrated Water Management Plan has the highest climate services or related terms count where information on hydro-meteorology is stated 15 times. The table shows that National Climate Change Adaptation Strategy has the highest frequency of climate change being mentioned.

Although climate change is mentioned in all 17 documents, climate information is stated in only two of the documents. The two documents are National Climate Change Adaptation Strategy and the National Action Programme to Combat Drought and Desertification (NAPCDD) which it is mentioned only one time (Naab et al., 2019). The authors also noted the lack of evidence in those documents which suggests that climate information service delivery has been mainstreamed in those documents

Table 2: Climate Information Services and Agricultural Policies in Ghana

No.	Policy Document	Climate change	Climate information	Meteorological information
1.	Food and Agricultural Section Development Plant II	1	0	0
2.	Ghana Shared Growth and Development Agenda I (2010 – 2013)	70	0	9
3.	Medium-Term Agriculture Sector Investment Plan (2011 – 2015)	8	0	0
4.	National Climate Change Adaptation Strategy	107	1	0
5.	National Environmental Policy	7	0	0
6.	Ghana Environmental Action Plan Vol. 1	1	0	0
7.	National Integrated Water Resources Management Plan (2012)	64	0	0
8.	National Water Policy (2007)	4	0	0
9.	Ghana Shared Growth and Development Agenda II (2014 – 2017)	14	0	0
10.	Ghana Poverty Reduction Strategy I (2003 – 2005)	5	0	1
11.	Ghana Poverty Reduction Strategy I (2006 – 2009)	0	0	0
12.	Tree Crops Policy (2013)	7	0	0
13.	Ghana Irrigation Development Policy (2011)	1	0	0
14.	Ghana Livestock Development Policy and Strategy (2016)	7	0	0
15.	Agricultural Extension Policy (2002)	0	0	0
16.	Bank of Ghana Agricultural Policy (2004)	0	0	0
17.	National Action Programme to Combat Drought and Desertification	5	1	1

Source: climate services 13 (2019) 24- 32



2.5 The contribution of civil society organisations to climate change communication in Ghana.

Several civil society organizations in Ghana, as part of their cooperate responsibilities and their service delivery, implemented various programmes aimed at making climate information services accessible to smallholder farmers. These programmes cut across the national level to the regional level. Some of these are discussed below.

2.5.1. Climate Change communication initiative by Cooperative for Assistance and Relief Everywhere (CARE)

Over the years CARE Ghana has been focusing on improving the livelihood of poor farmers by helping those farmers adapt to the ever-increasing effects of climate change. In collaboration with local organisations, CARE is training agricultural extension officers on how to support poor farmers in adapting to climate change. CARE work in Ghana is driven by a participatory Community-Based Adaptation. This approach involves creating and raising the awareness of community members and stakeholders to identify the appropriate response to climate change challenges faced by community members. CARE has implemented several initiatives aimed at supporting smallholder farmers to enhance their ability to resist the impact of climate change.

The Adaptation Learning Program (ALP)

The ALP was launched in 2010 by CARE International. The programme was executed in Ghana Niger, Mozambique and Kenya in partnership with local civil society organisations and government institutions (CARE 2019). The ALP sought to identify



effective methods for Community-Based Adaptation (CBA) by working with communities that are exposed to climate change (CARE 2019). The ALP implementation in Ghana was focused on three forms of CBA. These are the Participatory Scenario Planning (PSP) workshops, Community rain gauges and Climate Information Services (CIS) (Gbetibouo et al., 2017).

The PSP workshops according to the authors were mechanisms for the collective sharing and interpretation of climate forecasts. These workshops were attended by local community members and technical experts. The workshops were conducted after the seasonal climate forecast was made available by the Ghana Meteorological Agency (GMet). These seminars created locally agreed climate change adaptation strategies based on evidence. After the completion of the workshops, advisories that contained the details of forecast information were packaged and disseminated to the local people (Gbetibouo et al., 2017). The different stakeholders in the workshops according to the authors were divided as follows;

- I. **Users:** The users, according to the authors, are the persons and groups that use advisories and climate information to make decisions for the impending rainy season. These included community members and farmers.
- II. **Intermediaries:** these people, according to the authors, included institutions that were involved in the organization or facilitation of the PSP process. They were made up of the donors, technical experts and those who were disseminating the advisories.



III. **Climate information providers:** these include the national meteorological agency which collected and provided climate data and weather forecasts.

The community rain gauges according to the authors were installed in communities where ALP was implemented. Community monitors were trained on taking rainfall records from the rain gauges with support from the national meteorological services. The information recorded by the monitors was forwarded to the national meteorological services. The collected information according to the scholars helped to build historical forecast data for the specific locations.



Figure 1: A community rain gauge at Kasuliyili.

Source: field survey, 2020.

The CIS was established through a joint initiative between CARE and Farm Radio International (FRI). The main reason for the CIS according to the authors was to use radio broadcasting to provide climate information to smallholder farmers from rural



areas in Ghana. The CIS was run by community volunteers who linked radio broadcasts to loudspeakers to enable the information to reach wide community audiences. They added that the CIS received community climate information transmitted from the radio station and transmit the information to community members and respond to questions on climate information from the communities.



Figure 2: A climate information center by CARE

Source: CARE

Communication channels used by CARE to convey climate information to farmers

After the PSP workshops, the advisories developed were communicated to farmers through various channels (Gbetibouo et al., 2017). These channels include radio broadcasts, religious leaders, chiefs, and local groups such as farmer-based organization (CBOs) and Community-Based Extension Agents (CBEAs). These



authors added that local radio stations, CIC durbars, funerals, festivals, local markets, farmer-to-farmer extension and farmer field schools were used to disseminate the to the farmers and that women in particular used Village Savings and Loans Associations (VSLAs) and CBEAs.

The authors also noted that local radio stations were very instrumental in disseminating the advisories because they ensured the direct involvement of local communities in a participatory way. For communities that do not have CICs, the beneficiaries were organised into listener groups and radio sets were provided for them to tune in at precise times of the day to listen to the broadcasted advisories and also to enable them to take part in the discussions (Gbetibouo et al., 2017).



Figure 3: Farmers listen to climate change information from a radio set.

Source: CARE



Another important channel of communication used by CARE was farmer-based organisations (CBOs). Many farmers preferred the CBOs because the group ensures efficient dissemination of information and they also have a larger multiplier effect which brings about wider coverage than radio broadcasting (Gbetibouo et al., 2017). The use of the CBOs according to the authors allowed feedback because there were periodic meetings that led to direct communication between climate information producers and users. This according to the researchers reduced the tendency for information dilution when there are intermediaries. Besides, the users are confident in accepting advisories when the information is shared through their trusted colleagues as compared to people they do not know.

Impact of CARE climate services on communities

According to the literature, the approach adopted in communicating climate change led to an improvement in the expertise, attitudes and agricultural practices of community members.

The CISs, PSPs, advisories and rain gauges provided by CARE empowered the communities with knowledge of climate forecast, climate change and CSA practices (Gbetibouo et al., 2017). According to the researchers, communities have demonstrated extensive knowledge of the importance of climate change information as well as the seasonal forecast for agricultural planning. These were realized during focus group discussions in which farmers reported that the PSPs helped in improving their disaster preparedness and also their decision-making on planting times. CARE approach has also enabled community members to interact with technical experts



leading to an increase in their knowledge about climate change and CSA practices (Gbetibouo et al., 2017). This according to the authors has removed the barriers to interaction between local communities and national institutions like GMet, MoFA and so on.

Improved communication and knowledge of community members enhanced their understanding of CIS, climate forecast and advisories (Gbetibouo et al., 2017). Moreover, the scholars noted that improved access to climate information has enhanced their adaptation. Community members who participated in CARE PSPs workshops were sharing and discussing the climate forecast and the advisories among other community members (Gbetibouo et al., 2017). The approaches encouraged partnerships among different stakeholders such as service providers and users of CIS. Together with building the capacity of local government agencies, the ALP engaged in a partnership between service providers such as radio stations and other civil society organisations in learning and disseminating CIS (Gbetibouo et al., 2017). The PSP workshops also provided strategic networking and opportunities to state institutions to work with each other to address climate change-related issues (Gbetibouo et al., 2017). At the intuitional level, the PSP has enhanced the capacity of state institutions in the performance of their functions. The PSP has assisted the National Disaster Management Organization (NADMO) in appreciating the need for early warning systems to be comprehensive in incorporating risk assessment, monitoring and dissemination among others (Gbetibouo et al., 2017). The ALP on its part has also enabled NADMO to address concerns related to natural disasters in which relevant



stakeholders are brought under the umbrella of PSP to discuss the issues (Gbetibouo et al., 2017). The Savanna Agricultural Research Institute (SARI) has learned the use of climate information to assist farmers in their farming activities (Gbetibouo et al., 2017). According to the authors, SARI has replicated the PSP with farmers in Dimabi, Kpalsogu and Wantugu. These are all communities in the Tolon District of the Northern Region. SARI has also introduced PSP into its Innovative Platform Concept where they bring farmers together to discuss and prioritise their problems and provide solutions. They also explore the possibilities of developing policies to deal cope with climate change.

2.5.2. Climate change communication initiative by Esoko

Between the years 2011 and 2017, the West African chapter of CCAFS piloted how climate information services can be disseminated to farmers in its climate-smart villages in northern Ghana to help the farmers avert the risk associated with climate change. The piloted project was done in partnership with Esoko, a private company that works in Information and Communication Technology (ICT). After the pilot project proved successful in making climate information reach farmers, Esoko expanded the initiative so that more farmers could access the CIS and make informed farming management decisions using a system called the farmer helpline.

Esoko farmer helpline

In the year 2014, Esoko in partnership with international and national organizations launched a sound approach to CIS in Ghana called the farmer helpline. The farmer helpline involved designing CIS and then communicating the information to the



farmers for their farming decisions making (Samuel et al., 2016). The partner organizations included SARI, Council for Scientific and Industrial Research (CSIR), MoFA, the Ghana Meteorological Agency (GMet) and Climate Change Agriculture and Food Security (CCAFS). This partnership involved Esoko making seasonal forecast information produced by GMet accessible to farmers using their mobile phones to assist them to adapt to the effects of climate change.

This initiative was part of Esoko's mission to drive the economic empowerment of the African rural folks through technology and innovation. It enabled farmers who could not access advisory services from extension officers to call the center for direct interaction with an agent (Fugar, 2019). The Esoko initiative enabled Ghanaian farmers especially those in the Northern Region to use climate information through the platform to make farming decisions like choice of crops and schedules of planting and application of fertilizer.

Selected farmers were trained on how to navigate their mobile phones to get the messages, interpret the messages and call the farmer helpline and they could call and speak to an agent in their local languages (Samuel et al., 2016). One lesson Esoko learned from the initiative was that the farmers accepted whatever information that is received from the experts (Samuel et al., 2016). Apart from the seasonal climate forecast, other information farmers received from the helpline included agro-advisory alerts and market prices of farm produce.



A survey conducted by Esoko among farmers who benefited from the project revealed that there was a consistent decrease in crop failures and about 90% of the beneficiary farmers experienced an increase in their farm productivity (Samuel et al., 2016). Besides, the importance of Esoko's farmer helpline in the provision of CIS was reflected in the readiness of an overwhelming majority (97%) of farmers to pay for accessing climate information from the experts (Samuel et al., 2016).



Figure 4: Farmers reading climate change information using the farmer helpline

Source: Esoko 2019.

2.5.4. The Climate-Resilience Agriculture and Food Systems (CRAFS) project by OXFAM BG.

The CRAFS project aimed at building the resilience of smallholder farmers by promoting resilient livelihood activities and improving food supply whiles regenerating the natural resources of the environment Alexia (2019). The project activities according to Alexia (2019) aimed at raising the awareness of smallholder



farmers of climate change impact, why they need to adapt to it and the restoration of the natural resource base. The activities according to Alexia (2019) developed around four areas.

- I. Climate change awareness raising,
- II. Improved farming methods for secured livelihood and diversification of livelihood activities (beekeeping and honey making),
- III. Protecting and managing the natural resource base and
- IV. Influencing institutional capacity.

These activities took place at different levels; district, community, household and individual levels. The first activities were designed to increase climate change awareness and adaptation among farmers. They included participatory vulnerability risk assessment, results in dissemination at the district level for a better articulation of local and district-level action plans and training of community volunteers and journalists. Also included in these activities according to Alexia (2019) were the development and distribution of leaflets and other sensitization materials including the fabrication and positioning of billboards.

Radio programmes on CSA and other conservation agricultural practices and climate change adaptation were also carried out and one of the focuses of this awareness-raising was a reduction in the prevalence of bush burning which harms soil fertility (Alexia, 2019). The project also supported smallholder farmers through dry season farming seed production, tree nurseries compost making and other conservation



agricultural practices (Alexia 2019). According to Alexia (2019) was done through the training and distribution of inputs and small ruminants and a mechanism for the redistribution of the livestock's newborn known as 'pass-on the gift' was put in place. Village Savings and Loans Associations (VSLAs) were also encouraged. The project also influenced the local government for the project activities to be replicated and scaled up by the government. This according to Alexia (2019) was done through the partners influencing budget planning at the district level and the creation of various learning and communication materials.

2.5.5. Principles and strategies of climate change communication

This part of the literature looks at the various principles and strategies of climate change communication. It discusses the various principles and strategies climate change communicators must adopt to make climate change communication more meaningful.

Principles of climate change communication

To communicate climate change effectively, (Corner, A., Shaw, C. & Clarke, J 2018), proposed six principles to use by IPCC in engaging the public and communicating activities on climate change. These principles are discussed below.

1. Be a confident communicator

According to Corner et al., (2018), scientists are usually extremely reliable, and with a reliable voice, communicators can connect effectively with their audience. Corner et al., (2018) added that even though there are some exceptions, climate communicators



can build trust among their audience by communicating confidently and authentically. They also argued that as a climate communicator, the scientific knowledge and control over the subject will give you trustworthiness and when climate communicators become clear about whether they are speaking in their personal opinion or their professional capacity they will help their listeners to understand the information given to them.

2. Talking about the actual world and not abstract ideas

The ‘big numbers’ of climate change such as universal average temperature targets and amount of atmospheric carbon dioxide do not relate to the everyday experiences of the local people even though they explain the science and strategy direction. Corner et al., (2018) therefore urged climate change communicators to start their climate discussion on mutual ground, using simple language and examples the audiences are conversant with. They, therefore, advised climate communicators to frame their language in such a way that it can be related to their audiences’ everyday lives.

