

CHRISTIAN SERVICE UNIVERSITY COLLEGE

**IMPACT OF CLIMATE CHANGE ON THE LIVELIHOOD OF WOMEN IN
AGRICULTURE IN GHANA: A CASE STUDY OF DONKOKROM**

BY

ANIMAKO ADAMS AMIDESTY

(16000721)

**DISSERTATION SUBMITTED TO THE DEPARTMENT OF PLANNING
AND DEVELOPMENT OF THE FACULTY OF HUMANITIES; CHRISTIAN
SERVICE UNIVERSITY COLLEGE, IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE
IN MONITORING AND EVALUATION**

SEPTEMBER 2023

DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in this University or any other University.

Candidate's Signature Date

Animako Adams Amidesty

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of the dissertation laid down by Christian Service University College.

Supervisor's Signature: Date:

Name: Dr. Nicholas Kofi Nti

ABSTRACT

The study set out to investigate the impact of climate change on the livelihood of women in agriculture in Ghana using Donkokrom as the research setting. The researcher employed quantitative research specifically, descriptive and correctional methods to study the phenomena. A total of one-hundred and fifty (150) survey questionnaires were distributed to female farmers in Donkokrom. Upon following up with the farmers, ninety questionnaires were received. Five questionnaires were excluded from the final data analysis due to incompleteness. Therefore, a total of eighty-five questionnaires were used for the analysis representing 56.7%. Descriptive statistics and hierarchical regression were used for the analysis with the help of SPSS version 20. The finding shows that the majority of the respondents indicated that for the last 10 years, access to rainfall patterns has Changed/alterd while only a few of them opined that they don't know. Most of the respondents indicate that changes are caused by climate change-related reasons while the minority selected other related issues such as superstition/religion. In terms of challenges of climate change on their farming activities, the result revealed that the majority of the women farmers select bushfires as the major challenge they face followed by the rising day temperature, floods, Persistent drought, Early cessation of the rainy season, less rain during the rainy season, Erratic rainfall during the rainy season, Rising night-time temperatures, Late onset of the rainy season, More rain during the rainy season, and the uncertain onset of the rainy season. Finally, the impact of climate change adaptive strategies on the livelihood of the farmers revealed that all the independent variables – Seed Variety, Soil Moisture Retention Techniques, Soil Fertility Techniques, and Irrigation Infrastructure significantly improved the livelihood of the women farmers in the country. Recommendations were put forth for the stakeholders and future researchers.

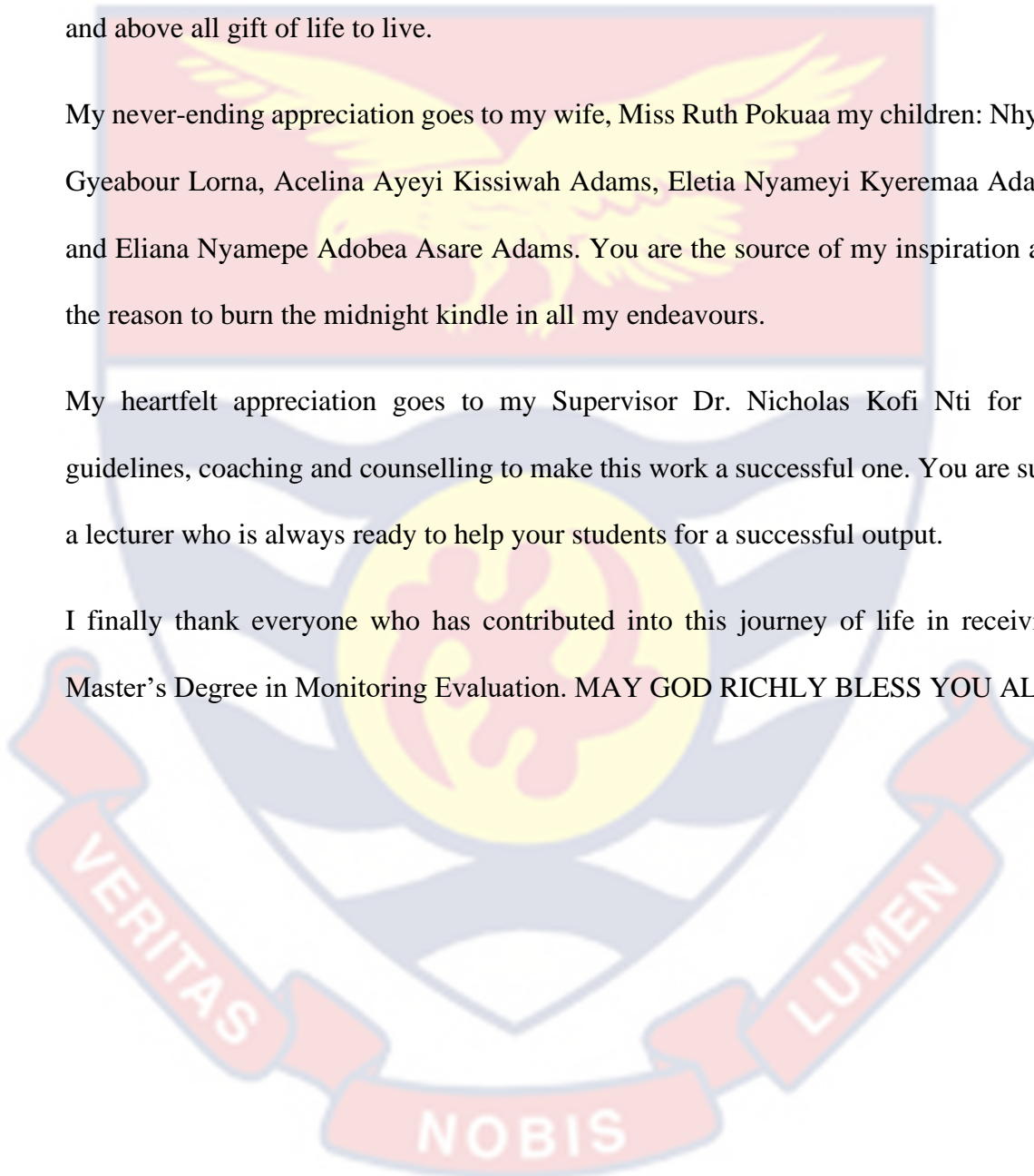
ACKNOWLEDGEMENT

The great gift of living on earth God has endowed me is the gift of life, through this study where I was at Kwahu Afram Plains North moving from Donkokrom to Kumasi every week. My topmost gratitude goes to Almighty God for inspiration, knowledge, and above all gift of life to live.

My never-ending appreciation goes to my wife, Miss Ruth Pokuaa my children: Nhyira Gyeabour Lorna, Acelina Ayeyi Kissiwah Adams, Eletia Nyameyi Kyeremaa Adams and Eliana Nyamepe Adobea Asare Adams. You are the source of my inspiration and the reason to burn the midnight kindle in all my endeavours.

My heartfelt appreciation goes to my Supervisor Dr. Nicholas Kofi Nti for his guidelines, coaching and counselling to make this work a successful one. You are such a lecturer who is always ready to help your students for a successful output.

I finally thank everyone who has contributed into this journey of life in receiving Master's Degree in Monitoring Evaluation. MAY GOD RICHLY BLESS YOU ALL.



DEDICATION

This academic research work impact of climate change on the livelihood of women in agriculture in Ghana: a case study of Donkokrom is dedicated to God the Father, the Son and the Holy Spirit for the strength, wisdom, directions and ideas endowed me to come out.

Heavenly Father, I am forever grateful to you.