3. Connecting with what matters to the listeners

Studies consistently indicate that the values and political opinions of people have a greater effect on their behaviour toward climate change than the scientific information they have about it (Corner et al., 2018). Corner et al., (2018) stressed that the basis of the realities of scientific information should be on shared principles and that connecting with widely-shared public principles, in their communication and public engagement will make it more likely that their message will be accepted.



They added that, when climate communicators have information concerning the kind of things their audience could be interested in and start their discussion on terms the audiences are familiar with, they will get the attention of the audience than presenting their information using science and explaining how relevant it is to the audience. These authors, therefore, advised climate change communicators to filter their climate change information and related topics in a way that suits the value of their audience.

4. Telling a human story

Corner et al., (2018) indicated that a lot of people appreciate the world through stories and not figures and charts, and argued that in communicating climate change, communicators should be targeting a descriptive structure and display the human face that follows the scientific information when giving the message. They added that the use of narratives not only helps the audience in understanding complex and intellectual issues, it also makes the science easier to be recollected and process as compared to the customary methods of communication like the use of graphs and figures. They stressed that using a story method implies describing the problem, showing the effects and talking about the remedies. These they believed will help climate communicators communicate a convincing message.

5. Leading with what you know

With regards to leading what you know, Corner et al., (2018) noted that one feature of climate science which should not be overlooked or put aside and can be a major obstacle in discussions with non-scientists is uncertainty. Based on this, Corner et al., (2018) stated that dealing with what is already known to the audience before you



discuss uncertainties is a method that will help in ensuring that uncertainties do not disrupt a compelling story. They, therefore, opined that climate change communicators should concentrate on what is known to the audience before they discuss what is unknown and place emphasis on areas there is strong scientific agreement about a theme.

6. Using effective pictorial communication

Here, Corner et al., (2018) are of the view that selecting imageries and diagrams is as significant in evidence-based communication as verbal and written communication. Using climate visuals together with new guidance from the Tyndall Centre will serve as useful tools on how to communicate effectively in a visual medium. According to Corner (2011), climate change communicators must take great care to ensure that raising people's awareness about climate change does not encourage people to avoid taking responsibility for adapting to climate change. They advised climate change communicators to use evidence-based imageries that show people in a real-life situation taking actions that respond to the effects of climate change.

The Center for Research on Environmental Decisions (CRED) in an article entitled 'the psychology of climate change communication', also came out with eight (8) principles that should be used in communicating climate change. As a guide to experts, media personnel, educationists, politicians and other concerned individuals, CRED believed that climate change communication like any other communication will be more effective when those principles are followed. These principles are;



1. Know your audience

CRED (2009) noted that climate change communicators should do well and understand who their audience is. To know the audience CRED (2009) advised climate change communicators to try and identify the misunderstandings their audience is likely to have in mind concerning climate change. When this is done, the communicators now have to remove the inaccurate information they have about climate change and then give them the correct information.

2. Get the attention of your audience.

According to CRED (2009), climate change communicators can get the attention of their audience when the message is well framed. CRED (2009) noted that people feel better and more optimistic about attaining their goals when the information is presented in a way that they are comfortable with. To be able to do this, climate change communicators are asked to;

- i. Study the composition of the audience concerning definite subgroups based on ethnicity, age, gender, religion, occupation and so on.
- ii. Select communication materials that will resonate with your audience.
- iii. Identify local weather events, and use those events as examples when discussing climate change with your audience.
- iv. Present the information such that it will create the awareness of the audience about possible losses (both current and future) as a result of inaction on climate change and not concentrating on the gains (both current and future).



3. Translating scientific information into existing knowledge

CRED, (2009) noted that there is low comprehension or interest in communication that is full of scientific language, a situation that can contribute to the lack of public action on climate change. To overcome this, CRED (2009) recommended that climate change communicators should consciously translate scientific information to concrete knowledge for the local audience to understand and respond and recommended the following strategies;

- i. Use experimental materials like clear images in films when making a presentation on climate change.
- ii. Avoid the use of jargon, complex scientific terms and abbreviations during discussions with the public. Rather, use words that the audiences understand.
- iii. In situations where only a technical term can be used to present the message, carefully explain those terms to the audience.

4. Beware of the overuse of emotional appeals

CRED, (2009) noted that appealing to emotional systems could help in the short term but it is difficult for people to maintain the same level of emotional stability because the attention of people can simply be shifted to other issues if they are not given further reason to remain engaged. To ensure this CRED (2009) advised climate change communicators to understand that their audience has more persistent problems and create balanced information which can cause an emotional reaction with more logical information to make a mark in any part of the brain. Communicators should also make a balance between pre-existing fears about



issues concerning climate change to discuss. They can also do this by asking the audience to know their level of awareness of climate change through the media and exposing them to documented pictures of climate change and taking note of their reactions

5. Address scientific and climate uncertainties

CRED (2009), emphasized that people will better appreciate climate information when the information is presented to them for discussion as a group. Group processes CRED (2009), noted provide individuals the opportunity to share knowledge, skills and personal experience in diverse ways. CRED (2009) recommended that climate change communicators present climate information to informal groups. This will allow the group members to ask questions and express their opinions.

6. Tapping into different identities and affiliations

In explaining this strategy, CRED (2009) emphasized that the sense of belongingness an individual feels towards the members of a social group can inform the type of identity the individual will want to apply in a given situation. CRED also pointed out that messengers who are closer to the audience may get a stronger reaction to calls for action on climate change as compared to messengers who are not closer to the audience. They added that people will be prompted to act when there is a sense of belongingness to the individual or society that is making the demand. Based on this, CRED (2009) recommended that climate communicators should present the information by tapping into various groups that the audience represents and encourage the audience's sense of affiliation with group members, their immediate environment



and the wider society that enjoys the benefits of their natural resource. Additionally, the communicator should elicit the support of someone locally known to their audience to introduce you if you are an outsider.

7. Encourage group participation.

According to CRED (2009), many environmental decisions are group decisions and so climate communicators need to appreciate the way people take part in group situations. Moreover, group values are imperative since they regulate who should speak, when to speak, the way the message should be presented and how members can disagree. CRED (2009), therefore recommended climate change communicators break the large group into smaller groups that can help initiate discussions and encourage early participation from various stakeholders. This is because when stakeholders have the feeling that they were actively involved decision-making process, chances are that they will support the final decision.

8. Making behavior change easier.

CRED (2009) advised climate change communication practitioners to make behavior change easy by making use of the default effect. This will inspire listeners to change their behavior which will go a long way to reducing the effects of climate change. Since the default option does not need any action it is easier and so the audiences are likely to accept it whether or not they would have taken it if it were not the default option. CRED (2009) asked climate change communicators to give their audiences instant motivation to make behavior change easy.



Climate change communication strategies

Climate change communication is a science that seeks to engage individuals and communities through information sharing and deliberation to inspire behavioral changes required to mitigate and adapt to increasing climate change (B. Harvey, J. Ensor, Liz Carlile, B. Garside, Z. Patterson & L. O. Naess, 2012). According to A. Coghlan & J. Carlos, (2011) there is a gap between scientist understanding of global warming and the general public). Corner et al., (2018) believe that climate change can be communicated in such a way that the message will be easy for the general public to understand, and make it more applicable to their everyday lives and experiences. Corner et al., (2018) believe that communicating with the audience based on common ethics develops trust between climate change information providers and the listeners.

In 2019, Climate Knowledge Development Network (CKDN) came out with a framework that they believe can be applied to any climate communication campaign. In this framework, Mairi Dupar, the technical advisor and managing editor of CKDN, with support from Lisa McNamara and Maria Jose Pasha, outlined some communication strategies which when adopted will make climate change communication effective. These scholars put these strategies into four broad categories. These are:





1. Identify and understand your audience

According to M. Dupar, L. McNamara & M.J. Pacha (2019) climate change communicators need to start the communication by first identifying and understanding who their audiences are. This according to the authors is done by first identifying stakeholders including groups who can make positive change, the type of information and the analysis, and what can be done to help meet their knowledge needs. In making the content of climate change communication as useful and relevant as possible, these authors advised climate change communicators to divide their listeners and modify the information to the exact needs and concerns of the various target groups. Communicators according to these authors then need to understand the knowledge and values of the intended audience and use framing and language that will resonate with the target audience and evolve their contribution to the climate change issue.

2. identify who the best messengers are for your content

One important question these authors require climate change communicators to answer is ‘who is most likely to get the attention of your audiences?’ According to these authors, climate change as an issue of public communications drive looks like any campaign and so the messenger is equally important as the message. They emphasized that people react positively to information that is coming from individuals they trust and that trust is vital in climate change communication because acting on climate means difficult decisions including behavioral changes. They, therefore, advised climate change communicators to use messengers who are most influential and trustworthy. This they believe will enhance public interest and understanding of climate change-related issues.

3. Tailor knowledge products and use multiple formats

Under this strategy, climate change communicators are advised to frame their information in ways that apply to specific stakeholder groups. In implementing this strategy, they advised climate change communicators to;

- I. Use appropriate language: that is climate change communicators should translate the knowledge literally into different local languages according to the less technical target groups.
- II. Layer the message: that is climate change communicators should start the message with simple headlines that are eye-catching and signpost at more complex levels of information and analysis.
- III. Produce diverse formats when the budget allows: that is climate change communicators should tell the same story where possible in many formats to cater to the audience's varying personal preferences. These formats include text, pictures, films and animations. They can also use multimedia products that encompass all of them.
- IV. Make the content easy to access, use and share: here climate change communicators are asked to make sure that the content of their message can easily be understood, applied and distributed by the target audience. The scholars emphasized that extensive review and consultation can ensure that these are realized.



4. Recognize how digital and face-to-face communication can amplify each other.

The authors acknowledged that amid huge online chatter, digital outreach campaigns can raise serious climate change messages. These digital tools include social media posts, videos and other digital formats that the audience can easily distribute in their workplaces or networks. They also added that climate change communicators should combine face-to-face engagement with the audience in small groups with digital outreach through broadcast communications.

2.5.6. The main CSA adaptation strategies in Ghana

The main CSA adaptation strategies in Ghana as identified in the literature are agroforestry and dry-season farming. The discussions on the main SCA strategies adapted in Ghana will, therefore, be based on those strategies.

Agroforestry as a CSA strategy in Ghana

Agroforestry is a sustainable land and other natural resource management system which is compatible with the cultural practices of local communities that involves the creation of forest plants, crops and animals simultaneously or successively on a given piece of land increasing the yield of the land (Chandler et al., 1978). According to King (1978), agroforestry is a generic term that encompasses specific components.

These include the following;

- i. Agri-silviculture: this according to King (1978), is the deliberate use of land for the production of crops (including tree crops) at the same time.



- ii. Sylvo-pastoral systems; King (1978), explained that this is a land management system in which forests are developed to produce wood and rear domestic animals.
- iii. Agro-sylvo-pastoral system; this is a system in which land is reserved purposely to produce agricultural and woodland and rear domestic animals (King 1978).

Since 2001, Ghana has introduced several forestry-related approaches to improve its forest cover, address timber deficits and enhance the livelihood of Ghanaians. One of the approaches is the Modified Taungya System (MTS) (E. Acheampong, Thomas F. G. Insaadoo & Mirjam A. F. Ros-Tonen, 2016).

After the suspension of the taungya system in 1984, the government of Ghana re-introduced the system in a different form known as the Modified Taungya System (MTS) in 2002 (Achampong et al., 2016). According to the Forestry Commission (FC) the major aim of MTS was to reestablish the degraded forestry sector and generate livelihood opportunities for Ghanaians (FC, 2008). Through MTS farmers in the degraded forest reserve areas were given access to a piece of land to plant trees and food crops (Achampong et al., 2016). According to (Agyeman, 2006), the MTS had a compulsory land tenancy where farmers and the FC were considered co-owners of the forest plantation and the farmers were entitled to the lands until the tree crops matured. The benefit-sharing agreement among the major stakeholders was the other important feature of the MTS. The FC was entitled to 40% of the tree revenue; farmers were entitled to 40% of the tree revenue and all the food crops produced. The landlords and

the communities were entitled to 15% and 5% of the forest revenue respectively (Agyeman, 2006.). The MTS according to the literature was regarded as both an adaptation and a mitigation strategy. For example, F. Kalame, R. Aidoo, J. Nkem, & O. O. Ajayie (2014), in their analysis of the MTS in the Ashanti and Brong Ahafo Regions concluded that it represents an example of the application of a climate change adaptation policy under the Adaptation Policy Framework (APF).

The MTS was regarded as a profitable venture in parts of the country. It was seen as an adaptive measure in Ghana's first climate change communication to UNFCCC (Kalame et al., 2014). The authors also noted that in the transitional zone of Ghana, the MTS proved profitable for the government, local farmers, landowners and communities adding that the integration of food crops and trees helped improve food security in Ghanaian communities.

The implementation of the MTS was not without challenges. According to Achampong et al., (2016), the inability of the MTS to generate income from the period of trees canopy closure and timber harvesting, the delay in the signing and the absence of a clear procedure for the distribution of the 40% timber revenue among the farmers hindered the smooth implementation of the scheme. The other challenges identified by Achampong et al (2016), included restrictions on the type of trees and crops acceptable under the system together with insufficient supervision and support for the agency that was implementing the MTS.



Dry season farming/gardening in Ghana

Maanibe (2016), defined dry-season gardening as a process of crop production in the dry season in dry climatic areas where drought-resistant crops are planted by using moisture-enhancing methods. In Ghana, dry-season gardening is normally done using irrigation. Irrigation farming is one of the most important rural development mechanisms. The Ministry of Agriculture (MoFA 2007), classified irrigation into two types (formal and informal) depending on the level of government involvement in its establishment and management. According to MoFA when the government establishes large-scale irrigation projects they are described as formal irrigation but private small scales projects like wells, sprinklers and dugouts are described as informal irrigation. According to S. A. Donkoh, S. Kudadze, W. Adzawla & I.G.K. Ansa (2016), government intervention in the development of irrigation for dry season farming in Ghana has been in the area of dam constructions. Donkoh et al., (2016) added that the establishment of dams in various parts of the country has made it possible for the cultivation of dry-season vegetables and other crops like rice.

In Ghana, most interventions in irrigation have not looked at the smallholders who form the majority of farmers in the country. The majority of the interventions in irrigation in Ghana have been targeted at commercial farmers and some private irrigation schemes have not looked at engaging smallholder farmers at all Abass (2016). (Abass 2016) also noted that few smallholder agriculturalists in Northern Region practiced dry season farming because the few irrigation dams developed to support smallholder farmers in the region are done on a small scale.