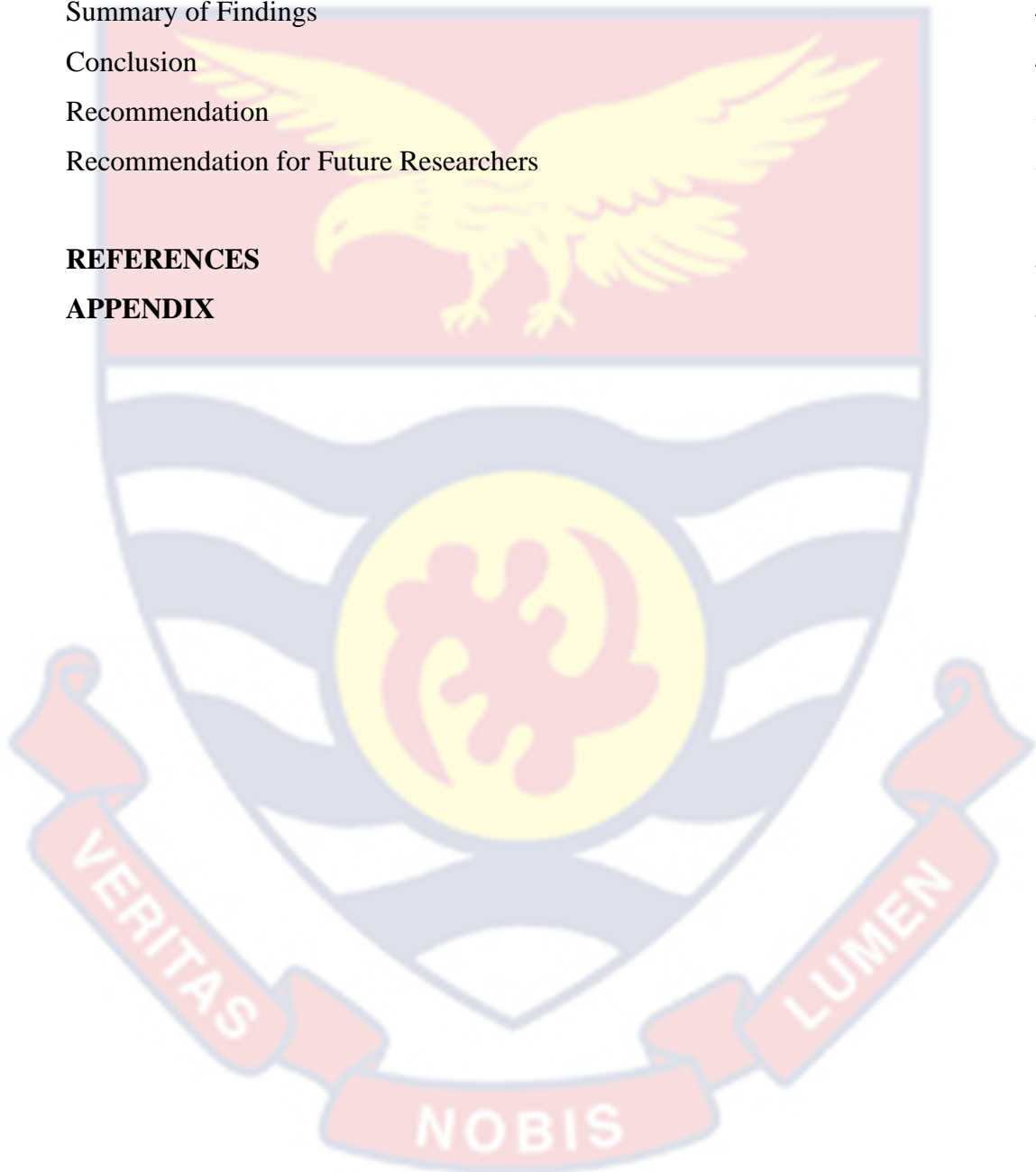


TABLE OF CONTENTS

DECLARATION	ii
ABSTRACT	iii
ACKNOWLEDGEMENT	iv
DEDICATION	v
TABLE OF CONTENTS	vi
LIST OF TABLES	ix
LIST OF FIGURES	x
CHAPTER ONE	1
INTRODUCTION	1
Background to the Study	1
Problem Statement	2
Research Objectives	4
Research Question	5
Significance of the Study	5
The Scope of the Study	6
Limitation of the Study	6
Definition of Terms	7
Organization of the Study	7
CHAPTER TWO	9
LITERATURE REVIEW	9
Introduction	9
Theoretical Frameworks	9
The Feminist Theory	9
Sustainable Livelihoods Framework (SLF)	11
Conceptual Framework	13
Concept Review	13
Climate Change	13
Livelihood	14
Women In Agriculture	15
Empirical Review	16

Climate Change Level of Awareness among Women Farmers	16
Challenges of Climate Change among Women in Agriculture	18
Climate Change Adaptation Strategy Used by Women in Agriculture	20
Impact of Climate Change Adaptation on the Livelihood of Women in Agriculture	22
Synopsis	24
CHAPTER THREE	25
METHODOLOGY	25
Research Approach	25
Research Design	25
Study Area	26
The Population of the STUDY	27
Sample and Sampling Size	28
Sampling Technique	28
Research Instrument	29
Data Collection Procedure	30
Data Analysis	30
CHAPTER FOUR	31
DATA ANALYSIS AND DISCUSSION	31
Introduction	31
Demographic Profile	31
Level of Awareness of Issues Regarding Climate Change among Women in Agriculture	32
Adaptation Strategies Used by Women in Agriculture to Overcome Climate Change Challenges	35
Climate Change Challenges Women in Agriculture Face in the Course of their Farming Activities	37
The Impact of Climate Change Adaptation Strategies on the Livelihood of Women in Agriculture in Donkokrom	39
Preliminary Analyses	39
Reliability Levels of the Scale	39
Data Distribution and Descriptive Statistics	40
Correlation Matrix	42

Testing of Hypothesis	44
CHAPTER FIVE	48
SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATION	48
Introduction	48
Summary of Findings	48
Conclusion	49
Recommendation	51
Recommendation for Future Researchers	52
REFERENCES	54
APPENDIX	57



LIST OF TABLES

Table 1: Demographic Characteristics (N=85)	32
Table 2: Climate Change Awareness of Female Farmers (N = 85)	35
Table 3: Adaptation strategies of Female Farmers	37
Table 4: Challenges as Applied to Your Farming Activities	38
Table 5: Cronbach alpha (α) for Reliability Test	40
Table 6: Distribution of Data and Descriptive Statistics	41
Table 7: Correlation Matrix	43
Table 8: Climate Change Adaptive Strategies and Livelihood of Women in Agriculture	47



LIST OF FIGURES

Figure 1: The Map of Donkokrom in the Afram Plains.



CHAPTER ONE

INTRODUCTION

This part of the study deals with the background issues of Climate Change and Women in Agriculture. It goes further to advance the problem statement for the study. The study further looks at the research question which emanates from the problem statement and research objectives. The chapter concludes with delimitations, limitations, and the significance of the study.

Background to the Study

The United Nations' Sustainable Development Goals dedicated Goal 5 to issues concerning gender equality. It stresses ending all forms of discrimination against women and girls everywhere especially violence and exploitation to give equal rights and opportunities in the workplace or any employment (United Nations, 2015). This will ensure that women are empowered to participate in all forms of activities and promote balanced social, economic, and environmental sustainability. Studies have shown that climate change and Covid 19 pandemic have affected the lives and livelihoods of women as they are more vulnerable and highly exposed (World Bank, 2020). The atmosphere, the hydrosphere, the cryosphere, the land surface, and the biospheres that interact among them make up the five parts of the climate system.

The land is a section used for agricultural activities and researchers have reported that climate change is a major challenge to the environment. Climate change is a global phenomenon that has been affecting various aspects of life on Earth. Among the most affected are agricultural practices and the livelihood of those who rely on them. Women, in particular, are more vulnerable to the impacts of climate change due to their limited access to resources, lack of decision-making power, and traditional gender roles. Agriculture is the backbone of many economies, particularly in developing

countries, and women play a significant role in the sector. They are involved in various activities, including planting, harvesting, and post-harvesting activities.

However, climate change has led to a decline in agricultural productivity, with extreme weather events such as floods and droughts, among others, causing crop failure and livestock losses. The impact of climate change on agriculture and livelihoods has been studied extensively. Nevertheless, little attention has been paid to how the phenomenon affects women in agriculture. This research seeks to fill this gap by exploring the impact of climate change on the livelihood of women in agriculture. The study examines the various ways in which climate change affects women in agriculture, including their access to natural resources such as water, land, and forests, as well as their ability to generate income from their agricultural activities. The research also explores the coping mechanisms used by women to deal with the impacts of climate change, including the use of new technologies, adaptive strategies, and social networks.

In addition, the study aims to provide insights into the specific challenges that women in agriculture face due to climate change, and the potential solutions that can be implemented to mitigate these challenges. The findings of this study will be useful to policymakers, development organizations, and other stakeholders in designing and implementing climate change adaptation strategies that take into account the specific needs and vulnerabilities of women in agriculture.

Problem Statement

Climate change is a global phenomenon that has caused significant impacts on various sectors of human life, including agriculture – crop yields, livestock production, and land use. Climate change has led to changes in weather patterns, including increased temperatures and irregular rainfall, which affect crop yields. It is eroding the

health, environmental, economic, social, and agricultural stability of the ecosystem and livelihood around the world. Although climate issues affect both men and women without any form of discrimination, it is documented that, women are affected most because they are most vulnerable and engaged in agricultural activities as sources of livelihood (Hellen, 2019).

Researchers have reported that women contribute enormously to agricultural growth and development in the areas of fisheries, animal husbandry, horticulture, and crop production. For instance, statistics indicates that agriculture supports a large proportion of women in emerging and developing economies in Asia and Africa (FAO, 2019) as the majority of them engage in peasant and backyard farming. It is documented that they carry the burden of domestic care work, especially in Sub-Saharan which occupies a large portion of their productive time (Care International, 2019). Ezatollah, et al. (2018) pointed out that while assessing the potential impact of climate change on agriculture and livelihood, it is imperative to examine the female factors because they are the backbone of food production in developing countries. The processes that inform their farming decisions, adaptation skills, and their response to farming challenges are essential to address (Karami, 2012). From a public policy perspective, understanding the adaptation strategies of women in agriculture will aid policymakers in developing a comprehensive plan to address climate change and environmental sustainability issues (Glass et al., 2015; Hillman, 2015).

In Ghana, research has been conducted regarding the effect of climate change on agricultural activities. For instance, Wrigley-Asante et al., (2019) conducted a study in two administrative municipalities that fall within the Forest-Savannah Transition Zone – the Ejura-Sekyedumase Municipality in the Ashanti region and the Wenchi Municipality in the Brong-Ahafo region. The study discovered that rainfall patterns

have drastically changed according to the respondents. Both male and female farmers shared the same views. The study of Abdul-Razak and Kruse (2017) conducted in the West Mamprusi district in the Northern Region of Ghana also reported that both female and male farmers stressed the dynamic changes that have taken place in the region due to climate change issues. Despite women bring major contributors to agricultural production and food security in developing countries such as Ghana, they are often disproportionately affected by climate change, which poses a significant threat to their livelihoods (Nketiah-Amponsah et al., 2018). The most fascinating issue is that the voices of women in agriculture in the Sub-saharan African especially Ghana are missing from literature and policy. Few researchers such as (Wrigley-Asante et al., 2019; Abdul-Razak & Kruse, 2017) tried to throw light on the phenomenon. However, their studies did not focus on women in agriculture but rather on farmers in general. Therefore, this study tries to fill such a gap by focusing on climate change issues facing only females in agriculture. Nketiah-Amponsah et al. (2018) argued that the lack of adaptive capacity and resilience among women farmers in Ghana combined with gender inequalities and the exacerbated impact of climate change on their livelihoods warrant research targeting such groups. Thus, it is crucial to examine the extent and nature of the impact of climate change on women in agriculture in Donkokrom in the Kwahu Afram Plain North, Eastern Region of Ghana, to understand the underlying factors, and to identify potential interventions that can help mitigate the adverse effects and enhance their resilience.

Research Objectives

The study seeks to investigate the impact of climate change on the livelihood of women in agriculture in Ghana. The specific objectives that will guide the researcher include:

1. To assess the level of awareness of issues regarding climate change among women in agriculture in Donkokrom in Afram Plains
2. To identify climate change challenges women in agriculture face in the course of their farming activities in Donkokrom in Afram Plains
3. To identify adaptation strategies used by women in agriculture to overcome climate change challenges in Donkokrom in the Afram Plains
4. To assess the impact of climate change's adaptation strategies on the livelihood of women in agriculture in Donkokrom in Afram Plains

Research Question

This study questionnaire will be guided by the following specific research questions;

1. What is the level of awareness regarding climate change among women in agriculture in Donkokrom in Afram Plains?
2. What climate change challenges do women in agriculture face in their farming activities in Donkokrom in Afram Plains?
3. What adaptation strategies do women in agriculture use to overcome climate change challenges in Donkokrom in Afram Plains?
4. What is the impact of climate change adaptation strategies on the livelihood of women in agriculture in Donkokrom in Afram Plains?

Significance of the Study

First, this study will contribute to issues affecting females in agriculture, particularly in the area of climate change and its influence on their agricultural activities. Because understanding how climate change affects women's livelihoods in agriculture can help develop policies and interventions to support them.

Second, the study will also help policymakers in Ghana especially the Ministry of Agriculture and Environmental Development Agency to implement a policy that will address climate change issues impacting the agricultural activities in Ghana.

Third, the study will serve as educational resource material for Universities and colleges offering agricultural programmes in the country. This will support their teaching and learning activities.

Finally, the study will set a tone for future researchers to develop an interest in climate change issues in the country and its dire consequences on females in agriculture.

The Scope of the Study

Contextually, the study centered on climate change and women in agriculture, a case of Donkokrom in the Kwahu Afram Plains District. Specifically, the study looked at the effects of climate change on women in agriculture. How climate change affects women in agriculture, the community, and the farming population as well, meanwhile, the core is on women in agriculture.

Limitation of the Study

The current study only focused on the female farmers within Donkofrom in the Kwahu Afram Plains District. The study only assessed issues such as climate change adaptation strategies among the farmers, challenges associated with climate change, and how the adaption strategies influence the livelihood of female farmers within the District. Methodologically, the study is limited to descriptive and correlational methods.

Definition of Terms

Climate change refers to the long-term changes in weather patterns, including temperature, precipitation, and wind, resulting from natural and human-induced factors such as greenhouse gas emissions.

Livelihood refers to how people earn a living, including their resources, capabilities, and activities.

Women in agriculture refer to women who are engaged in agricultural activities such as crop cultivation, livestock rearing, and fisheries.

Adaptation refers to the process of adjusting to the effects of climate change, which may involve modifying agricultural practices, diversifying income sources, and developing new skills and technologies.

Sustainable agriculture refers to agricultural practices that are environmentally responsible, socially equitable, and economically viable, which may include the use of renewable resources, conservation of biodiversity, and promotion of fair trade.

Organization of the Study

There are five primary chapters in this work. General Introduction is the title of the first chapter. It focused on the study history, problem statement, research questions, and objectives as well as scope, quick methodology, and organizational structure. "Literature review" is the title of the second chapter. It concentrated on a review of the pertinent literature on climate change and women in agriculture, a review of the theories supporting the study, a review of the conceptual framework, and an empirical review of studies that were similar to this one. The research design, research population, sampling size and methodologies, data collecting and analysis, and ethical

considerations were all included in the study's third chapter, "methodology". The study's conclusions were presented in the fourth chapter, which focused on the "analysis and discussion of data." The study's summary of findings, conclusions, and policy suggestions was covered in the last chapter.



CHAPTER TWO

LITERATURE REVIEW

Introduction

This section focuses on a review of academic theories related to climate change and women in agriculture. The conceptual review, theoretical review, and empirical review are the three primary sections of the chapter. The different concepts that provide a thorough comprehensive subject are covered in a conceptual review. The empirical review is focused on other academic research in the domain of climate change and women in agriculture whilst the theoretical review also addresses the body of theories that underpin the study.

Theoretical Frameworks

One of the most serious environmental issues facing the world today is climate change, which has a negative impact on the lives of millions of people. The impact of climate change on agriculture, particularly on the livelihood of women in agriculture, has been widely studied in the literature. In this study, we draw on several theoretical frameworks to understand the impact of climate change on the livelihood of women in agriculture. The theories underpinning this study include the Feminist Theory and Sustainable Livelihoods Framework (SLF).

The Feminist Theory

According to Pedwell (2006), feminist theory is a social, political, and intellectual movement that aims to eradicate gender inequality and dismantle gender-based power structures. It is argued that modernity, with its emphasis on development, equality, and reason, gave rise to feminism. However, post-structuralism's influence has resulted in what has been referred to as a "paradigm shift" within feminism (Pedwell, 2006), placing a greater emphasis on variety, difference, and positionality. The theory

first appeared in the late 19th and early 20th centuries and has since grown into a broad school of thought that includes a range of viewpoints and strategies.

The theory is based on the idea of gender equality and the conviction that comprehending societal issues requires a thorough grasp of the viewpoints and experiences of women (Assaduzzaman, Filatova, Lovett, & Frans, 2023). The feminist theory emphasizes the gendered aspect of climate change impacts in the context of climate change and contends that women are disproportionately affected by climate change as a result of their social and economic positions (Pedwell, 2006). Gender disparities have been identified in farming families, agricultural businesses, and rural communities through this research. It has demonstrated how the lives of women are shaped by the patriarchal system of power and masculine supremacy (Assaduzzaman, Filatova, Lovett, & Frans, 2023). Even while older men continue to own the land, manage women's labor, and make agricultural choices under patriarchal social systems, women continue to carry out the bulk of the work in agriculture globally, say Rainard, Smith, and Pachauri (2023). It has also been emphasized that agrarian ideology and discourses have produced idealized representations of rural life that justify the exploitation of women (Rainard, Smith, & Pachauri, 2023). Furthermore, feminist research on farm women has revealed how extensive women's work is and how it is both invisible and underappreciated (Assaduzzaman, Filatova, Lovett, & Frans, 2023).

Women are frequently in charge of food production in the agricultural sector, and as a result of climate change impacts like droughts, floods, and extreme weather events, they are more likely to be food insecure. Therefore, the goal of this study is to comprehend the particular difficulties that women in agriculture have as a result of climate change and their adaptive strategies to mitigate the impact of the phenomenon on their farming activities in Donkorkrom.

Sustainable Livelihoods Framework (SLF)

As emphasized by Roe (1998), "sustainable livelihoods" may mean different things to different individuals, but what unifies the various approaches is the need to reduce the complexity and uncertainty that give rise to demands for sustainable livelihoods in the first place. Sustainable livelihoods (SL) may be seen as a method of thinking about the objectives, scope, and priorities for development to hasten the process of eradicating poverty. The sustainable livelihoods technique is a thorough approach that aims to grasp and capture the fundamental aspects and root causes of poverty without focusing just on a select few problems (such as financial worries, food security, etc.).

Additionally, it attempts to outline the connections between the various facets (causes, manifestations) of poverty, allowing for more efficient operational prioritization of action. The Sustainable Livelihoods method (or approaches, given that there is no one right way to go about things) tries to assist the poor in achieving sustainable livelihoods, as assessed by poverty indicators that they define.

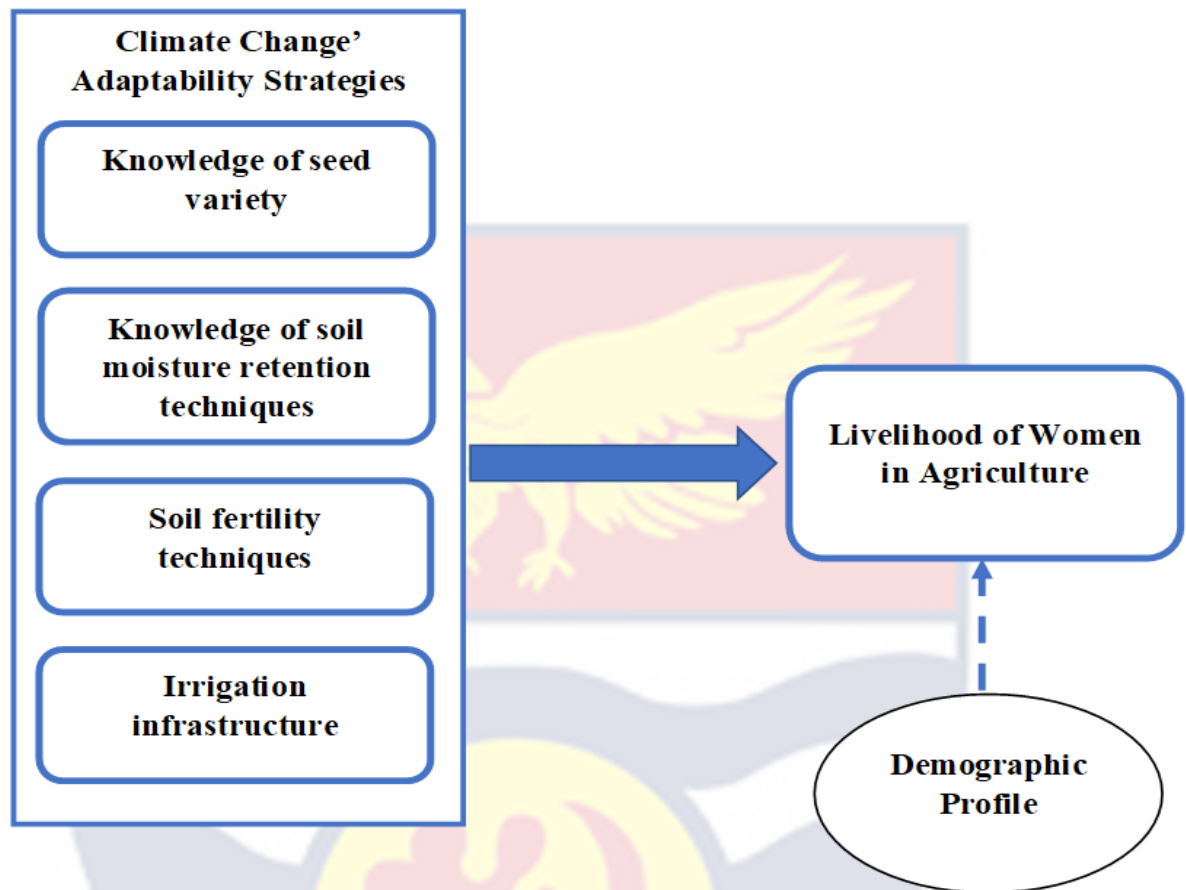
A livelihood is defined by Chambers and Conway (1992) as the skills, possessions (stores, resources, claims, and access), and activities required for a means of sustenance. A livelihood is considered sustainable if it can resist stress and shocks, recover from them, preserve or develop its skills and resources, and provide possibilities for the future generation to live sustainably. On a local and global scale, it should also have a positive net impact on other forms of employment. The following materials are commonly acknowledged as assets within the sustainable lifestyles hypothesis, according to McLeod (2001): Natural resources (land, water, animals, biodiversity, and environmental resources) and natural (environmental) capital. Basic infrastructure, such as housing, electricity, transportation, and communications, is