Impact of dry season gardening/farming on the livelihood of smallholder farmers

Recent surveys on dry-season farming have indicated that dry-season gardening has impacted significantly the livelihood of small-scale farmers in the country. In research on dry season vegetable farming and the effects it has on farmers' income at both Golinga and Bontanga irrigation sites in Northern Region, Donkoh et al (2016), farmers who cultivate vegetables during the dry season together with their vegetable production in the rainy season have a higher income than those who cultivate vegetables only in the dry season. Based on this finding, Donkoh et al (2016) indicated that support for the enhancement of irrigation farming especially in vegetable production in Ghana is justified. In a study on the potential of dry season farming to improve the income and nutrition of smallholder farmers in both the Upper East region and Northern Region, Abass (2016) identified limited access to water to support farming in the dry season as being accountable for the poor household incomes among rural communities that depend on subsistence farming as their major economic activity. Abass (2016) also noted that organisations implementing dry-season farming indicated that dry-season farming is one sure way to reduce poverty and unemployment and improve the nutrition of rural poor farmers, especially the youth.

In a report to determine the viability of dry season gardening as a means to alleviate poverty and improve the nutritional needs in the Lawra District of the Upper West Region Maanibe, in 2016, noted that the results of dry season farming on the livelihood of households were positive. Maanibe (2016) indicated that smallholder farmers who engaged in dry season farming made some profits and save money to buy

organic fertilizer for use during the main farming season despite some difficulties such as inadequate finance and family burdens. The farmers, Maanibe (2016) added also had enough food to eat thereby meeting their nutritional needs.

In a study to assess the effects of small-scale irrigation on food security and leisure of households in Kokoligu, after the completion of the irrigation dam, (E. Bagson & C. J. W. Kuuder, 2013) noted an improvement in food security since agricultural-associated activities were now all year round.

Challenges of dry-season gardening/farming in Ghana

According to the literature, the advancement of dry season farming in Ghana like any other factor is being hampered by some challenges. Abass (2016) identified the unavailability of water to serve farmers throughout the dry season in areas where big dams are constructed as a major challenge to dry-season farming. The high pest infection of some crops like tomatoes, garden eggs and okro is identified by Maanibe (2016) as one of the major challenges facing dry season farming. Other challenges identified by Maanibe (2016) as hampering the operation of dry season gardening in Ghana are inadequate financing, the distance farmers have to travel to reach water sources and the high cost of pesticides.

2.6. Challenges smallholder farmers faced in accessing climate change information

Various obstacles inhibit the ability of farmers in the Northern Region to access climate information despite the efforts made by civil society organisations such as



CARE and Esoko. These challenges range from illiteracy, poor infrastructure and poverty among others.

Illiteracy on the part of smallholder farmers is a major factor that makes farmers' ability to access climate change information services difficult. The majority of the farmers in the region are unable to access CIS because they cannot read the information due to illiteracy. A considerable number of farmers in Ghana and the Northern Region are illiterates and therefore find it difficult to make use of the current channels of communicating climate change information because the channels used in the communication are not appropriate (Naab et al., 2019). The CISs are most of the time sent as text messages with the information being very technical. Mobile phone messages are mostly not detailed enough which makes it difficult for users especially illiterate farmers to interpret and use the information given (Etwire et al., 2017). The local farmers especially the illiterate ones found it difficult to interpret.

Another challenge farmers face in accessing climate change information is related to how climate information is disseminated and the non-contextualization of the information. For instance, weather information in the region is mostly not communicated in the local dialect that the farmers understand. Language differences and low literacy levels in the local communities affected the ability of smallholder farmers to climate information services through various approaches (Gbetibouo et al., 2017). According to these authors, the language differences and the low level of literacy among smallholder farmers are not taken into consideration when producing advisories to be disseminated. A low level of education and training resulting in a lack



of understanding of the information affects farmers' ability to use the new technology of CIS delivery (Apiola et al., 2018). These scholars also identified the use of the English language to convey CIS and the lack of consideration of the appropriate cultural context of the community as another challenge small-scale farmers faced in accessing CIS. This affects the ability of those farmers to integrate this data into their farming decision and preparation.

The poverty situation in the region is one of the issues that militate against the ability of farmers to access climate change information services. The cost of accessing CISs in some instances was seen to be very expensive for some smallholder farmers, especially the poor farmers. This affected the ability of many farmers to utilize the services provided. Farmers may use the information provided by Esoko for example because they thought it was too costly (P. M. Etwire, D. Fielding & V. Kahui, 2017). Even though the media (radio and TV) provides an effective and efficient means for communicating CIS to wider audiences, it is not enough because not all households have radio sets (Gbetibouo et al., 2017).

Inadequate infrastructural facilities necessary to enable the dissemination of climate information services are found in the literature to be one of the most critical issues affecting the ability of farmers to access climate change information services in the region. Farmers in many communities could not access the CISs provided by civil society organisations because they either do not have a telecommunication network or the network is poor. For instance, inadequate networks together with no electricity for farmers to charge their phones make telephone calls and other services difficult



rendering them un-implementable in some communities (Etwire et al.,2017). Inadequate infrastructure such as a weak mobile network in remote areas, lack of electricity and the limited characters an SMS can contain discourage small-scaled farmers from accessing CIS through the use of mobile phones (V. Myllynpää et al., 2018).

The other challenges identified included a lack of commitment and collaboration among state agencies to implement policies and programmes. This together with a lack of collaboration among technical experts affects the delivery of climate information services to farmers (V. Myllynpää et al., 2018). The bureaucracy encountered by farmers in accessing CIS due to the presence of middlemen and the low awareness level of farmers on how they use their mobile telephones to access agricultural information has also been identified as some of the major challenges farmers face in accessing CISs (V. Myllynpää et al., 2018).

2.7. The implication of climate change communication for the adoption of CSA by smallholder farmers in the Northern Region.

The CCC strategies especially those implemented by the civil society organizations in the region have enhanced the ability of farmers to adopt CSA practices. For example, two Canadian civil society organizations; The Canadian Feed The Children (CFTC) and Farm Radio International (FRI) collaborated with local civil society organizations to implement a programme called “Climate Change Adaptation in Northern Ghana Enhanced” (CHANGE) project in the Upper West and Northern Regions. The Regional Advisory and Information Network Systems (RAINS) was the local



organization that implemented the CHANGE projects in Northern Region. One of the main goals of CHANGE was to increase smallholder farmer to access information about climate change and its associated effects and strengthens farmers' capacity to adapt to these effects. According to the CFCT (2016), the CHANGE project increased farmers' knowledge and skill in adapting to climate change. Most of them reported an improvement in their capacity to adapt and resist the effects of climate change on their agricultural output and their livelihood as a whole. The CFTC (2016) indicated that over 90% of smallholder farmers have implemented various CSA strategies in the region and that 100% of CBO leaders tested the CSA strategies they learned through training and radio and shared their experiences during radio programmes and at community forums. Through enhanced information from their participation in PSPs implemented by CARE, smallholder farmers are implementing CSA strategies like planting early-maturing and climate-resilient crops, composting, and minimum tillage among others (Gbetibouo et al., 2017).

The implementation of CARE's Adaptation Learning Programme (ALP) resulted in the expansion of dry-season farming through irrigated crop production using water from small dams Percy et al., 2015). Additionally, the African Adaptation Programme (AAP) on climate change in Ghana which was implemented in collaboration with UNDP and the EPA led to the establishment of nurseries to grow seedlings in communities and also installed water pumps and other agriculture equipment for dry season farming along the White Volta (AAP 2013).

Farmers who participated in the PSP reported that the knowledge gained from the participation enhanced their ability to prepare for disasters and make decisions on the planting times of various crops (Gbetibouo et al., 2017). These authors also reported that the farmers are now integrating certified seeds due to the improved knowledge of the differences between seeds and grains. They added that farmers have started implementing CSA strategies such as planting early-maturing crops and composting after they participated in the PSP. The adoption of these CSA strategies the authors have noted helped improve the overall income levels and food security in the communities.

The CIS provided by ESOKO to farmers in the northern region allowed farmers to apply different farming decisions regarding the selection of crop varieties, planting time and how to apply fertilizer (Samuel et al., 2019). This according to the authors contributed to a reduction in crop failures and increased household food security.

An evaluation of the Climate-Resilience and Agricultural Food Systems (CRAFS) showed an improvement between the intervention group and the comparison group in percentage (%) when it comes to the adoption of CSA strategies. Results of the review which was carried out by OXFAM BG. in 2018 are shown in table 3 below.

Table 3 The use of CSA practices between the intervention group and the comparison group.

No.	CSA practices	Intervention group (%)	Comparison group (%)
1.	Intercropped cereals with legumes on the same plot of land	77	82
2.	Use of soil conservation techniques	44	58
3.	Use of minimum tillage	72	77
4.	Crop rotation of cereals followed by legumes	76	83
5.	Use of pesticides	49	60
6.	Use of scientific weather forecast to decide when and how to plant crops	32	48
7.	Use of organic fertilizer	69	81
8.	Use of chemical fertilizer	79	78

Source: OXFAM BG 2019.

From the table, it is clear that the CRAFS project change the farming practices regarding the adoption of CSA practices in the region. This is especially so concerning the use of organic manure where 81% of the intervention group has adopted it compared to 69% of the comparison group. The comparison group, however, used chemical fertilizer (79%) more than the intervention group (78%).



2.8. Conclusions:

Despite the attention Ghana has paid to climate change, there is no link between the policy documents and measures taken to mainstream climate change communication to the actors in the agricultural sector, especially smallholder farmers. This makes it increasingly difficult for smallholder farmers to effectively adapt to climate change.

Even though most of the climate change adaptation efforts of Ghana that are agriculture-related often combine climate information activities to inform risk-oriented decision-making not much has been done to communicate climate change that will enable smallholder farmers to adopt climate-resilient agricultural practices. However, many projects implemented by NGOs and civil society organisations in Northern Ghana have employed community-based adaptation strategies which appeared to be more appropriate. These included CARE's ALP, the Esoko farmer helpline and the CHANGE project. These projects focused on building resilience in Ghanaian farmers using various strategies that support their ability to adapt climate-resilient agricultural practices.

From the literature, it is clear that Ghana's efforts at climate change adaptation are mostly reactionary instead of anticipatory with little effort being made to communicate climate change effectively to the local people. Although all the national policies on climate change recognized the need for the agricultural sector of the country to be transformed to become climate-smart, very little has been done to communicate specific CSA strategies to smallholder farmers to help them adapt to CSA. In Ghana, climate change communication is linear, where climate information is provided via



radio and television without doing much to involve the general public, especially smallholder farmers at the community level in the discussion on the issues and solutions. With this, it becomes very difficult to create awareness among smallholder farmers about climate change and why they should adopt CSA, especially in Northern Region.

The threats faced by Ghana due to climate change require that people and institutions including those at the community level respond in innovative ways. Although Ghana has put in place measures aimed at addressing the capacity gaps between national institutions and the general public, there continue to challenge in the areas of institutional capacity strengths and interactions. The major capacity-building challenge identified in the three major policies (SNC, NCCAS and NCCP) reviewed above has to do with how to translate complex climate science into simple messages that the public especially smallholder farmers can understand.

Despite the critical role, communication plays in adapting to climate change most climate change adaptation policy documents in Ghana do not contain a communication strategy. One such programme is the African Adaptation Programme (AAP) on climate change in Ghana. The AAP was implemented in Ghana in collaboration with the UNDP and the EPA among others. Even though the AAP on climate change in Ghana sought to encourage systematic change for an all-inclusive method of dealing with climate change adaptation, there was no communication strategy for the AAP team in Ghana to use (AAP 2013). It also realized that as many as 15 national agricultural policies have not mentioned climate change information let alone talk



about communicating climate change to smallholder farmers that will help them to adopt more CSA strategies.

Communication is critical in building the capacity of people on climate change. However, the “business as usual” type of communication is woefully inadequate. If the local people are to address the challenges associated with climate change, they need to be fully aware of it and how it is affecting them. Better communication and awareness creation on climate change among the various stakeholders from the national to local levels are essential for the success of climate adaptation in Ghana.

The climate change communication strategies introduced by civil society organisations in the region have transformed climate change communication. Previously elders were the primary source of CIS and farming decisions. However, those strategies by civil society organizations, according to the literature, have made the CBOs and the CBEAs the main source of information regarding farming decisions. These strategies showed that the involvement of stakeholders at all levels in the production and dissemination of CIS will improve the capacities of people to adapt to climate change.

The provision of CICs will enhance communities’ access to climate change information and also provide access to innovative technologies that will enable them to practice climate-smart practices. The CIC also has feedback mechanisms that will help to improve the technical aspect of advisory development. This will improve farmers’ ability to deal with the effects of climate change by being able to manage the various climate change-related risks.



The partnership approach that CARE and other civil society organisations have taken in communicating climate change in Ghana enabled community members to understand climate change and associated problems. Also, a bottom-up approach to communicating climate change is crucial as far as improving the resilience of communities to the effect of climate change is concerned. One major factor that made the CAREs approach effective in disseminating climate change information to smallholder farmers was the breakdown of complex climatic issues to make it simple to understand users in their local dialect.

The ALP and PSP workshops if replicated throughout the country will enable the district assemblies and community members to own the process since they will be required to run the workshops. Attention should, therefore, be given to the partnership approach of CARE in Ghana's bit to communicate climate change. This will enable smallholder farmers to adopt climate-smart agricultural practices which will lead to an improvement in their livelihood.

The literature also revealed that even though the local people have taken local initiatives (dry season gardening, mulching, mixed cropping, etc) to adapt to climate change, very little or no efforts in some instances have been made by the government to promote those initiatives. The climate change adaptation strategy of Ghana needs to be anticipatory instead of the usual reactionary. This requires deliberate efforts on the part of the government and other stakeholders in the policy discourse to formulate and execute policies that are geared towards positioning the locals to deal with the challenges associated with climate change.

For instance, communication on climate change-related issues should be done using communication strategies such as framing, priming stakeholder engagement and participatory theories. Moreover, more sources of water and other farm inputs, as well as extension services delivery, should be available for smallholder farmers to engage in dry-season farming using irrigation. Efforts should also be made to encourage the development of afforestation and the use of sawdust stoves in the northern region to enable the local people to easily adapt to climate change.

Capacity building and climate experts are required at all local levels to help in the design and implementation of national development programmes. The four policies thus: GSGDA, SNCII, NCCAS and NCCP, showed that the government and other development partners have put in place measures aimed at building the capacity of Ghanaians on climate change at the level of Ministries, Departments and Agencies (MDA) as well as the media but this is still not enough because the target audience is those already working in climate-related areas such as agriculture. There is, therefore, an urgent need for local-level capacity building, especially in the community where these policies are implemented. Also urgent is the need to create a linkage between national climate policy documents and climate communication to properly integrate climate change into the overall development agenda of the country.



CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter of the study describes the study area, study population, sampling procedures, questionnaire design and administration. The chapter ends by outlining how the data for the study was collected and analyzed.

3.1. The study area.

The Northern Region is chosen for the study area because of the region's vulnerability to climate change particularly rainfall. Moreover, the region is one of the agricultural-dominated regions in the country with a large proportion of the population depending on agriculture as the major source of living.

3.1.1. Location and Population

The Northern Region is one of the sixteen administrative regions of the Republic of Ghana. The region shares boundaries with North East Region to the north, Savanna Region to the south and the Oti Region and Togo international to the east. The total land area covered by the region is 70,384 square kilometers.

The total number of people who reside in the Northern Region according to the 2021 population census is 3,310,939 with a population density of 87.1 per kilometer (GSS 2021). Currently, the Northern Region has sixteen (16) administrative districts. These are made up of 11 ordinary districts, 4 municipal assemblies and 1 metropolitan assembly (ghanadisstricts.com. Retrieved on 8/10/2019)



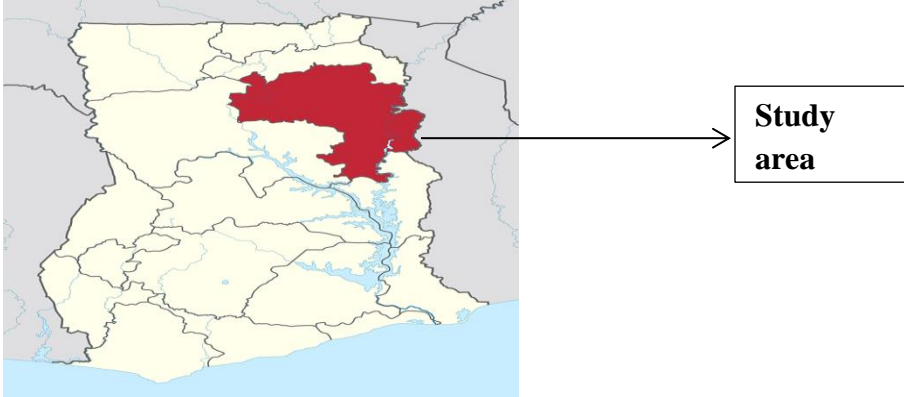


Figure 5: The Map of Ghana showing the Northern Region of Ghana.

Source: www.ghanamissionun.org

3.1.2. Climate and vegetation.

The Northern Region has a relatively hot climate. This is due to the single rainy season which starts in May and ends in October. The yearly rainfall recorded in the region varies between 740mm to 1230mm (Ghana Metrological Agency 2017). The dry season which usually begins in November ends in March/April.

Maximum temperatures which occur in the dry season start in March/April while minimum temperature occurs in December and January. The northeasterly (harmattan) winds occur in December and February. Humidity around this time in the region is normally very low. The vegetation there is characterized by a vast area of grassland intermingled with the Guinea Savannah Forest. Common trees in the region are drought-resistant trees like shea, dawadawa, baobab, neem and some mango.



3.1.3. Economic Characteristics

The main occupation for the people in the region is farming and other related agricultural activities such as fisheries and forestry which account for about 74.0% of the labour force. These are the dominant economic activities in all the districts except the Tamale metropolis. The dominant economic activities in the Tamale Metropolis are services and sales workers. These account for about 30.7% of the labour force (GSS 2013). This is because the metropolis is the most urbanized area in the region. The major industrial activity in the region is the repairs of vehicles and motorbikes which account for about 9.2% of the labour force. This is followed by manufacturing at 6.2% and accommodation and food service activities at 2.5%. Again in the Tamale Metropolis, repairs of motorbikes and vehicles account for about 30.4% of the labour force with manufacturing constituting 13.1% of the labour force (GSS 2013).

3.2. Research Design

The study adopted a survey research design involving both qualitative and quantitative research approaches. The mixed approach helped offset the weaknesses of either the qualitative or quantitative approach. Probability and non-probability sampling methods (purposive sampling and simple random sampling) were used in the study. The purposive sampling technique was used in identifying key informants and focus participants for focus group discussion. Simple random sampling was used in determining individuals for the administration of questionnaires. The sample size of the study was determined using a formula developed by Taro (1967) with a 95% confidence level.



To ensure that the survey was properly carried out, the districts were divided into rural, peri-urban and urban. Questionnaires and interviews were used to collect the required data for the study. Questionnaires were administered to the sampled population and consisted of open-ended questions and closed-ended questions. The interview was semi-structured and the respondents were visited in their houses and offices to ensure face-to-face interaction.

Key informant interviews were also used. These people were mainly officials of relevant institutions. With this, people with relevant information on the subject matter were contacted to get more information for the study. Focus group discussions were used in carrying out the study. The type of data collected was primary data. There were also personal visits to the offices of the relevant institutions for information on the study. These will include MoFA, EPA, and others. The data collected will be both primary and secondary.

Since the study describes the role of climate change communication on the adoption of CSA by smallholder farmers, the use of a survey in the collection of data was appropriate. This is because it enabled me to test the effects of one variable (climate change communication) and the other (adoption of CSA by smallholder farmers).

Also, a survey was used for this because the units of analysis for the study are made up of individuals and groups. Moreover, due to the large nature of the study population, the use of a survey made it possible to describe the characteristics of the



larger population. Time is also important here, with the limited given for the study, the survey will make it possible for the larger population to be studied within the time frame.

In this study, a qualitative approach was used to identify the main climate change communication strategies for providing climate change information for the adoption of CSA in Ghana and to determine how smallholder farmers in the region access information on climate change. A quantitative approach was used to analyse the effects of climate change communication on the adoption of CSA by smallholder farmers in the Northern Region.

3.3. Study population.

The population for the study was farmers that are involved in agriculture as the major source of livelihood in the selected districts in the region. These comprised farmers especially those who practice dry season farming, agroforestry and other CSA strategies such as mulching, composting and mixed farming. This is because they are the people whose farming practices include CSA strategies. MoFA officers and extension officers in the selected districts were also part of the study population. The total number of farmers in the selected metropolitan and Municipal Assemblies is 76,747. This is made up of 55,726 farmers (73%) from the Tamale Metropolis and 21,021 farmers (27%) from the Sagnarigu Municipal. The extension agents in the two districts were also part of the study population.



3.4. Sampling

The study adopted a multistage sampling procedure to select the districts in the region, farmers especially those who practice dry season farming, agroforestry and other CSA practices. The sampling procedure included; purposive sampling, cluster sampling and proportionate sampling. Tamale Metropolis and Sagnarigu Municipal were selected because these are the areas where agroforestry and dry-season farming are used in the region. Although other CSA strategies are practiced by smallholder farmers in the other districts in the region, the two areas have these two together with the other CSA strategies. These are also the areas with complete and reliable telephone network coverage. The study population was divided into two (2) clusters with each district representing a cluster. Each cluster was given a proportion and the number of respondents in the districts was based on the proportion given. This ensured a fair representation of the districts. The extension agents in the selected districts assisted me in selecting the communities and some of the respondents.

3.4.1. Sample size

From the sample frame of 76,747 farmers, a probability sampling technique was adopted to select a sample size of 396 farmers as participants for the study. the following formula developed by Taro (1967) was adopted to get these 396 participants,



$$n = \frac{N}{1 + N[e]^2}$$

Where n = sample size, N = population frame and e = margin of error.

But $N = 76,747$, and $e = 0.05$

$$\Rightarrow n = \frac{76,747}{1 + 76,747(0.0025)}$$

$$\Rightarrow n = \frac{76,747}{1 + 192}$$

$$\Rightarrow n = \frac{76,747}{193} \Rightarrow n = 396.0$$

3.5. Sources of Data

Both primary and secondary sources of data were employed, but predominantly primary data sources were used to conduct the study. Primary data was obtained from households, extension officers and other officials of relevant institutions. Secondary data was collected from relevant national institutions like the Ministry of Food Agriculture (MoFA), Environmental Protection Agency (EPA) and the District Assemblies (DAs) among others.

3.6 Data collection tools

The main tools for data collection for the study were questionnaires and checklists. The study used a questionnaire as one of the major data collection tools. This was administered to the study population. To be able to get credible information for the



study the questionnaire was properly constructed and administered. There were closed-ended questions and open-ended questions. Closed-ended questions gave the respondents multiple-choice answers while the open-ended questionnaires allowed the respondents to express their opinions and give their answers. This also made the research more original and valuable. Some of the questions were also scaled using the Likert scale. The questionnaires consisted of four sections. These were; the pathways through which climate change information is communicated to smallholder farmers in Ghana, how smallholder farmers in the Northern Region access climate change information, challenges smallholder farmers in the Northern Region face in accessing climate change information and the effect of CCC on the adoption of CSA practices in Northern Region. The purpose of using the questionnaire was to ensure uniformity and greater validity of the data collected

To get more focus on the questions, the questionnaires were administered using an in-house survey. The respondents for the study were smallholder farmers in the selected districts who use CSA practices and relevant MoFA staff in those districts. These people were visited in their houses or workplaces for face-to-face interactions. The data collected with the face-to-face interviews was primary data because the information collected will mainly be firsthand information. Data was both quantitative and qualitative.

3.7. Interview

Face-to-face interviews were conducted with relevant units of analysis to get the needed information for the study. The respondents for the interviews were selected

with the guidance of the agriculture extension agents in the selected districts. These included the dry season farmers, agroforestry farmers and other farmers who use other CSA strategies like composting, mixed farming, mixed cropping and so on. These are the people whose farming practices include CSA strategies. Only one individual from a household (mainly the household head) was interviewed. The agricultural extension officers in charge of the selected areas and other MoFA staff were also interviewed.

Key informant interviews (KII) were also used to collect the data. With this, people with more information about the subject area of the study were interviewed to get more information to enrich the study. These people included MoFA staff and other opinion leaders in the communities who are experts in climate change communication and CSA practices.

Focus group discussions were also employed in collecting data. These groups included vegetable farmers' associations, seed grower's associations and other associations whose activities relate the agriculture in general and CSA practices in particular. These groups were identified with the help of agriculture extension agents. As a tool for collecting qualitative data, I asked participants questions that helped me to understand their perceptions, attitudes, beliefs and opinions about the topic of interest. Although these discussions were moderated, participants were free to talk with group members and share their views on the issues discussed. The maximum membership of the groups was 12 participants.



3.8. Methods of data analysis

To make the findings of the study meaningful, the data collected was analyzed both qualitatively and quantitatively focusing on the content of the questionnaire. Data extracted from the interviews were categorized for clarification and to outline descriptive and interpretive analysis of the results. The data was organized in line with the research questions and objectives using coding.

Quantitative data were analyzed using descriptive statistics such as frequencies and percentages. This was done with STATA (version 13) software. Qualitative data was analysed based on content analysis. This was done by establishing the categories, themes and patterns. This was done in line with the study objectives. This is to bring all relevant data together to ensure systematic and rigorous analysis.

Results were presented using tables, figures and percentages. To add more meaning and enhance statistical analysis, the results of the data were interpreted qualitatively. Social science researchers can use qualitative research techniques to strengthen the design of quantitative studies (Leech et al., 2006).



CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Introduction

In this chapter, the main findings of the study “the role of climate change communication on the adoption of Climate-smart Agriculture by smallholder farmers in the Northern Region of Ghana” are presented. Having collected data based on the objectives, descriptive statistics on the characteristics of the sampled population are presented. These include age, gender, household size, and marital status. Following the presentation of the descriptive statistics, we present the results of the pathways through which climate change information is communicated to smallholder farmers in the Northern Region.

The results of how smallholder farmers in the Northern Region access climate change information are presented next. The results on the effectiveness of the different pathways in communicating climate change information to smallholder farmers follow. The results of the challenges smallholder farmers face in accessing climate change information are also discussed. Finally, the results of the implications of climate change communication for the adoption of CSA by smallholder farmers in the Northern Region are presented and discussed to bring out the implications of Climate Change Communication for the Adoption of Climate-Smart Agriculture by Smallholder Farmers in the Northern Region of Ghana.



4.2. Socio-demographic characteristics of smallholder farmers in the Northern Region.

This section discusses the socio-demographic characteristics of the respondents. It presents a detailed description of the study population in terms of demographic characteristics such as age, gender, household size and marital status

4.2.1. Age distribution of the respondents

The age distribution is one of the most important demographic features that is used to analyze and interpret the pattern and its effects on the development of agriculture and other sectors of the economy of the communities in the region. The age limit of the respondents was given as fifteen (15) and above. The age distribution of the respondents is presented in the chart below.

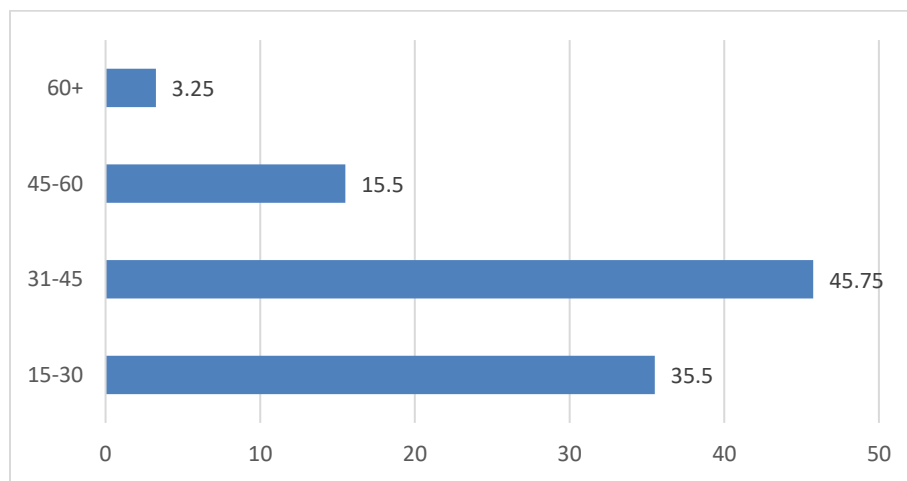


Figure 6: Age distribution of the respondents (%)

Source: field survey: June 2020.