referred to as physical capital. It also includes the tools and machinery used in industry. Health, knowledge, skills, information, and the capacity to work are all aspects of human capital. Social capital refers to assets on the social side, such as networks, relationships of trust, participation in organizations, and access to larger institutions. Last but not least, financial capital comprises readily accessible financial resources such as pensions, remittances, savings, and lines of credit.

However, McLeod (2001) recommends a number of changes to the asset categories that serve as the foundation for SL theory, as well as the addition of two additional assets: institutional knowledge and institutional or political capital. The human asset base's information, knowledge, and abilities do not, in the opinion of Lowe and Schilderman (2001), acquire the attention they merit. However, the SL method offers a conceptual and programmatic framework for the long-term reduction of poverty. In contrast to more traditional methods that have sought to battle poverty by identifying and addressing poor people's needs, the SL approach seeks to improve the lives of poor individuals by building on what they already have, or their assets (UNDP, 1999).

The term "livelihood strategies" refers to the different pursuits people make to make a living, such as farming, fishing, or wage work. The numerous effects that various interventions can have on people's livelihoods, such as changes in income, food security, or general well-being, are known as livelihood outcomes (Manda et al., 2021; Archer et al., 2018). The SLF places a strong emphasis on recognizing and enhancing the many sources of livelihood that individuals utilize to withstand environmental shocks and stressors.

Conceptual Framework



Source: (Manda et al.,2021)

Concept Review

Climate Change

According to Khatri-Chhetri et al. (2020), "climate change" is the long-term transformation of the Earth's climate, which includes variations in temperature, precipitation, and wind patterns. According to Chandra et al. (2017), it is generally accepted in the scientific community that human actions like the burning of fossil fuels, which releases significant quantities of greenhouse gases into the atmosphere, are to blame for climate change. The recent report of the Intergovernmental Panel on Climate Change (IPCC) highlighted that it is unequivocal that human influence has warmed the atmosphere, oceans, and land, and that many of the observed changes in the climate

system are unprecedented in thousands if not hundreds of thousands, of years (Alston et al., 2018). The phenomenon has a disproportionate effect on the vulnerable in society especially women and children. The study also emphasizes the serious risks and effects of climate change, such as the frequency and severity of severe weather events increasing, sea level rise, and biodiversity loss.

Livelihood

According to Morse and McNamara (2013), livelihood refers to how people make a living, encompassing their capabilities, assets, and activities required to survive and thrive. It is a crucial aspect of sustainable development and poverty alleviation, particularly in low-income countries (Morse & McNamara, 2013). Numerous studies have explored the different dimensions of livelihood and its impact on individuals and communities. For instance, De Haan and Zoomers (2005) examined the relationship between livelihood diversification and poverty reduction in rural areas of developing countries. The study found that livelihood diversification can help households reduce their vulnerability to external shocks and improve their income levels. Ellis and Mdoe (2003) also explored the impact of livelihood strategies on household well-being in Tanzania. The study highlighted that diversification of livelihood strategies is a key factor in achieving sustainable livelihoods, and that access to assets and resources, as well as social networks, play a critical role in shaping livelihood outcomes. A study by DFID (2001) examined the impact of livelihood interventions on poverty reduction in different regions of the world. The study found that livelihood interventions can contribute to poverty reduction by enhancing income, creating employment opportunities, and improving access to services and assets.

Furthermore, Bebbington (1999) explored the concept of sustainable livelihoods and its application to rural development in Latin America. The study

reported that sustainable livelihoods can contribute to poverty reduction by building resilience and increasing economic opportunities, while also promoting social and environmental sustainability. Livelihood is a complex concept that encompasses a range of factors that influence an individual's ability to make a living. Studies have shown that livelihood diversification, access to resources and assets, and social networks are key determinants of livelihood outcomes and that interventions aimed at promoting sustainable livelihoods can contribute to poverty reduction and sustainable development (Morse & McNamara, 2013).

Women In Agriculture

Women have been involved in agriculture since the dawn of civilization. However, their contributions have often gone unrecognized and undervalued (Wrigley-Asante et al., 2019). Studies have demonstrated that women play a critical role in global food production and are key contributors to the agricultural sector. For instance, it is important to note that women comprise a significant portion of the agricultural labor force globally. The Food and Agriculture Organization (FAO, 2016) estimates that women make up 43% of the work force in agriculture in developing nations. In sub-Saharan Africa, women work in agriculture at a rate of over 50%. Despite this, women often face significant challenges and barriers to their participation in agriculture, including limited access to resources such as land, credit, and inputs, as well as gender-based discrimination and cultural norms (Chandra et al., 2017).

Studies have shown that empowering women in agriculture can have significant positive impacts on food security and economic development (Wrigley-Asante et al., 2019). For example, a study by the International Food Policy Research Institute (IFPRI) found that improving women's access to agricultural resources could increase agricultural productivity by 2.5 to 4%, which could help to reduce global hunger by 12

to 17%. Additionally, a study by the World Bank found that increasing women's control over land could lead to higher crop yields, increased household income, improved health outcomes, increased education levels, and reduced poverty.

Despite the significant contributions of women to agriculture, they often face significant challenges and barriers to their participation. These challenges include limited access to resources such as land, credit, and inputs, as well as gender-based discrimination and cultural norms (Nketiah-Amponsah et al., 2018). Addressing these challenges and empowering women in agriculture is critical to achieving global food security and sustainable development (Chandra et al., 2017). In conclusion, women play a critical role in global food production and are key contributors to the agricultural sector. Empowering women in agriculture can have significant positive impacts on food security, economic development, and long-term community well-being (Nketiah-Amponsah et al., 2018). However, significant challenges and barriers to women's participation in agriculture persist, and more needs to be done to address these challenges and promote gender equality in the agricultural sector.

Empirical Review

Climate Change Level of Awareness among Women Farmers

Climate change is a pressing issue that affects all sectors of society, including agriculture. According to studies, women who work in agriculture are particularly susceptible to the effects of climate change because of their socioeconomic situation, level of knowledge, and restricted access to resources. For instance, Sarker and Alam (2018) conducted a cross-sectional section regarding Bangladesh women's level of awareness about climate change issues. The study surveyed 235 women in farming through a random sampling technique. The researchers reported that in Bangladesh women had a moderate level of awareness regarding climate change. Hence,

policymakers need to increase their access to information and resources that could enhance their adaptation strategies.

Furthermore, a similar study was conducted in Kenya to compare the level of awareness between male and female farmers. The researchers interviewed a total of 30 farmers in the country through interview questions. The study reported that women had a lower level of awareness regarding climate change compared to men. The study also found that women faced more challenges in adapting to climate change due to their limited access to resources (Muyanga et al., 2018). Gebreegziabher et al. (2019) conducted a study in Ethiopia regarding the climate change awareness level among women farmers in the country. The researchers surveyed 230 females in agriculture through a cross-sectional study and purposive sampling technique. The researchers discovered that women have less knowledge about the phenomena. They proposed that interventions such as awareness-raising campaigns and education programs are needed to increase their knowledge. Alemu et al. (2017) delved into the factors influencing women's low level of awareness of climate change issues in Ethiopia. The researchers conducted a correlational study with 350 women mostly from the farming communities. They discovered that females' low level of awareness regarding climate change was influenced by their level of education, access to information, and participation in community organizations.

Also, in Zimbabwe, researchers used descriptive design to investigate female farmers' level of understanding of climate change. 293 farmers took part in the study. The study reported that women had a low level of awareness regarding climate change. The researchers suggested that policy interventions were needed to enhance women's knowledge and adaptation strategies (Nhemachena et al., 2018).

In Ghana, Wrigley-Asante et al., (2019) used a total of 612 farmers (328 females and 284 males) and interviewed them using a purposive sampling technique concerning their understanding of climate change. The researchers employed descriptive design to investigate the phenomenon. They found that female farmers in Ghana have a moderate level of awareness about climate change but women's level of awareness varied depending on their age, educational level, and farming experience. The researchers recommended that climate change education should be tailored to meet the needs of women farmers. Similarly, Agyeman et al. (2018) used a cross-sectional study to examine 300 female farmers' understanding of climate change. The researchers discovered that women farmers in northern Ghana had a low level of awareness about climate change. They recommended that educational programs should be designed to target women farmers and improve their understanding of climate change. Osei et al. (2017) also conducted a similar study and reported that women farmers in Ghana had a limited understanding of climate change and its impacts on their agricultural practices.

Challenges of Climate Change among Women in Agriculture

Research has shown that female farmers, who play an important role in agricultural production, are particularly vulnerable to the effects of climate change because of the challenges it poses to their agricultural activities (Wrigley-Asante et al., 2019). It is documented that climate change has a disproportionate impact on women farmers due to their socioeconomic status, gender roles, and access to resources (Abdul-Razak & Kruse, 2017). A study by Alhassan et al. (2019) revealed that female farmers are more likely to be involved in rain-fed agriculture, which is highly sensitive to climate variability. The researchers interviewed 120 women farmers concerning their agricultural practices through a cross-sectional survey.