The figure shows that the majority (45.75%) of the respondents are within the age range of 31- 45. This is followed by the age range (15 – 30) within which 35.5% fall. This is so because these age ranges are made up of people who have access to mobile phones in most communities. This makes them more accessible via mobile phones than respondents in the other age groups to climate change information. The age range with the lowest percentage (3.75%) of the respondents is 60+. This is partly because people from this age bracket in the study area mostly do not have access to mobile phones which, due to the coronavirus pandemic, was the main tool the researcher used in conducting the interviews. It is important to note that the views of these people most of whom are experienced farmers were underrepresented in the study.

4.2.2. Gender distribution of the respondents

Both male and female farmers are engaged in the agricultural sector of Ghana. Based on this, the study engaged farmers of both sexes. However, males are more engaged in farming activities, especially in terms of ownership of farm enterprises than their female counterparts in the study area. Figure 7 presents the distribution of the respondents in terms of gender.



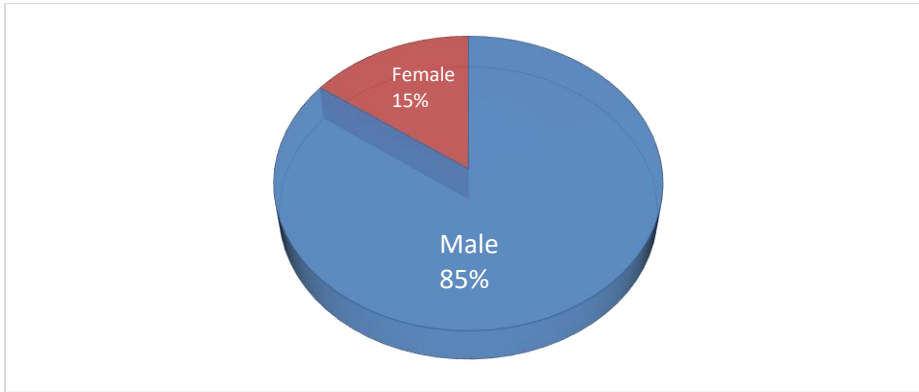


Figure 7: Gender distribution of the respondents (%)

Source: field survey: June 2020

Figure 7 indicates that 85% of the respondents are males while 15% are females. This meant that the majority of the respondents were male. The reason for this is that the households' decision-making in the agricultural sector of Ghana is dominated by males. Other studies on agriculture and climate change adaptation strategies have revealed that the agriculture sector in the region is male-dominated (Owusu 2015). Also, a study conducted by MoFA in 2011 indicated that the economically active population who are engaged in agriculture in Northern Ghana had more males than females (MoFA, 2011).

4.2.3 Household size of the respondents

Household size is one of the socio-demographic characteristics of the respondents that the study considered. It is important to emphasise that a household in the study is defined as a nuclear family which comprises the couple and their children. Figure 8 shows the distribution of the respondents by household size.

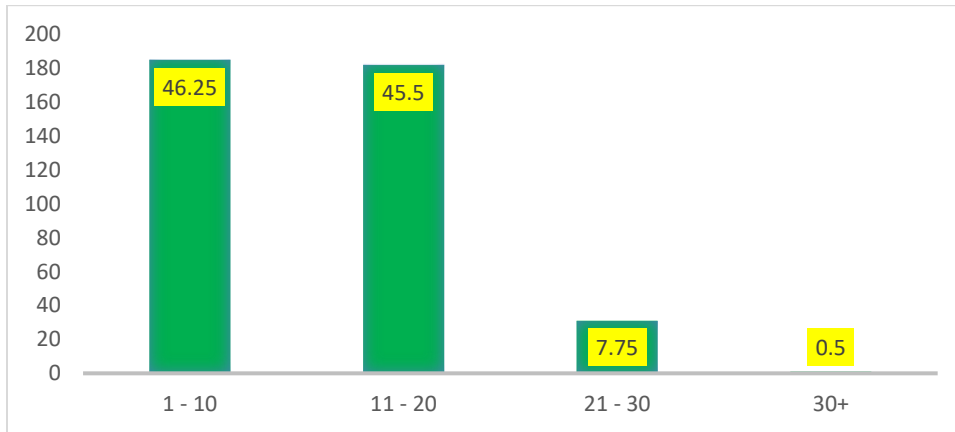


Figure 8: The household size of the respondents (%).

Source: field survey: June 2020

Figure 8 shows that the majority (46.25) of the households of the respondents have sizes ranging from 1 -10. This is followed by respondents whose household sizes range from 11 – 20 with a percentage of 45.5. The household bracket 30+ has the least of the respondents falling within it. This suggests that the majority of the respondents are likely to be coming from communities that are urban or peri-urban since urban areas have small household sizes than rural areas in the region. According to the 2010 population census, the average household size for the Northern Region was 7.1 and 8.2 for urban and rural areas respectively.

4.2.4 Marital status of the respondents

The marital status of a farmer is one of the major determinants of the adoption decision-making of the farmer (Mandleni et al. 2018). Mandleni et al (2018) added that an increase in the marital status of farmers increases the possibility of adopting any CSA strategy. Marital status, therefore, has the potential to influence a farmer's

decision as to whether or not to adopt a particular CSA strategy. Table 4 shows the distribution of the respondents by their marital status.

Table 4 Marital status of the respondents

Marital status	Freq.	%
Single	35	8.75
Married	357	89.25
Divorced	4	1.00
Widow/ Widower	4	1.00
Total	400	100

Source: field survey: June 2020.

Table 5 indicates that the majority (89%) of the respondents are married with only a few (9%) single. Only a few (4%) of the respondents were either widows, widowers and divorced. Ideally, the information is a reflection that married people are more actively engaged in agricultural activities than those that are not married. It was realised that most of the unmarried youth travel out of their communities to the cities to seek other non-farm sources of income.

4.3. Awareness of channels of climate change information flow to smallholder farmers.

This section identifies the channels through which climate change information is communicated to smallholder farmers in the Northern Region. It considers the awareness level of smallholder farmers about climate change by looking at the proportion of the respondents who have ever heard of the concept of climate change. Smallholder farmers' sources of information for climate change will be presented



next. This will be done by considering the various channels through which respondents have issues about climate change being discussed. The channels through which the respondents often hear the concept of climate change are also discussed. This is meant to address objective one of the study. This meant addressing objective one of the study

4.3.1 Levels of awareness of climate change among smallholder farmers.

The first step in the analysis seeks to find out the level of awareness of climate change among smallholder farmers in the region. Respondents were asked if they have ever heard of the concept, of “Climate Change” with “**YES**” or “**NO**” as possible responses. The result of the level of awareness of climate change among smallholder farmers in the region is shown in figure 9 below.

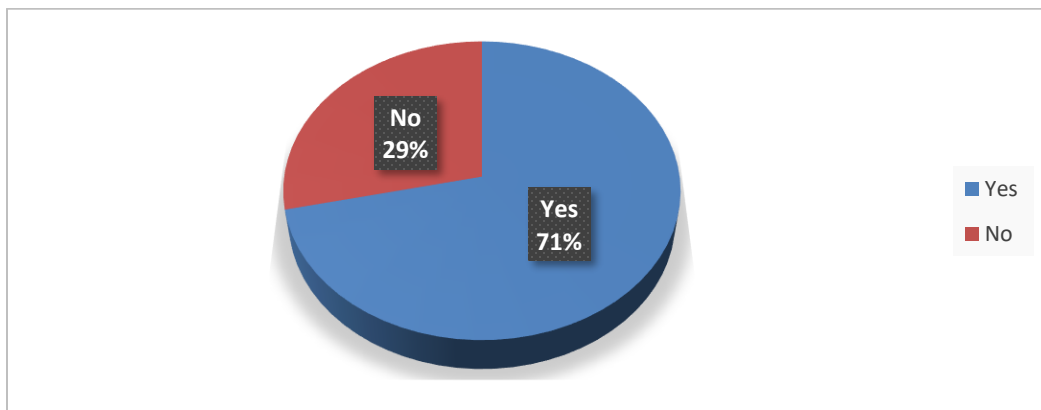


Figure 9: Level of climate change awareness(%)

Source: field survey: June 2020.

Inferring from figure 9, it can be observed that the majority (286), representing 71% of the respondents have heard of the concept “Climate Change” before. The rest (114)



representing 29% have never heard about the concept of climate change. The same situation was realized during an interaction with members of focus groups. Almost all the members of the groups indicated they heard of the concept of “Climate Change” before. For example, at one of the focus group discussions, a member had this to say about climate change;

There is nobody here who has never heard of climate change, we hear it on radio, television and from extension agents. Even we talk about it among ourselves (Sagnarigu Municipal, Northern Region, Ghana, March 2020).

This indicates that there is a high level of awareness of climate change among smallholder farmers in the region. This situation offers an opportunity for climate change communicators to bring to the notice of the farmers the adaptation measure needed to be put in place to cope with climate change and its effects. This is because farmers are in a better position to be educated on the strategies, they need to be able to deal with the effects of climate change on their livelihood since they already know about it. The task before climate change communicators now is getting the best strategies to effectively communicate climate change including adaptation measures to smallholder farmers in the region so that they can adopt CSA.



4.3.2. Smallholder farmers' sources of information on climate change.

The 286 respondents who had information about climate change were asked to indicate the sources from which they had the information by picking from a list of sources provided. This will help in analysing objective one of the study. The various sources from which the respondents had information about climate change are represented in figure 10 below.

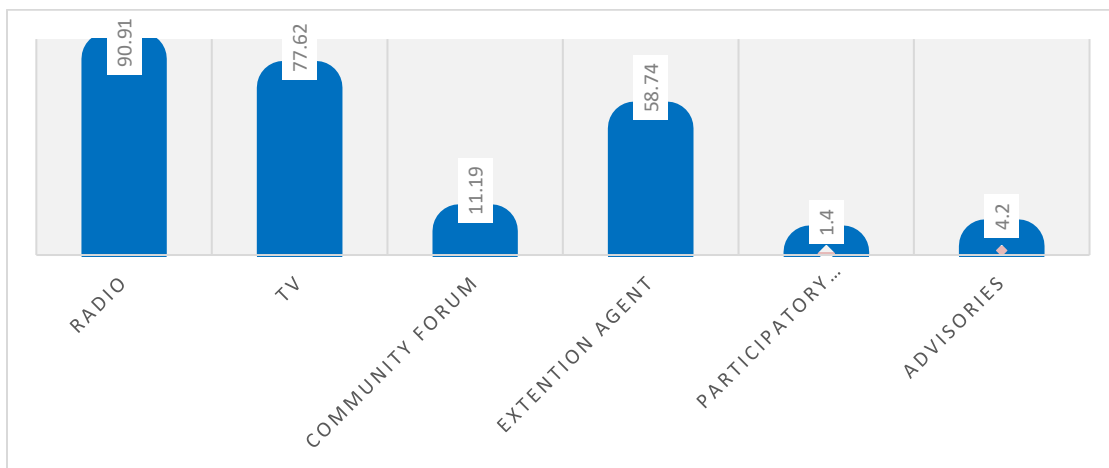


Figure 10: Smallholder farmers' sources of information on climate change.

Source: field survey: June 2020.

The bar chart above indicates that the channel through which most of the respondents had climate change information is the radio with a total of 260 respondents representing over 90% of the 286 respondents. The next channel is a television with 222 respondents representing 77.1% of the 286 respondents. Agricultural Extension Agents (AEAs) are the third-highest channel from which most of the respondents had their climate change information with 168 (58.7%) of the 286 respondents.



Even though the AEAs are the main source of agriculture information for smallholder farmers in Ghana, fewer farmers had their climate change information from them. This situation is worst as far as female farmers are concerned since only 4 of the 168 respondents who had agriculture extension agents as their source of information about climate change are women farmers. This is due to the difficulty female farmers faced in accessing extension services in the region. This was manifested when a female respondent, in reacting to why she is not getting climate change and other agriculture information from extension agents said;

.....You cannot talk to them about your farming activities because they are all men. sometimes when you do that and people see, they may suspect that there is a love affair between the two of you.that is why we hardly discuss our farming activities with them (KI, Sagnarigu Municipal, Northern Region, Ghana, March 2020).

This is a worrying signal as far as the improvement of agricultural productivity is concerned. This is because agriculture extension services are not only a major source of agricultural information for farmers but it also ensures that farmers have access to improved agricultural technologies which contributes to the well-being of farmers. Unfortunately, this erroneous view which is common among many farming communities in northern Ghana makes it very difficult for female farmers to maximise their full potential as far as contribution to agricultural production is concerned. This affects the ability of the female farmer to improve their well-being and that of their dependents.

The situation whereby fewer farmers had extension agents as their source of climate change information is partly due to the higher extension agent-farmers ratio in Ghana. According to Social Enterprise Development of Ghana, SEND-Ghana (2019), the farmer-extension agent ratio is about 1: 1500 farmers. This means that one extension agent is taking care of 1,500 farmers whose locations may be widely dispersed. The AEs are, therefore, unable to effectively provide climate change and agricultural information for all the farmers. This is one of the reasons why relatively fewer numbers of respondents had AEs as the major source of climate change information. Participatory Scenario Planning, an approach used by CARE international in its climate change communication is found to be one of the sources with the lowest number of respondents who had their climate change information through it despite its success in communicating climate change to smallholder farmers. According to Gbetibouo et al. (2017), in areas where the PSP was implemented, community members demonstrated general knowledge of the significance of climate change information and seasonal focus for their agricultural planning, disaster preparedness, and making decisions on planting times.

There is therefore the need for the government of Ghana to replicate the PSP concept by bringing together all stakeholders in the agricultural sector to develop and co-produce climate change information that is relevant to local decision-making and planning. This can be done by ensuring two-way climate change information sharing that brings together knowledge from local actors including farmers from the various communities and climate scientists. This will ensure iterative learning and dialogue

between the various stakeholders to constantly co-produce climate change information services that will respond to users' needs. This view was supported by a key informant when he said;

If the government can bring together all the actors in climate change from scientists to local farmers in the communities as CARE International was doing some time ago, they will be able to share ideas on how best to deal with the impact of climate change. This will help farmers plan their agricultural activities well amid climate change. (KI. Sagnarigu Municipal, Northern Region, Ghana, March 2020).

4.3.3. Most prevalent channels for climate change communication to farmers

After the respondents indicated the sources through which they hear climate change, they were further asked to indicate which of these channels they frequently hear issues about climate change being discussed. This is to help in further analysis of objective one of the study. This was meant to help in determining which channels farmers frequently hear about the issues of climate change. The results are summarized in figure 11 below.