Furthermore, Nhemachena et al. (2016) conducted a study in Zimbabwe regarding the challenges women face in their farming activities. The researchers employed a descriptive design with 203 respondents among the rural dwellers. They reported that women farmers face challenges such as reduced crop yields, low soil fertility, and increased labor demands due to climate change. A similar study was conducted in Malawi by Gbetibouo (2019). The researcher through a purposive sampling technique surveyed 123 women in the country to assess the problems they encounter in their farming activities. It was revealed that women face challenges such as intermittent rainfall, low crop yields, loss of livestock, and decreased water availability due to climate change. Agarwal (2015) found that women farmers face challenges in accessing climate change adaptation strategies and technologies. These challenges are due to social norms, limited education, and lack of decision-making power, which limit their access to resources and information.

In Ghana, similar studies have been conducted concerning the challenges climate change poses to women in agriculture. For instance, Ayana and Oosterveer (2020) conducted a study with 153 farms from the northern part of the country regarding climate change and their farming activities using descriptive study. The researchers discovered that farmers face challenges such as changes in rainfall patterns, increased temperatures, and extreme weather events that lead to droughts and floods. Amankwah and Agyeman (2021) reported that some of the challenges that women in agriculture face due to climate change are poor crop yield, and the loss of crops and livestock, which results in food insecurity and loss of income. The researchers surveyed 187 women farmers with a purposive sampling technique. The study confirms the finding of Abid, Scheffran, and Schneider (2016) that women are more vulnerable to the impacts of climate change due to their limited access to productive resources, such as

land, credit, and technology, which can enable them to adapt to changing weather conditions.

Furthermore, women's traditional roles in society limit their ability to participate in decision-making processes and access information about climate change and adaptation strategies. This lack of participation and information limits their ability to implement adaptive measures to mitigate the impacts of climate change. The importance of gender-sensitive climate change adaptation strategies must be championed to involve women in decision-making processes (Njue et al., 2019).

Climate Change Adaptation Strategy Used by Women in Agriculture

According to Abid, Schneider, and Scheffran (2016), in Pakistan, women constitute about 43% of the agricultural workforce in the country but they are disproportionately affected by climate change as a result, scholars have investigated how women farmers have developed various adaptation strategies to cope with the impacts of climate change. For example, Nhemachena, Nhamo, Matchaya, Nhemachena, Muchara, Karuaihe, and Mpandeli S. (2020) conducted a cross-sectional study among Southern African countries (South Africa, Zimbabwe, Mozambique, and Tanzania) to assess the adaptability strategies farmers use to combat climate change. The researchers discovered that women in agriculture in the country have developed varied strategies such as crop diversification, the use of improved seed varieties, soil and water conservation techniques, tree planting, and the adoption of climate-resilient crops to overcome the effect of climate on their farming activities. This study supports the finding of Doss et al. (2018) that women farmers in Africa are adopting improved seed varieties and soil and water conservation techniques to cope with climate change.

In Basin, South Africa, Gbetibouo (2009) interviewed 25 farmers regarding their techniques for overcoming the impact of climate change on their farming activities. The researchers discovered that women farmers have adopted improved maize varieties that can resist drought, pests, and diseases. The study gives credence to Nyong et al. (2007) in their findings from the African Sahel and stresses the similarities between developing countries. They reported that female farmers in the African Sahel adopt strategies such as the use of improved seed varieties which have improved crop yields and reduced crop losses due to extreme weather events. According to Nhemachena, Nhamo, Matchaya, Nhemachena, Muchara, Karuaihe, and Mpandeli (2020), women farmers have also adopted soil and water conservation techniques such as conservation agriculture and agroforestry. These techniques help to conserve soil moisture and improve soil fertility, leading to increased crop productivity and resilience to climate change (Nyong et al., 2007). In Kenya, women farmers have adopted conservation agriculture practices such as minimum tillage, intercropping, and mulching, which have led to improved soil health and increased yields (Simotwo, Mikalitsa, & Wambua, 2018).

In Ghana, similar studies have been conducted regarding the Climate Change Adaptation Strategy farmers used in mitigating the phenomenon. For instance, Wrigley-Asante et al., (2019) did a cross-sectional study with 612 farmers (328 females and 284 males) from the Forest-Savannah Transition Zone of mid-Ghana regarding the adaptation strategies. The researchers reported that farmers in the country used strategies such as improved seedlings, and fertilizer application to mitigate the impact of climatic conditions on their farming activities. Additionally, Abdul-Razak and Kruse (2017) conducted a similar research on the methods used by small-scale farmers to address the effects of climate change on their agricultural operations in the West Mamprusi district,

one of the 26 districts of Ghana's Northern Region. The study discovered that farmers employed strategies like Economic resources, Social Capital, Awareness and training, and Technology Adoption in dealing with the situation.

Impact of Climate Change Adaptation on the Livelihood of Women in Agriculture

According to Wrigley-Asante et al. (2019), the issue of changing climate is affecting women's roles and responsibilities which have significant implications for their livelihoods. It is generally known that women farmers have less access to resources including land, financing, and extension services, making them more sensitive to the effects of climate change (Alhassan et al., 2019; Abdul-Razak & Kruse, 2017). According to Chandra, McNamara, Dargusch, Caspe, and Dalabajan (2017) conducted among smallholder farmers in the Philippines regarding the impact of climate change on their activities and their adaptability strategies. According to the research, farmers are more susceptible to climate change, which may lead to a loss of income, financial assets, agricultural produce, and a worsening of debt issues. Khatri-Chhetri, Regmi, Chanana, and Aggarwal, (2020) conducted a study in Nepal regarding how farmers can adopt Climate-smart agriculture (CSA) to mitigate the impact of climate change on their farming activities in the country. The researchers reported that climate issues have a dire effect on farmers in the country such as loss of farmlands, low crop yields, and financial decline. The negative effects of climate change were lessened by farmers who used CSA technologies and practices like direct seeded rice (zero tillage and low tillage utilizing a machine), green manuring (GM), laser land leveling (LLL), and the system of rice intensification (SRI).

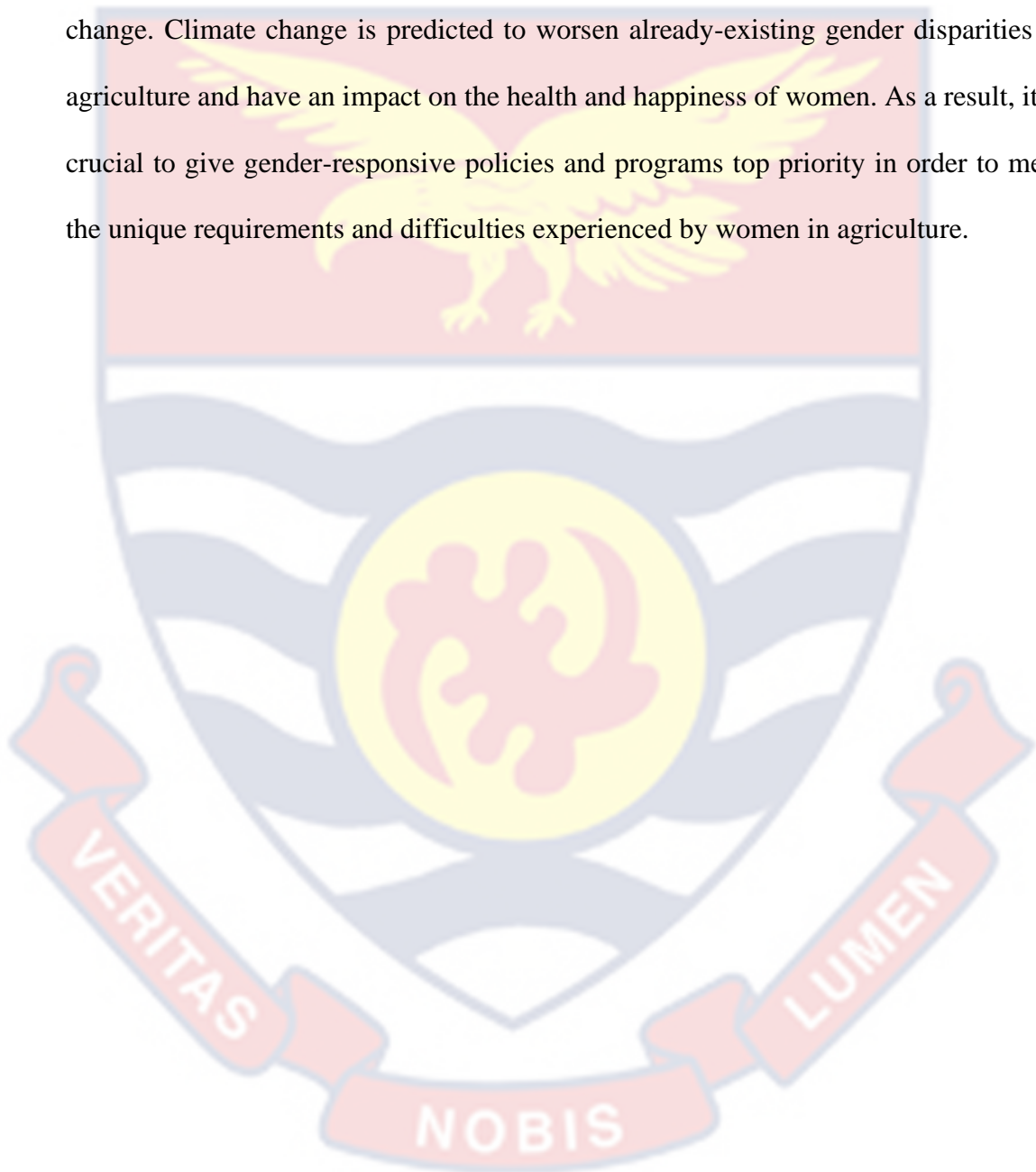
In Sub-Saharan Africa, the issue of climate change and its impact on farmers has been at the forefront of discussion among researchers and policy-makers. For instance, Jost, et al. (2016) conducted a cross-sectional study between Uganda, Ghana,

and Bangladesh on climate change and adaptation of climate-smart agriculture (CSA) in smallholder farming communities within the countries. According to the research, women may be less able to adapt to climate change due to resource or financial limitations. This proves that female farmers are more susceptible to the effects of climate change on their agricultural operations.