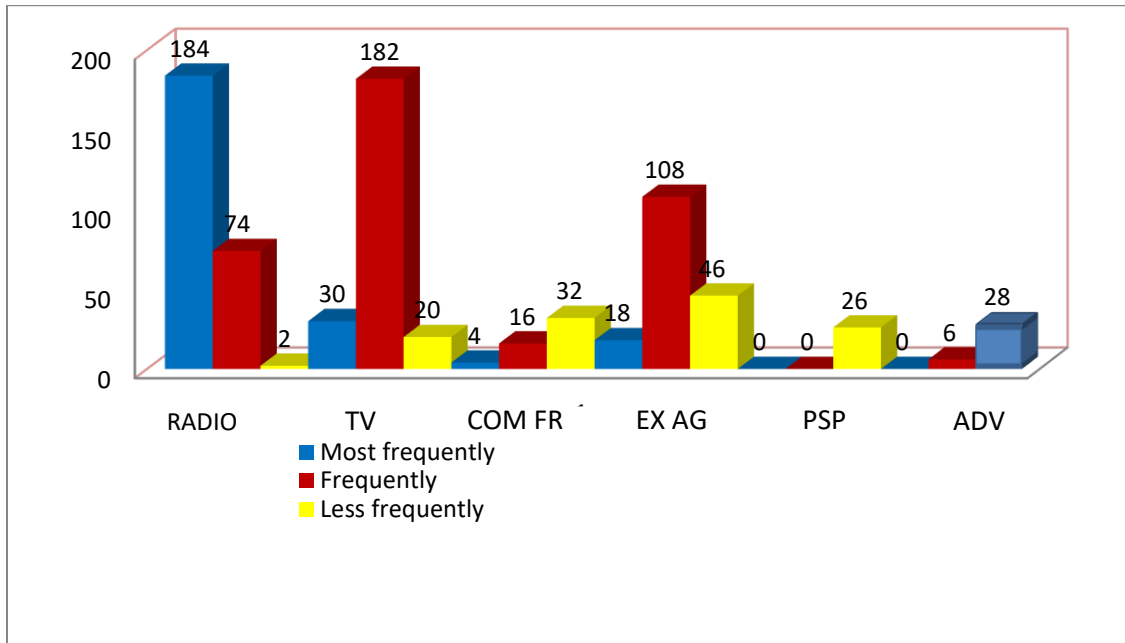


Figure 11: Most prevalent channels for climate change communication to farmers.

Source; field survey: June 2020

Figure 11 showed that the majority 184 (70.77%) of the 260 respondents who hear climate change from radio indicated that it is the medium through which they most frequently hear issues about climate change being discussed while only 2 (0.77%) described radio as the medium through which they less frequently hear issues about climate change being discussed. This shows how influential the radio stations especially the local stations can be in communicating climate change to smallholder farmers. An added advantage of the use of mass media is the fact that almost every household has access to a radio set. This finding is supported by a participant in an FGD who said;

almost every house in this community has a radio set even mobile phones have radio components..... so the radio is the source through which most people in this community listen to issues about climate change (FGD, Tamale Metropolis, Northern Region, Ghana, March 2020).

Interestingly, the table showed that only 18 (10.47%) of the 168 respondents who hear climate change from extension agents describe them as the medium through which they most frequently hear issues about climate change being discussed compared to 46 (26.74%) who described them as the medium through which they less frequently hear issues about climate change being discussed. Again, this situation confirms the inability of the extension agents to provide climate change information to smallholder farmers in Ghana and the Northern Region due to their limited numbers. An agriculture extension agent is responsible for so many farmers making it difficult for them to do their work effectively. The few who are available do not also have the required logistics that will enable them to do their work effectively. At a focus group discussion with members of Tungteeya Women Group, a vegetable farmers association in Garizegu in the Sagnarigu municipal assembly, a member said;

The agriculture officers are not many and the few who are there do not also have the logistics that enable them to work effectivelysometimes you can call them and they will tell you they do not have fuel or the motorbike is broken down and so they cannot come (FGD, Sagnarigu Municipal, Northern Region, Ghana, March 2020).



It is, therefore, not surprising that the number of respondents who hear climate change issues from extension agents less frequently (26.74%) is more than those that hear it most frequently (10.47%). Because of their fewer numbers, they are not able to effectively communicate climate change information to smallholder farmers. This negatively affects the ability of the farmers to access climate change information. There is, therefore an urgent need for the ministry of agriculture to increase the number of extension agents in the region especially female agents. This will make it possible for farmers especially women to have more access to climate change information.

4.4. Effectiveness of climate change communication

As the end-users of climate change information, farmers are one of the best groups of people in determining how climate change should be communicated effectively. As a result of this, respondents were given the chance to state how they think climate change communication can be done effectively. This is to help in addressing objective two of the study.



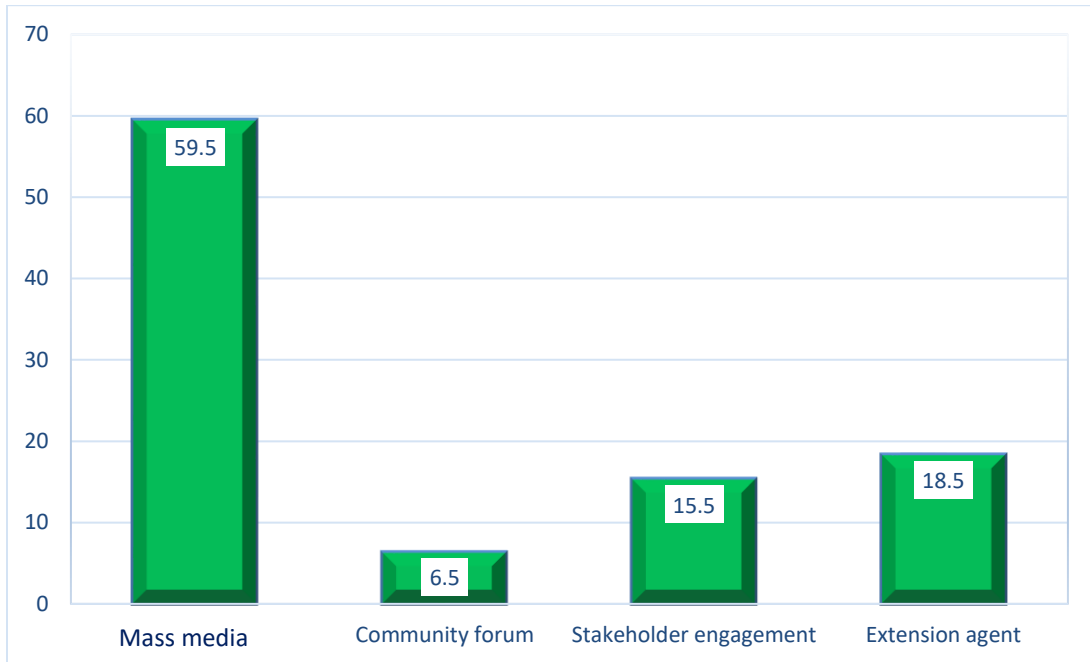


Figure 12: Ensuring that climate change communication is effective

Source: filed survey: June 2020.

Figure 13 shows that the majority (59.5%) of the respondents perceive mass media as the most appropriate channel through which climate change should be communicated if the communication is to make any meaningful impact. Several reasons were given by the respondents as to why they see the mass media as the most effective pathway in communicating climate change information in the region but the dominant reason given was that the media has more coverage. Many people can be reached out to when climate change communication is done through the mass media.

Communicating climate change will therefore be more effective when it is done through the mass media. Although agricultural extension agents are primarily

responsible for disseminating agricultural information including that on climate change, only 18.5% of the respondents hold the view that communicating climate change through Agricultural extension agents will make it more effective. This means farmers are beginning to lose confidence in the ability of the agricultural extension agents to disseminate agricultural information to farmers because of their limited numbers among others. This 18.5% of the respondents who think climate change can be effectively communicated through extension agents could be made up of people who are members of farming groups or are opinion leaders in the communities and as such, they are among the few people that the extension agents pay attention to in the communities. This view was expressed by a respondent when he said;

'the extension agents have some special people they have time for, if you don't belong to a farming group, you cannot easily get them unless you are a special person like the chief or chairman(KI, Sagnarigu Municipal, Northern Region, Ghana, March 2020).

The community forum is seen by the respondents as less effective in communicating climate change to smallholder farmers.

During focus group discussions participants expressed similar views as to how climate change communication can be done to make effective. Throughout the focus group discussions, the use of the mass media and increasing the number of extension agents were emphasized as the best ways climate change can be communicated to make it effective. Below are some of the views of the participants.

I think when farmer groups like ours are supported with radio sets, we can be able to listen to climate change and other agricultural-related programmes on the radio,..... Alhassan, (he called a member by the name Alhassan) like the radio they gave you some time ago (FGD, Sagnarigu Municipal, Northern Region, Ghana, March 2020).

The radio set he said was given to the colleague farmer (Alhassan) was given to him by CARE International Ghana in collaboration with Farm Radio International as part of their efforts to communicate climate change in Ghana. Another member has this to say on increasing the number of extension agents.

There should be more extension agents in such a way that every community will have an agent attached to it.....if the government adds extension assistance to the other Youth Employment Agency (YEA) programmes it will help (FGD, Sagnarigu Municipal, Northern Region, Ghana, March 2020).

If the government can employ university graduates who have an agricultural background and attach them to communities as part of the Nation Builder Corps (NABCO) they can help to effectively disseminate climate change and other agricultural information to farmers.

In almost all the Key Informant Interviews (KII), the respondents also rated community forums as the least in making climate change communication effective. They cited a lack of logistics as one of the challenges hindering the use of community

forums. Below is how a respondent (key informant) reacted to the use of community forums as a strategy for communicating climate change.

The major challenge with the use of community forums is the lack of logistics. how do we get the gadgets and other equipment like video screens and generators to the communities? (KI, Sagnarigu Municipal, Northern Region, Ghana, March 2020)

On the use of opinion leaders and other influential people in communicating climate change in the communities, some of the key informants had divergent views. For example, while an informant from MoFA had the view that as the leaders of the communities, opinion leaders can contribute significantly to the dissemination of climate change information, his colleague from SARI had thought otherwise. Below are some of the respondents' views shared on the issue.

The MoFA official said;

..... as the leaders of the communities, they are among the trusted people in the communities and so communicating climate change through them will make the message effectivebecause the public will have trust in whatever they say about climate change and will most likely behave in a positive manner(KI, Sagnarigu Municipal, Northern Region, Ghana, March 2020).

On his part, the SARI officer had this to say;



....We need to get a clear distinction between climate change issues and environmental issues..... Climate change issues are more technical... So how are these opinion leaders going to be educated before they can move into the community members?,there could be some distortion... if I sit these leaders down most of whom are illiterates to explain to them what climate change issues are for them to be the agents of communicating these issues to the community members there will be distortions. So I think there should not be too many intermediaries between the person informing and the person to be informed(KI, Tamale Metropolis, Northern Region, Ghana, March 2020).

Having listened to the experts, I think the technical nature of presenting climate change issues makes it very difficult to effectively communicate climate change through the opinion leaders. This is because most of these people do not understand the language used. This makes it extremely difficult for them to understand and effectively communicate climate change issues to their community members. Due to the complexities that are associated with climate change issues, communicating climate change using opinion leaders in the communities will, by all means, lead to serious distortions as the SARI official rightly put it.

Even though the respondents rate the mass media as the most effective medium through which climate change communication can be done, using the mass media in a particular manner may not yield the needed results. According to Nisbet, (2009), how the mass media frame the issues of climate change strongly influences how the layman will understand and interpret it. In framing climate change, climate change

communicators should highlight what could be perceived as the core of the issue, suggest linkages between events in the local context, propose which local actors should be seen as responsible, and suggest how challenges should be handled. In light of this, climate change communicators need to be circumspect about the things they say and how they say those things when discussing issues about climate change in the media. This will affect the level of interest smallholder farmers will have in listening to discussions on issues about climate change from the media and their willingness to adopt CSA strategies on their farms and other livelihood activities.

4.5 Challenges smallholder farmers in the Northern Region face in accessing climate change information.

This part of the chapter identifies the challenges smallholder farmers in the Northern Region face in accessing climate change information from the sources indicated in 4.3.2. It starts with the identification of the general challenges farmers face and ends with the most important challenge the farmers face in their quest to access climate change information. This is supposed to address objective three of the study.

Like their colleagues in other parts of Ghana, there are perceived challenges smallholder farmers in the region face in accessing climate change information. This part of the study seeks to highlight the challenges smallholder farmers face in their quest to access climate change information. Respondents were, therefore, asked to indicate from a list of the challenges they face in having access to climate change and to indicate the most important of those challenges in the region. In all, there were



seven challenges listed but five were identified as the most important. The result of their responses is presented in table 5 below

Table 5: Challenges smallholder farmers in the northern region faced in accessing climate change information

CHALLENGES	Freq	%	Com. freq.
Lack of access to a radio set	4	1	1
Lack of mobile phone	6	1.50	2.50
Issues of CC not discussed in the local dialect	38	9.50	12.50
Issues discussed too scientific	14	3.50	15.50
Inadequate extension agents	338	84.50	100.00
Total	400	100	

Source: field survey: June 2020.

Inferring from the table it is observed that the inadequate number of extension agents is identified by a majority of the respondents as the most important challenge they face in accessing information on climate change. A total of 328 (82%) of the 400 respondents identified an inadequate number of extension agents as the most critical challenge they face. A total of 28 and 14 respondents also identified climate change issues not being discussed in the local dialect and the issues being too scientific respectively as the challenges they face in accessing climate change information. The insufficient number of extension officers and the lack of discussion of climate change issues in the local dialect were expressed extensively during focus group discussions. Members complained about the lack of access to the services of extension officers as



the most important challenge they face in accessing climate change information. This view of the respondents was exemplified in a statement by a MoFA staff (key informant) that;

'they are currently under-resourced and cannot provide the needed services and information to farmers' (KI, Sagnarigu Municipal, Northern Region, Ghana, March 2020).

Other challenges identified during the focus group discussions were the lack of radio sets and the lack of sustainability of climate change communication programmes. During the interviews with some of the Key Informants, the high cost of radio programmes was identified as one of the challenges in climate change information delivery in the region. For example, one Key Informant said;

The easier way we can reach out to farmers with climate change information is through radio discussion but due to the high cost of the radio programmes, we are not able to do it more frequently (KI Tamale Metropolis, Northern Region, Ghana, March 2020).