In Ghana, researchers have reported that climate change has become a critical challenge for agriculture in the country, affecting the livelihoods of women, who are disproportionately affected due to their gender roles and responsibilities in agriculture. For instance, Assan, Suvedi, Schmitt Olabisi, and Bansah (2020) investigated the perceptions of men and women on changes brought on by climate change in Ghana using both qualitative and quantitative research methodologies. According to the research, there are parallels in how male and female respondents see climate change's negative effects, such as the lengthening of the growing season and unpredictable rainfall patterns. Alhassan, Kuwornu, and Osei-Asare (2019) also explore farmers' vulnerability to climate change and variability in the northern region of Ghana. The researchers sampled 210 smallholder farming households in the region and reported that there is a significant difference in the vulnerability levels of female-headed and male-headed farming households in terms of the challenges climate imposes on their farming activities. The fascinating discovery was that Female farmers were more vulnerable to the livelihood impact of climate change relative to their male counterparts. Therefore, policy-makers and researchers should devise gender-responsive policies and programs to address the impact of climate change due to the social norms and cultural practices that limit women's participation and decision-making power in agriculture.

Synopsis

In conclusion, the effect of climate change on women's agricultural livelihoods is a complicated and diverse topic. Due to their less resources and societal constraints, women farmers are especially susceptible to the negative consequences of climate change. Climate change is predicted to worsen already-existing gender disparities in agriculture and have an impact on the health and happiness of women. As a result, it is crucial to give gender-responsive policies and programs top priority in order to meet the unique requirements and difficulties experienced by women in agriculture.



CHAPTER THREE

METHODOLOGY

Research Approach

Research approaches, as per Creswell and Clark (2017), are plans and methods that span everything from broad assumptions to particular methods for collecting, analyzing, and interpreting data. The approach provides a number of choices. Which approach should be employed to study a topic is a crucial choice. This choice should be taken in light of the research design of the study, the researcher's philosophical presumptions, and the specific data collecting, analysis, and interpretation techniques used. Creswell (2014) argued that quantitative research techniques are the foundation of the research strategy that focuses on using numerical variables for data analysis. In order to answer research questions and evaluate hypotheses, quantitative research employs the collection and analysis of numerical data (Creswell & Creswell, 2017). It is employed to look into the connections between variables and draw population-level generalizations. In this procedure, the data is analyzed using statistical analysis after being obtained via techniques like surveys and experiments.

Research Design

The descriptive research approach was used because of the study's quantitative character and its goals. The approach enables researchers to focus on "what"-related problems as opposed to "why"-related ones (Creswell & Clark, 2017). It "describes" things or events without necessarily going into details like where, when, what, or why they happen. The design is centered on the methodical gathering of quantifiable data to characterize a circumstance or occurrence. With this approach, the data gathered forms the basis for more studies to fully comprehend the research questions and provide an appropriate response (Creswell, 2014). A cross-sectional design is used in the study,

allowing researchers to collect primary data from a group of respondents just once (Creswell & Creswell, 2017). Objectives one and two can be addressed practically by using descriptive tools like frequencies, percentages, averages, and standard deviation. To accomplish goal three, it also permits the use of inferential tools like multiple regression.

Study Area

Geographically, Kwahu Afram Plains North District (formally, Kwahu North District) is one of the 261 Metropolitan, Municipal, and District Assemblies in Ghana and forms part of the 33 Municipalities and Districts in the Eastern Region. Kwahu Afram Plains North District is located in the northernmost part of the Eastern Region. The study area, Donkorkrom, the headquarters of the district, has a land mass of 2570 sq km, making it the biggest District in the Eastern Region. The Kwahu Afram Plain North District has two major road entrances: via Nkawkaw, Mpraeso-Bepong-Kwahu Tafo, and Adawso, where a ferry run by the Volta Lake Transport Company (VLTC) crosses the three-kilometer wild Afram River to Ekye-Amanfrom. Through Kpandu-Turku in the Volta Region, where Volta Lake is located, lies the second entry. The area is located in the Savannah Forest and Savannah transitional zone. May to June is the start of the first rainy season, while September to October is the start of the second.

With Kwahu South to the south, the Volta River to the east, Sekyere East and Asante Akyem District in the Ashanti Region to the west, and Sene East District and Atebubu Amanten Municipal in the Bono East Region to the north, the Kwahu Afram Plains North District is bordered. The district has 66,555 residents as per the population and housing census of 2021, with 35,567 men and 30,988 women. Figure 2 presents the map of Donkokrom in the Afram Plains.

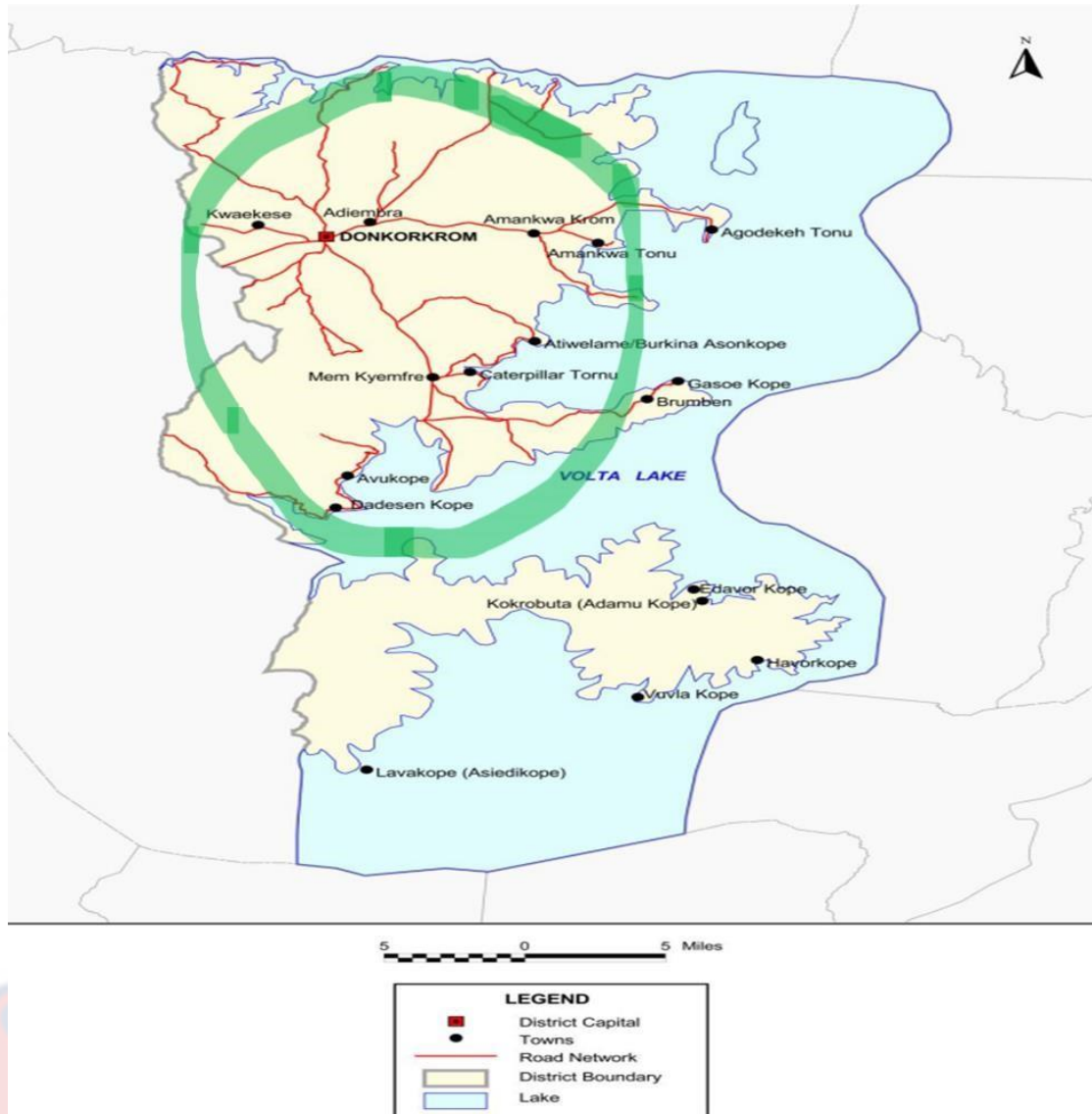


Figure 1: The Map of Donkokrom in the Afram Plains.

The Population of the STUDY

The population of a study refers to the group of individuals or subjects that a researcher selects to study. For this particular topic on women in agriculture in Ghana, the population of the study would be women who are actively involved in the agriculture sector in Ghana. The sample population will be limited to women in agriculture in the Donkokrom within the Kwahu Afram Plains North District.

Sample and Sampling Size

A sample, in the words of Bryman (2015), is the portion of a population that is picked for investigation. Typically, the researcher chooses the sample size depending on the study issue, the resources at hand, and the degree of precision they are looking for. A greater sample size often improves the reliability of the study results and the representativeness of the sample. The sample size should be large enough to ensure that the sample is representative of the population from which it was drawn (Hair, Black, Babin, & Anderson 2010). In this study, the researcher distributed 150 survey questions to female farmers who have farms in Donkokrom. Upon following up with the farmers, ninety questionnaires were received. Five questionnaires were excluded from the final data analysis due to incompleteness. Therefore, 85 questionnaires were used for the final analysis which represents 56.7%.

Sampling Technique

According to Hair, Black, Babin, and Anderson (2010), the sampling method is the act of choosing a portion of individuals or units from a larger population to represent the whole population. The researcher has a choice to use either probability or non-probability sampling techniques in selecting the sample for the study (Bryman, 2016). One of the non-probability sampling techniques is convenient sampling. Convenient sampling is a form of non-probability sampling approach that includes choosing participants for the research that are conveniently reachable or readily available.

Convenient sampling is a popular technique due to its ease of implementation and cost-effectiveness, especially in situations where time and resources are limited (Creswell, 2014). According to Polit and Beck (2021), convenient sampling is appropriate when the research question does not require a representative sample, or when the researcher has limited resources or time. Creswell and Creswell (2018) note

that convenient sampling may be used in qualitative research, as the focus is on understanding the experiences and perspectives of the participants rather than generalizing the findings to the population. For the nature of the climate change study especially focusing on women in agriculture, the researcher used a convenient sampling technique in selecting the respondents for the study. The researcher used a convenient sampling technique to select female farmers from Donkokrom who were willing to participate in the research.

Research Instrument

In this study, the researcher used a survey for data collection. The questionnaire was divided into five main parts.

Part I deals with the demographic characteristics of the respondents. The profile includes the farmers' age, years in farming, level of education, and whether the farmer has a second business or not.

Part II deals with women's level of awareness concerning climate change issues. Six items were used to assess the level of female farmers concerning climate change. The questions include *"How would you access the rainfall patterns of this community within the last 10 years?"*, *"If altered/changed, what do you think has caused it?"*

Part III examines the adaptation strategies of climate change that farmers used to mitigate the situation. The criteria include infrastructure for irrigation, knowledge of seed varieties, knowledge of soil moisture retention strategies, and knowledge of soil fertility approaches. Farmers were asked to select as many as possible the technique they used to mitigate climate change.

Part IV focused on the challenges women farmers face due to climate change. Some of the items are *Bush fire, Persistent drought, Less rain during the rainy season,* etc. Respondents were asked to check (/) all challenges as applied to their farming activities.

Part V examines the livelihood of women in agriculture. The items include the Food production from my farm in the last 5 years has, The Income from my farming activities in the last 5 years has, and My Household Income from farming activities in the last 5 years has. Participants were asked to select from the following responses: Decreased a lot, Decreased a little, Remain the same, Increase a little, and Increase a lot. Appendix A presents the questionnaire for the study.

Data Collection Procedure

Data collection procedure refers to the systematic and organized process of gathering data for a research study either quantitative or qualitative (Polit & Beck, 2021). It is an essential aspect of research that requires careful planning and execution to ensure that the collected data is accurate, valid, and reliable. There are various data collection procedures that researchers can use, depending on their research objectives, the type of data they want to collect, and the resources available to them. Some common data collection procedures include surveys, interviews, focus groups, observation, experiments, and document analysis.

Data Analysis

The study employs a quantitative design to examine the impact of climate change on women in agriculture. For data analysis and interpretation, the researcher used distribution frequency and inferential statistics such as correlation and regression with the help of Jamovi 2.3.26 and Microsoft Excel.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

Introduction

This part presents the result of the data analysis. It is presented chronologically based on the research questions.

Demographic Profile

Table 1 presents the demographic characteristics of women in agriculture in Donkokrom in the Afram Plains. The demographic profile was measured with the following variables: secondary occupation, age, years of experience in farming, and educational level. In terms of the secondary occupation, the data shows that thirty-five (35) farmers representing 41.18% indicated that YES they have a second job aside from farming while fifty (50) equivalent to 58.82% farmers registered NO. The data on age category shows that the majority of the women farmers in Donkor are below the age range of 51 years and above. In terms of years in the farming business, the result shows that the majority of them have been in the business between 2 – 5 years (52.95%) while only 10.59% have been in the farming business above 9 years. Finally, the educational level information shows that the majority of the farmers have basic school to no formal education while only 21.18% have Senior High School/Tech/vocational education. Table 1 presents the demographic profile of the women farmers in Donkokrom.

Table 1: Demographic Characteristics (N=85)

Socio-Demographic characteristics	Frequency	Percentage
Secondary Occupation		
YES	35	41.18
NO	50	58.82
Age		
Below 30 years	16	18.82
31-40	20	23.53
41- 50	18	21.18
51 – 60	20	23.53
Above 60	11	12.94
Years in Farming		
Below 2years	19	22.35
2 – 5	45	52.94
6 – 9	12	14.12
10 – 15	9	10.59
Educational Level		
No Formal Education	26	30.59
Basic School Education	21	24.71
Junior High School	20	23.53
Senior High School/Tech/Voc Education	18	21.18

Source: Field 2023

Level of Awareness of Issues Regarding Climate Change among Women in Agriculture

Table 2 presents the respondents' level of awareness of Climate Change Issues in Donkorkrom in the Kwaku Afram Plains. The data shows that the majority of the respondents have some level of knowledge regarding climate change. For example, on item 1: *How would you access the rainfall patterns of this community within the last 10*

years? Forty representing 47.1% selected that for the last 10 years, access to rainfall patterns has Changed/alterd; fifteen of the participants representing (14.06%) indicated that rainfall has stayed the same while thirty (35.29%) of them said, they don't know. On item 2: *If altered/changed, what do you think has caused it?* Fifty respondents that represent (58.82%) indicated that changes are caused by climate change-related reasons, twenty-five members (29.41%) attributed it to superstition/religion while ten members represent (11.76%) indicated other reasons. For item 3: *What do you do because of the altered rainfall patterns?* Thirty-five participants (41.18%) selected I adapt my farming practices to the changes; fifty farmers (58.82%) said they do nothing, and nobody selected others. For item 4: *Do you have access to weather information?* Fifty-two of the respondents representing (61.18%) selected Yes while thirty-three farmers (38.82%) chose No. On item 5: *What kind of weather information?* Thirty of the participants representing (35.29%) selected Rainfall, forty-five of them (52.94%) chose Temperature while ten respondents (11.76%) indicated others. Finally, item 5: *From which medium do you receive the weather information?* shows that thirty-three of the respondents (38.82%) selected Radio, thirty-two members representing (37.65%) chose Television and twenty farmers (23.53%) selected Agric Extension Officer.

The finding supports a series of research findings. For instance, Assan, Suvedi, Schmitt Olabisi, and Bansah, (2020) conducted a study regarding climate change perceptions between female and male respondents. The research reported that the phenomenon has caused issues like rising temperatures, shortened cropping seasons, and erratic rainfalls. A similar study by Alemu et al. (2017) delved into the factors influencing women's low level of awareness of climate change issues in Ethiopia. The researchers conducted a correlational study with 350 women mostly from the farming communities. They discovered that females' low level of awareness regarding climate

change was influenced by their level of education, access to information, and participation in community organizations. In Ghana, Wrigley-Asante et al., (2019) found that female farmers in Ghana have a moderate level of awareness about climate change but women's level of awareness varied depending on their age, educational level, and farming experience. Agyeman et al. (2018) also discovered that women farmers in northern Ghana had a low level of awareness about climate change. They recommended that educational programs should be designed to target women farmers and improve their understanding of climate change. Osei et al. (2017) also conducted a similar study and reported that women farmers in Ghana had a limited understanding of climate change and its impacts on their agricultural practices. Table 2 presents the respondents' assessment of their Climate Change Awareness.

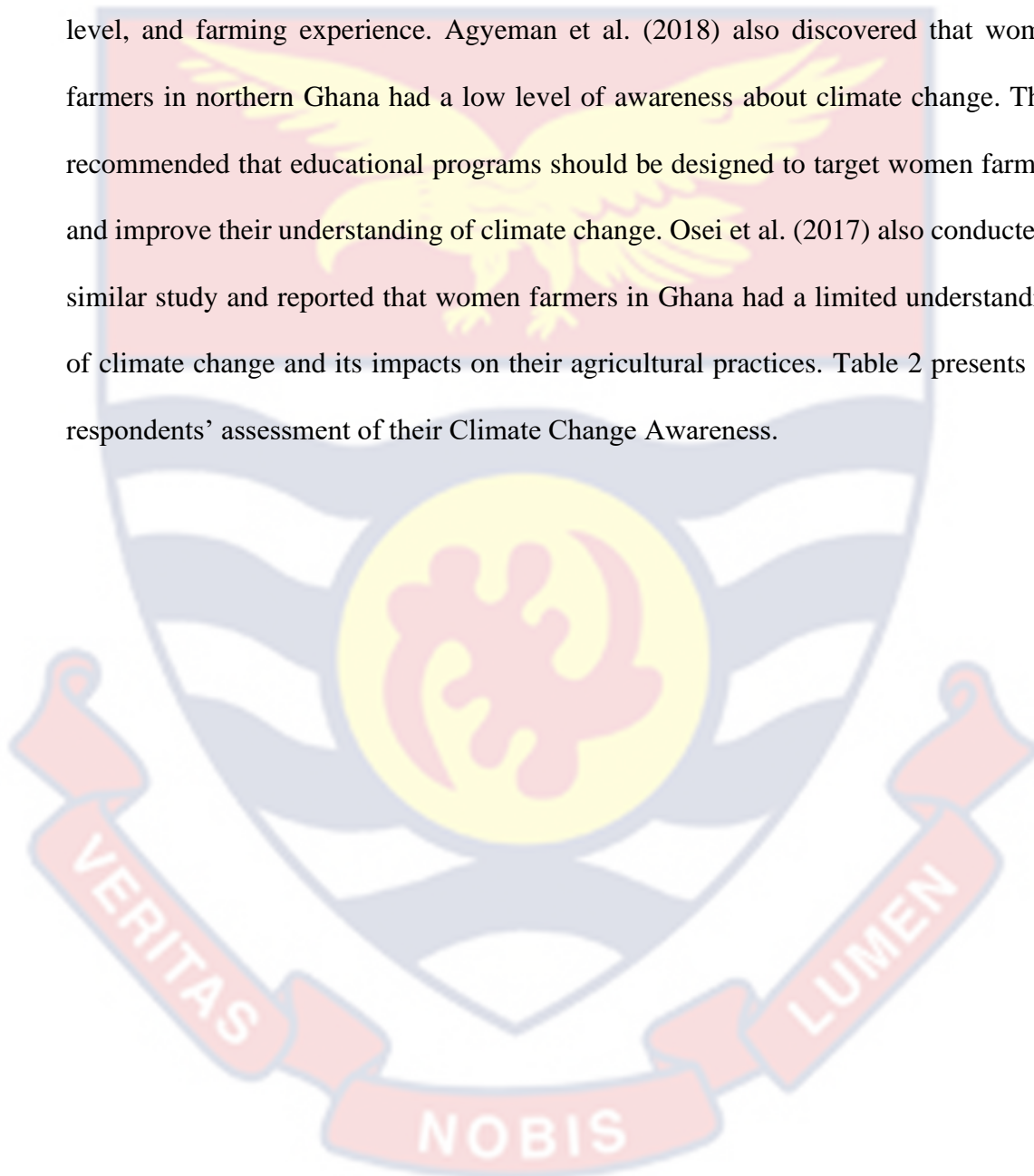


Table 2: Climate Change Awareness of Female Farmers (N = 85)