Regarding the lack of unsustainability nature of climate change communication programmes, a participant in a focus group discussion has this to say;

... some time ago I used to listen to somebody on my phone. this person will be asking me for information about my farming, and he will ask if I have planted a particular crop, I should press a particular number on the phone. When I was



listening to it, I was able to get climate and other agricultural information but because the programme has stopped, I don't get it again. If that programme had continued till now, it will have been helpful to us (FGD, Sagnarigu Municipal, Northern Region, Ghana, March 2020).

The programme, the participant talked about was the farmer helpline which was started in Ghana by a technology and development company called Esoko. The interactions with key informants also revealed an inadequate number of extension agents, a lack of logistics, and inexperience on the part of some extension agents as some of the challenges farmers in the region faced in accessing climate change information. For example, a key informant said;

'the extension agents are not enough and some of them lack the needed experience in climate change communication and the logistics to enable them work are not enough' (KI, Sagnarigu Municipal, Northern Region, Ghana, March 2020).

In fact, almost all the key informants reported that the inadequate number of extension agents as a major challenge that hinders the ability of smallholder farmers from having access to climate change information in the region.

Previous studies have also identified inadequate extension agents as one of the major challenges farmers face in accessing climate change information. According to Naab et al., (2019), the major challenge to climate change communication in Ghana is the inadequacy in the number of extension staff. What this means is that most of the



respondents recognized agricultural extension agents as their major source not only for agriculture but also for climate change information. This view is supported by Naab et al., (2019) in their assertion that the most effective way to communicate climate change information is the use of field extension staff who work on the ground to have a detailed understanding of the local situation. With their limited numbers, respondents are quick to point to the inadequate number of extension agents as their major challenge in accessing climate change information. There is, therefore, the need for the ministry of agriculture to recruit and deploy more agricultural extension agents. This will help improve the extension agent-farmer ratio in the country and improve the ability of smallholder farmers to adapt to climate change.

4.5. The implications of CCC for the adoption of CSA by smallholder farmers in the Northern Region

This part of the section takes a look at the implication of the CCC strategies and the impacts of the strategies on the adoption of CSA strategies by smallholder farmers in the region. It starts with the identification of the various CSA strategies farmers in the region practice. This is followed by the source of information for the strategies practiced. The effects of the two main CCC strategies used in CCC in the region (expert discussions and interaction with agricultural extension agents) on the adoption of the main CSA strategies adopted by smallholder farmers in the region conclude the section. This is meant to address objective four of the study.



4.5.1. The CSA strategies farmers in the region practiced.

Since most of the CSA strategies are conventional, the study sought to identify the various CSA strategies smallholder farmers in the region currently use. The major reason is that finding out the CSA strategies already being practiced will help in determining the effects of the CCC strategies on the adoption of additional CSA strategies by smallholder farmers in the region. The results are presented in figure 15 below.

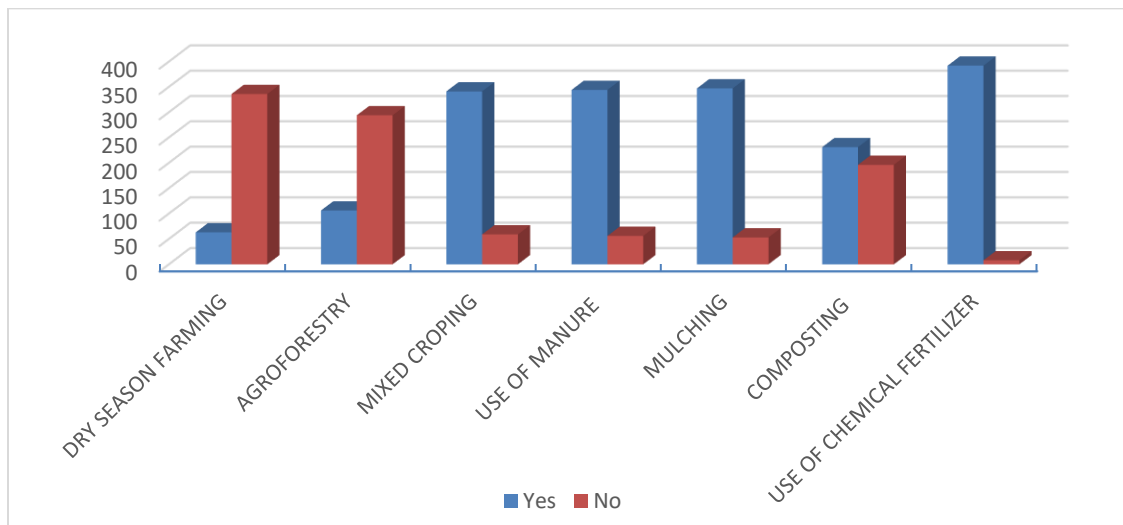


Figure 13: The CSA strategies farmers in the region practice

Source: field survey: June 2020.

Figure 14 revealed that the CSA strategy that is less practiced in the region is dry season farming. As low as 15.75% of the respondents practice dry-season farming. This is followed by agroforestry and composting with 26.5% and 57.75% respectively. Apart from those three strategies, over 70% of the respondents are practicing the other strategies. Mulching has the highest percentage (86.75%) of adopters. This is followed



by manure usage and mixed cropping with 86.00% and 85.25% respectively. All the respondents cited a lack of small-scale irrigation dams as the major reason why they are not practicing dry season farming when they were asked to explain. They also cited the unregulated nature of land use in the country as the reason why small-scale irrigation dams cannot be constructed. They indicated that most of the dam sites which served as their source of drinking water have all been leased to individuals for residential and commercial purposes. The same reason was cited for their inability to practice agroforestry even though they know the benefits they can derive from it. For example, a respondent said;

‘I used to plant a lot of trees on my farm because I know the importance of the trees to me but now all of the trees have been cut down by people who bought the land from the land owners to build their houses. this is why I cannot plant trees anymore’ (KI, Sagnarigu Municipal, Northern Region, Ghana, March 2020).

The application of chemical fertilizer is a common practice among smallholder farmers in the study area. An overwhelming majority (98%) of the respondents indicated that they apply chemical fertilizers on their farms. Only a few farmers (2%) indicated that they do not apply chemical fertilizers on their farms. The majority of the 2% comes from a community in the Sagnarigu municipality called Yongduuni where the farmers have adopted one particular type of compost called ‘Kpambirigu’. This is a mixture of ‘Kpambirigu’ (a bi-product of shea butter), rubbish, and other organic materials in a pit for it to decompose to become an organic fertilizer. This is

what almost all farmers in the community are using which allows them to use less chemical fertilizer. In a Key Informant Interview (KII), the respondent said,

when you apply too much of the Kpambirigu on your farm, the crop may overgrow which will result in low yield. He added 'the 'Kpambirigu' can last for more than two years on a piece of land and so many farmers in the community rely on it as their major source of manure for their crops(KI, Sagnarigu Municipal, Northern Region, Ghana, March 2020) '.

This was manifested in the clear absence of a refuse site in the entire community. This is because rubbish is the key input used in the making of 'Kpambirigu'.

What this means is that Ghana will benefit a lot if all farmers in the region will adopt 'Kpambirigu' as manure for their farms. This is because the absence of refuse in the communities as it is used to make 'Kpambirigu' will contribute more significantly to ensuring that the sanitation situation in the communities improves. This will lead to a reduction in the prevalence of diseases like cholera, malaria, and diarrhea. The other benefit the nation stands to gain is in the area of the environment. With a reduction in the use of chemical fertilizers, the lives of many microorganisms in the soil will be saved. This will be very good for the well-being of the environment.



4.5.2 Source of information about the CSA strategies practiced

Identifying the various sources of information for the CSA strategies practiced by smallholder farmers in the region is equally important as the identification of the CSA strategies practiced. The identification of these sources is very crucial in determining the best medium to communicate climate change and the effects of climate change communication on the adoption of CSA by smallholder farmers in the region. The respondents were, therefore, asked to indicate their sources of information for the CSA strategies they are practicing. The results of the findings are presented in fig. 16 below.

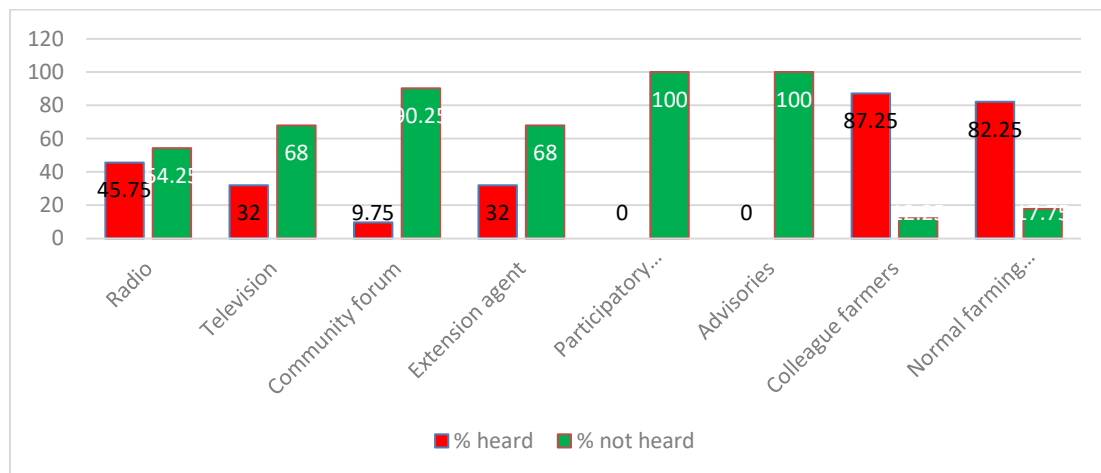


Figure 14: Source of information about the CSA strategies practiced (%)

Source: field survey: June 2020.

The results indicate that the source from which most of the farmers had information for the CSA strategies they practiced in their farms is their colleague farmers. Over 87% of the respondents had their colleague farmers as the source of information for the CSA strategies they practiced. This implies that out of every 100 respondents, over



87 of them had information about the CSA strategies they practiced in their farms from their colleague farmers with less than 13 respondents having got the information from other sources either than their colleague farmers. This is followed by a group of farmers whose CSA strategies are normal farming practices with 82% of the respondents. This also means that out of every 100 respondents, over 82 of them practice the CSA strategies as a normal farming activity they do on their farms.

Over 82% of the smallholders practicing the CSA strategies as conventional farming practice means that the much-touted CSA strategies were already being observed by our forefathers in response to the impact of climate change. This assertion is supported by the FAO (2017) when it states that ‘CSA is not a new product or a one-size-fits-all set of practices, but rather a three-tiered action-based approach to identify existing production systems that can best respond to the impact of climate change’. This means that apart from the dry season farming which goes with the availability of irrigation dams is a CSA strategy that is site-specific, the rest of the strategies such as mulching, composting and mixed farming are already being practiced by the farmers as a normal farming practice.

Similarly, 82% of the respondents who have their colleague farmers as their source of information for the CSA strategies they practiced on their farms is an indication of farmer-to-farmer information sharing in agriculture. It is, therefore imperative that climate change communicators transmit climate change information to farmers by putting them into groups. This will facilitate the transfer of information from one farmer to another. This view is supported by the Center for Research on



Environmental Decisions (CRED). According to CRED (2009), climate change communicators need to break the large group into smaller groups that can help initiate discussions and encourage early participation from various stakeholders. The suggestion of putting the farmers into groups is borne out of the belief that when stakeholders feel like they were part of the decision-making process they are likely to support the outcome.

The mass media (both radio and TV) come third and fourth where 45% and 32% respectively of the respondents received information about the CSA they practiced from. The implication is that out of every 100 respondents, more than 54 and 67 of them got information about the CSA strategies they practiced from other sources including normal farming practices other than radio and TV respectively. This suggests that even though the media is seen by most of the respondents as the best medium through which climate change communication can be done to make it effective, most of them do not get information about CSA strategies from the media. It can be speculated that the reason for this could be that CSA strategies are not being discussed in the media or the discussion is not being done properly or the farmers do not understand the language in which the issues are being discussed. Other authors share these same views.

For example, (Naab et al., 2019) noted that a significant number of farmers in the Northern Region are not formally educated and therefore find it difficult to make use of the current channels of communicating climate change information in the region because those channels are not suitable for them.



The mass media placing third in terms of farmers' source of information for the CSA strategies they practiced on their farms demonstrates the important role the media can play in disseminating climate change information to farmers and other end users. This view was supported by all the MoFA staff and other experts in climate change and agriculture (key informants). All these experts recommended the mass media (radio and TV) as the medium through which climate change and CSA strategies can be communicated to make it effective. Also, participants of the various FGDs conducted recommended the media as one of the best sources through which climate change communication and CSA information can be done if it is to be effective. These views of the respondents including that of the key informants and the Focus Groups are supported by Duper et al., (2019) who advised climate change communicators to combine face-to-face engagement with their audiences with digital outreach through media broadcast.



Table 6A: the implication of CCC on the adoption of CSA by smallholder farmers

CCC STRATEGY	CSA STRATEGY ADOPTED						
	Dry Season Farming						
Expert Discussion	1	2	3	4	5	Total	Chi2 (P value)
0	0	0	0	20	12	32	
1	6	10	0	30	14	60	10.6154(0.014)
Total	6	10	0	50	26	92	
	Manure application						
Expert Discussion	1	2	3	4	5	Total	Chi2 (P value)
0	2	4	2	74	14	100	
1	6	26	16	140	52	242	13.5028(0.009)
Total	10	30	18	218	65	342	
	Compost application						
Expert Discussion	1	2	3	4	5	Total	Chi2 (P value)
0	0	6	2	82	26	116	
1	10	22	4	130	68	234	10.8994(0.028)
Total	10	28	6	212	94	350	
	Mixed cropping						
Expert Discussion	1	2	3	4	5	Total	Chi2 (P value)



0	0	2	2	40	6	50	
1	2	12	6	140	30	190	1.5639(0.815)
Total	2	14	8	180	36	240	

Source: field survey: June 2020.

The table revealed that mixed cropping is the CSA strategy that most of the respondents are practicing as a result of the CCC strategies (expert discussion) adopted by climate change communicators in the region. This is because 170 (89.50 %) of the 190 respondents who practice mixed cropping held the view that the expert discussion as a CCC strategy has enabled them to practice mixed cropping while only 14 (7.5%) thought otherwise. Six (3%) of them were undecided.

Dry season farming is the CSA strategy with the least percentage of the respondents with the opinion that the expert discussion as CCC strategy has enabled them to practice dry season farming.

It is important to note that expert discussion as a CCC strategy has had a great impact on the decision of farmers to practice all four CSA strategies in the region. This is because over 70% of the respondents who practice each of these CSA strategies held the view that expert discussion as CCC strategy has enabled them to practice the CSA strategies.

The results of a Chi-Square again revealed that Expert Discussions had a significant effect on the CSA strategies except mixed cropping which has a $\chi^2=1.5639$ and P-Value= 0.815. Expert Discussion according to the findings had significant effects on

the manure application with $\text{Chi}^2=13.5028$ and $\text{P-Value}=0.009$, dry season farming with $\text{Chi}^2= 10.6154$ and $\text{P-Value}= 0.014$ and compost application with $\text{Chi}^2= 10.8994$ and $\text{P-Value}=0.028$.

This outcome suggests that our forefathers were already practicing many of the CSA strategies such as mixed cropping, manure application, and mulching. This suggestion is supported by one of the key informants when he said;

...you know our forefathers were very conscious of the environment and so they were applying strategies such as mulching, mixed coping, and so on...they were also planting trees because it is a religious belief (KI, Tamale Metropolis, Northern Region, Ghana, March 2020).

Also, during a focus group discussion, a member supported the argument about tree planting when he said;

... in Islam, one of the good deeds whose reward does not end is tree planting. When you plant a tree, you get a reward whenever someone sits under the tree. This reward will continue until the tree dies belief (KI, Tamale Metropolis, Northern Region, Ghana, March 2020).



Table 6B: the implication of CCC on the adoption of CSA by farmers

CCC STRATEGY	CSA STRATEGY ADOPTED.						Chi2 (P value)
	Dry season farming						
Interaction with AEA	1	2	3	4	5	Total	
0	0	0	0	34	18	52	
1	6	10	0	16	8	40	25.1895(0.000)
Total	6	10	0	50	26	92	
Interaction with AEA	Manure application						Chi2 (P value)
	1	2	3	4	5	Total	
0	2	8	6	140	18	174	
1	8	22	12	78	48	168	43.3108(0.000)
Total	10	30	18	218	66	342	
Interaction with AEA	Compost application						Chi2 (P value)
	1	2	3	4	5	Total	
0	4	8	0	146	46	204	
1	6	20	6	66	48	146	33.0708(0.000)
Total	10	28	6	212	94	350	
Interaction with AEA	Mixed cropping						Chi2 (P value)
	1	2	3	4	5	Total	
0	0	2	4	86	8	100	
1	2	12	4	94	28	140	14.3412(0.006)
Total	2	14	8	180	36	240	

Source: field survey: June 2020



This result is similar to the previous table (table 8A) with mixed cropping having the highest percentage (87%) of the respondents who are practicing it on their farms due to the influence of CCC (interaction with an extension agent). Again, dry season farming has the lowest percentage of respondents who agreed that interaction with extension agents as a CCC strategy has helped them to practice it as a CSA strategy.

One of the reasons is that farmers' ability to engage in dry season farming largely depends on the availability of water and not whether or not they have ever heard of it. That is, no matter how farmers are well informed about dry season farming they will not be able to engage in it if they do not have access to a water facility that will help them do so. Farmers' ability to practice dry season farming is therefore dependent on water availability than being well informed about dry season farming.

The results of a Chi-Square test also revealed that the CCC strategy (interaction with an extension agent) had significant effects on the CSA strategies adopted. Interaction of AEA as a CCC strategy was therefore seen to be more effective on the farmers' adoption of the CSA strategy. It had a $\chi^2 = 43.3108$ and $P\text{-value} = 0.000$ on manure application, $\chi^2 = 33.0708$ and $P\text{-value} = 0.000$ on compost application, $\chi^2 = 25.1895$ and $P\text{-value} = 0.000$ on dry season farming and $\chi^2 = 14.3412$ and $P\text{-value} = 0.006$ on mixed Cropping. The implication here is that when climate change communicators adopt the strategy of reminding the audiences about what our forefathers were doing in the olden days together with religious aspects of some of the CSA strategies, it will enhance the adaptation of the CSA strategies by smallholder farmers in the region in particular and the nation at large



CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

This chapter presents the summary, main conclusions, policy recommendations and suggestions for further studies based on the finding of this study.

5.2. Summary of the Study

The findings of the study indicate that there is a high level of awareness of climate change among smallholder farmers in the region. The majority (71%) of the respondents have heard of the concept “Climate Change” before whiles 29% of the respondents have never heard about the concept “of climate change”. Also, most members of the focus groups interacted with during the study indicated they have never heard of the concept “Climate Change.

The mass media (radio and television) discussions, community forums, participatory scenario planning, interaction with agricultural extension agents and interaction with colleague farmers were identified as some of the pathways through which climate change is communicated to smallholder farmers in the region. The mass media was identified by a higher proportion of the respondents as being the major source through which farmers hear about climate change. This makes the media a major source through which smallholder farmers in the region learn about climate change issues being discussed.



Due to the limited number of agriculture extension agents, they are unable to provide climate change information to smallholder farmers in Ghana and the Northern Region and so most of the respondents do not receive climate change information from these agents.

Female farmers are at a disadvantage as far as access to climate change and other agricultural information is concerned. The findings showed that the fact that most of the extension agents are males makes it difficult for female farmers to have access to climate change information from these agents.

An expert discussion was identified as the dominant approach in which issues about climate change are being transmitted. More than 95% of the respondents indicated that expert discussions are the forum in which they have ever heard climate change issues being discussed. The interaction with members of focused groups also indicated the same. Over (59%) of the respondents indicated that they heard of climate change issues during their interaction with agricultural extension agents.

A good number (66%) of the respondents believe that the communication channel through which they receive climate change information was appropriate. This means that, to these people, it is appropriate to communicate climate change to smallholder farmers through communication channels such as radio, television, extension agents, and community forums among others.



The mass media is regarded by most respondents as the most effective channel for communicating climate change. The reason for this view according to them is the wider coverage the mass media has. This allowed climate change communicators to reach out to many audiences when the media is used.

However, due to the limited number of agricultural extension agents, farmers no longer consider them the most effective medium of communicating climate change. Moreover, it was revealed that due to the complex nature of climate change issues, communicating climate change through opinion leaders such as chiefs, imams and pastors will not be feasible since it can result in serious distortions of the message. This is because most of these people do not understand the language used which makes it difficult for them to understand and effectively communicate climate change issues to their community members correctly. The complexities that are associated with climate change issues make it difficult to communicate climate change using opinion leaders in the communities without distortions.

Various challenges were identified to be hindering the ability of smallholder farmers to receive climate change information. The limited number of agricultural extension agents was, however, identified as the number one challenge farmers in the region face in accessing climate change information. Other challenges identified include the discussion of climate change issues being too scientific, using the language the local people do not understand, lack of mobile phone network, poor radio coverage or transmission and lack of access to radio sets.



The findings also revealed that farmers in the region practice various CSA strategies. These include; dry-season farming, agroforestry, mixed cropping, the use of manure, mulching and composting. Dry season farming is the CSA strategy with the least number of respondents practicing it. The small number of small-scale irrigation dams in the region was cited as the reason why smallholder farmers in the region are unable to practice dry-season farming.

The mass media, agricultural extension agents, advisories, colleague farmers, community forums and participatory scenario planning were identified as the major sources from which farmers receive information about the type of CSA they practiced. The results showed that there is a great deal of agricultural information sharing among the farmers in the region. This is because over 87% of the respondents had farmer-to-farmer communication as the source from which they hear the CSA strategy they practiced on their farms.

Most of the farmers already practice the CSA strategies as their everyday farming practices. As a result of this, over 82% of the respondents see the CSA strategies as traditional farming practices and reported no sources from which they learned about it. The media (TV and radio) appears to be the most effective medium through which climate change information can be communicated to the farmers in the region. Over 45% of the respondents who practice the various CSA strategies obtained information about the strategies from the media.



The making and application of compost, agroforestry and dry-season farming are the CSA strategy the people of the region now practice as a result of the CCC strategies adopted by climate change communicators in the region. As much as 85.71% of the respondents agreed that they practice composting because they obtained information about it through CCC while 66.50% and 57.13% accepted that CCC has enabled them to practice agroforestry and dry season farming respectively. According to (Gbetibouo et al., 2017), farmers who participated in the PSP have started implementing CSA strategies such as planting early-maturing crops and composting after they participated in the PSP

The CSA strategy which the majority of the respondents practiced not because of the CCC strategy in the region is mixed cropping whereas only 5% of the respondents said they practice it as a result of the CCC strategy in the region.

5.3. Conclusions of the Study

1. There is a high level of awareness of climate change among smallholder farmers in the region.
2. There are many pathways through which farmers in the region access climate change information but mass media stands out as the major pathway through which climate change is communicated to farmers in the region.
3. The limited number of extension agents in the country makes the agents an inefficient source for sharing climate change information in the region. It is difficult for farmers to access climate change information from these agents. The situation is worse when it comes to women farmers because most of the

agents are men and societal issues make it difficult for these female farmers to seek climate change and other agriculture information from them.

4. The main approach by which issues about climate change are being transmitted to farmers in the region is expert discussion. This is where a person with in-depth knowledge of climate change and other agricultural issues discussed those issues through various channels.
5. It is very appropriate to communicate climate change to smallholder farmers through communication channels such as radio, television, extension agents, and community forums among others. This is because almost every farmer in the region has access to one or two of these channels. However, due to the complex nature of climate change issues, communicating climate change through opinion leaders such as chiefs, imams and pastors will not be feasible since it can result in serious distortions. This is because most of these people cannot communicate climate change.
6. An inadequate extension agent is the major challenge farmers in the region face in accessing climate change information. Other challenges include using the language the local people do not understand, lack of mobile network and poor radio network.
7. Farmers in the region practice various CSA strategies such as dry season farming, agroforestry, mixed cropping, use of manure, mulching and composting.
8. There is a high degree of farmer-to-farmer information flow in the region. Most of the farmers had their colleague farmers as the source of information



for the CSA strategy they practice. Other sources of information include the mass media and extension agents.

5.4. Recommendations

There is an urgent need for stakeholder institutions and organisations such as MoFA and Ghana Irrigation Development Authority (GIDA) to put in place various measures that will go a long way to address those challenges and also sustain the gains made as far as farmers' adaptation to climate change is concerned.

There is a need for MoFA to train and recruit more agricultural extension agents especially women extension agents to the farming communities in the region. This will reduce the ratio of the extension agent-farmers in Ghana which currently stands at about 1:1500. This will also enhance the ability of farmers, especially women farmers to access extension services and improve the productivity of their enterprises.

The Participatory Scenario Planning (PSP) which was implemented by CARE International in some parts of the region should be replicated in all parts of the country. Metropolitan, Municipal and District Assemblies (MMDAs) should team with CARE International to get this done. This can be done by bringing together all stakeholders in the agricultural sector to develop and co-produce climate change information that is relevant to local decision-making, planning and ensuring two-way climate change information sharing between community members and climate change scientists. This will assist farmers in the communities to actively participate in the



sharing of climate change information strategies for disaster preparedness and agricultural planning.

It is strongly recommended that the mass media should be used in communicating climate change in the region. This will ensure that community members have access to climate change information since most of the respondents regard the media as the most effective medium through which climate change can be communicated. The mass media especially television and radio are regarded by most of the respondents as an effective and efficient tool for conveying climate change information to community members. MoFA staff at the various MMDAs and other climate change communicators can combine face-to-face engagement with their audiences with pictorial and digital outreach through the use of media broadcasts.

There should be a collaboration between the National Media Commission (NMC) and MoFA on the use of the media to communicate climate change in the region at a lesser cost. Given the high cost associated with running programmes in the media, MoFA, NMC and other players within the media landscape can collaborate to ensure that this is done at a moderate cost. All the extension agents who were contacted as key informants identified the high cost associated with running CCC programmes in the media as a major challenge hence the need to find ways and means to reduce the cost. The NMC should also guide the content of climate change communication programmes. This is to ensure that the communication programmes will improve the understanding of adaptation challenges creating awareness of the adaptation pathways



and encouraging the use of dialogue with key stakeholders with a focus on knowledge co-generation.

There is an urgent need for climate change communication and adaptation programmes in the mass media should be sustained. This is critical in ensuring that community members properly adapt to climate change. This is based on the fact that most of the respondents indicated that they wished the adaptation programmes were continued.

The identified CSA strategies in the study should be promoted and supported by MoFA, GIDA and MMDAs to make households in the region more resilient and improve their adaptive capacity to climate change. Some of these adaptation programmes are environmentally friendly because rubbish is the main input in making them, especially kpambirigu and other compost. This means that the country stands to benefit immensely if those activities are encouraged in the communities because it will lead to environmental cleanness with its attendant benefits such as good hygiene and good health.

MoFA, GIDA and the MMDAs need to collaborate with industry players within the mass media industry to ensure that these climate change communication and adaptation programmes are sustained. In doing this, the community members should not be left out. They have to be involved in designing and implementing the various programmes and projects so that they feel a sense of ownership of those programmes. This will enhance the sustainability of the programmes and projects.



Since farmers share a lot of agricultural information including climate change among themselves, there is a need for MoFA and GIDA to create farmers' groups at the community, district and regional levels. The study identified farmer-to-farmer information sharing as one of the main sources of information flow for the CSA strategies that are being practiced in the region. These groupings will facilitate the interaction between climate scientists and the local people thus, the sharing of information on climate change and adaptation strategies. Larger groups can be broken into smaller groups for easy management and effective information delivery. This will help improve information sharing between climate change experts and the local people themselves.

Moreover, MoFA, GIDA, GMet and EPA need to formulate specific climate change adaptation policies and programmes that are linked to enhancing livelihood diversification. For example, alternative energy sources such as the use of sawdust as fuel for cooking instead of wood can be promoted by the various MMDAs in their communities. Furthermore, programmes that are tailored towards income-generating activities such as skill training in craftsmanship should be incorporated into the national climate change adaptation strategies. These will enable farming households to venture into livelihood activities such as rearing livestock. It will also reduce the pressure that is put on the environment and enhance the sustainability of the biodiversity of the ecosystem.

5.5 Areas for Further Study

The implications of Climate Change Communication for the Adoption of Climate-Smart Agriculture by Smallholder Farmers in the Northern Region of Ghana have been done. The CSA strategies adopted by smallholder farmers in the region and the challenges farmers in the region faced in accessing climate change information among others have been identified.

It is strongly recommended that research studies be conducted on the implication of climate change communication for the adoption of Climate-Smart Agriculture by smallholder farmers in other parts of the country. It might be interesting to see that the finding will not be the same for the other regions. A study on the effectiveness of E-extension in disseminating agricultural information to smallholder farmers is also worthwhile.



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