1. How would you access the rainfall patterns of this community within the last 10 years?	Changed/alterd 40 (47.1%)	Stayed the same 15 (14.12)	Don't know 30(35.29)
2. If altered/changed, what do you think has caused it?	climate change related reason 50 (58.82)	superstition/ religion 25 (29.41)	Others 10 (11.76)
3. What do you do because of the altered rainfall patterns?	Adapt my farming practices to the changes 35 (41.18)	do nothing 50 (58.82)	Others
4. Do you have access to weather information?	YES 52 (61.18)	NO 33 (38.82)	don't know
5. What kind of weather information?	Rainfall 30 (35.29)	Temperature 45 (52.94)	Others 10 (11.76)
6. From which medium do you receive the weather information?	Radio 33 (38.82)	Television 32 (37.65)	Agric Extension officer 20 (23.53)

Source: Field data (2023)

Adaptation Strategies Used by Women in Agriculture to Overcome Climate Change Challenges

Table 3 presents the adaptation strategies that farmers use to mitigate the impact of climate change on their agricultural activities. The data revealed that the majority of female farmers 79 (92.94%) in the region employ soil improvers (compost/manure) and mixed cropping as the main adaptation strategies in combatting climate. The next adaptation strategies include Soil improvers (inorganic fertilizer) and Planting in valleys/wetlands 75 (88.23%). The following adaptation strategies follow

chronologically, namely: Rainwater harvesting/ Irrigation, Early planting, Early harvesting, and Same crop two or more times. However. The least adaptation strategies used by the farmers are Late 40 (47.06%) and Early maturing varieties 36 (42.35%).

The findings of this study support Nhemachena, Nhamo, Matchaya, Nhemachena, Muchara, Karuaihe, and Mpandeli S. (2020). They conducted a cross-sectional study among Southern African countries (South Africa, Zimbabwe, Mozambique, and Tanzania) to assess the adaptability strategies farmers use to combat climate change. The researchers also discovered that women in agriculture in the country have developed varied strategies such as crop diversification, the use of improved seed varieties, soil and water conservation techniques, tree planting, and the adoption of climate-resilient crops to combat climate change. Also, in South Africa, Gbetibouo (2009) interviewed 25 farmers regarding their techniques for overcoming the impact of climate change on their farming activities. The farmers reported adaptive strategies such as improved maize varieties that can resist drought, pests, and diseases. The study gives credence to Nyong et al. (2007) in their findings from the African Sahel and stresses the similarities between developing countries. They reported that female farmers in the African Sahel adopt strategies such as the use of improved seed varieties has improved crop yields and reduced crop losses due to extreme weather events. According to Nhemachena, Nhamo, Matchaya, Nhemachena, Muchara, Karuaihe, and Mpandeli. (2020), women farmers have also adopted soil and water conservation techniques such as conservation agriculture and agroforestry. Table 3 presents the adaptation strategies of the women farmers in Afram Plains.

Table 3: Adaptation strategies of Female Farmers

Adaptation Strategies	Percentages
Soil improver (compost/manure)/Mixed cropping	79 (92.94%)
1. Soil improver (inorganic fertilizer)/ Planting in valleys/wetlands	75 (88.23%)
2. Rainwater harvesting/ Irrigation	71 (83.52%)
3. Early planting	69 (81.12%)
4. Early harvesting	68 (80.00)
5. Same crop two or more times	65 (76.47%)
6. Late planting	60 (70.59%)
7. Late harvesting	59 (69.41%)
8. Drought resistant varieties	50 (58.82%)
9. Planting on raised ridges	45 (52.94%)
10. Soil water conservation/mulching	42 (49.41%)
11. Late maturing varieties	40 (47.06%)
12. Early maturing varieties	36 (42.35%)

Source: Field data (2023)

Climate Change Challenges Women in Agriculture Face in the Course of their Farming Activities

Table 4 presents the challenges women in agriculture face concerning the impact of climate change. The data shows that the majority of the women farmers 80 (94.12%) select bush fire as the major challenge they face in their farming activities. It is followed chronologically by the rising day temperature 76 (89.41%), flood 72 (84.71%), Persistent drought, Early cessation of the rainy season, less rain during the rainy season, Erratic rainfall during the rainy season, Rising night-time temperatures, Late onset of the rainy season, More rain during the rainy season 42 (49.41%), and the uncertain onset of the rainy season 40 (47.06%).

The findings back up related research carried out in Ghana. In Ghana's northern area, Alhassan, Kuwornu, and Osei-Asare (2019) investigate how vulnerable farmers are to climate change and variability. The researchers sampled 210 smallholder farming households in the region and reported that there is a significant difference in the vulnerability levels of female-headed and male-headed farming households in terms of the challenges climate imposes on their farming activities. The fascinating discovery was that Female farmers were more vulnerable to the livelihood impact of climate change relative to their male counterparts. Table 4 presents the challenges farmers face in the Afram Plains.

Table 4: Challenges as Applied to Your Farming Activities

Items	Percentages
1. Bush fire	80 (94.12%)
2. Rising day temperature	76 (89.41%)
3. Flood	72 (84.71%)
4. Persistent drought	65 (76.47%)
5. Early cessation of the rainy season	60 (70.59%)
6. Less rain during the rainy season	55 (64.71%)
7. Erratic rainfall during the rainy season	51 (60.00%)
8. Rising night-time temperatures	46 (54.12%)
9. Late onset of the rainy season	43 (50.59%)
10. More rain during the rainy season	42 (49.41%)
11. The uncertain onset of the rainy season	40 (47.06%)

Source: Field data (2023)

The Impact of Climate Change Adaptation Strategies on the Livelihood of Women in Agriculture in Donkokrom

Preliminary Analyses

The researcher conducted a preliminary analysis to assess the suitability of the data in terms of its reliability, distribution, mean scores, and standard deviations before conducting multiple regression.

Reliability Levels of the Scale

The researcher used the suggestion of Tabachnick and Fidell (2019) to conduct the scale reliability. The climate change adaptation strategies of the women in agriculture in Donkokron were examined with the following variables: Seed Variety (5 items); Soil Moisture Intention Technique (3 items); Soil Fertility Techniques (4 items), and Irrigation Infrastructure (7 items). The Cronbach alpha (α) for the items ranges from 0.732 to 0.927 which are within the ranges set up by Tabachnick and Fidell (2019). They were considered as the independent variables.

In terms of the dependent variable – The livelihood of Women in Agriculture, three (3) items were used as proxies to measure livelihood. The Cronbach alpha for the items was 0.872 which falls within the accepted threshold. Hence, putting the independent and dependent scales together as a scale is well-suited for this research. Table 5 shows the Reliability Test (Cronbach alpha (α)) of the instrument.

Table 5: Cronbach alpha (α) for Reliability Test

	No. of items	Cronbach alpha (α)
Climate Change Adaptation Strategies		
Seed Variety	5	.732
Soil Moisture Retention Techniques	3	.856
Soil Fertility Technique	4	.881
Irrigation Infrastructure	7	.927
The livelihood of Women in Agriculture	3	.872

Source: Field data (2023)

Data Distribution and Descriptive Statistics

The results of skewness and kurtosis are presented in Table 6. According to Tabachnick and Fidell (2019), data is considered normally distributed if it has values of skewness range between +1.00 and -1.00 and the values of Kurtosis range between +2.00 and -2.00. The data for skewness and kurtosis for this study as shown in Table 6 revealed a value of 0.164 to 0.810 and 172 to -1.921. The values demonstrate that the data were normally distributed with no outliers which qualifies it for conducting the Ordinary Least Square test. Table 6 presents the Descriptive Statistics and Data distribution of the study.

Table 6: Distribution of Data and Descriptive Statistics

	Seed Variety	Soil Moisture Retention Techniques	Soil Fertility Technique	Irrigation Infrastructure	The livelihood of Women in Agriculture
N	85	85	85	85	85
Mean	4.14	3.12	3.54	4.02	3.60
Median	4.11	3.33	3.34	4.12	3.13
Standard deviation	1.09	1.25	1.18	2.10	1.50
Skewness	-0.223	-0.561	-0.164	-0.618	-0.810
Kurtosis	1.720	-0.972	-1.207	-1.921	1.356

Source: Field data (2023)

Correlation Matrix

Table 7 reveals the correlation matrix using Person (r). Person (r) was used to assess the relationship between the climate change adaptation strategies of the women in agriculture in Donkokron: Seed Variety: Soil Moisture Intention Technique; Soil Fertility Techniques, and Irrigation Infrastructure, and their livelihood. The data shows that the livelihood of the women in agriculture in Donkokrom strongly corrected with all the variables used to assess the climate change adaptation strategies, namely: Seed Variety, Soil Moisture Intention Technique, Soil Fertility Techniques, and Irrigation Infrastructure. Table 7 presents the correlation matrix of the data.

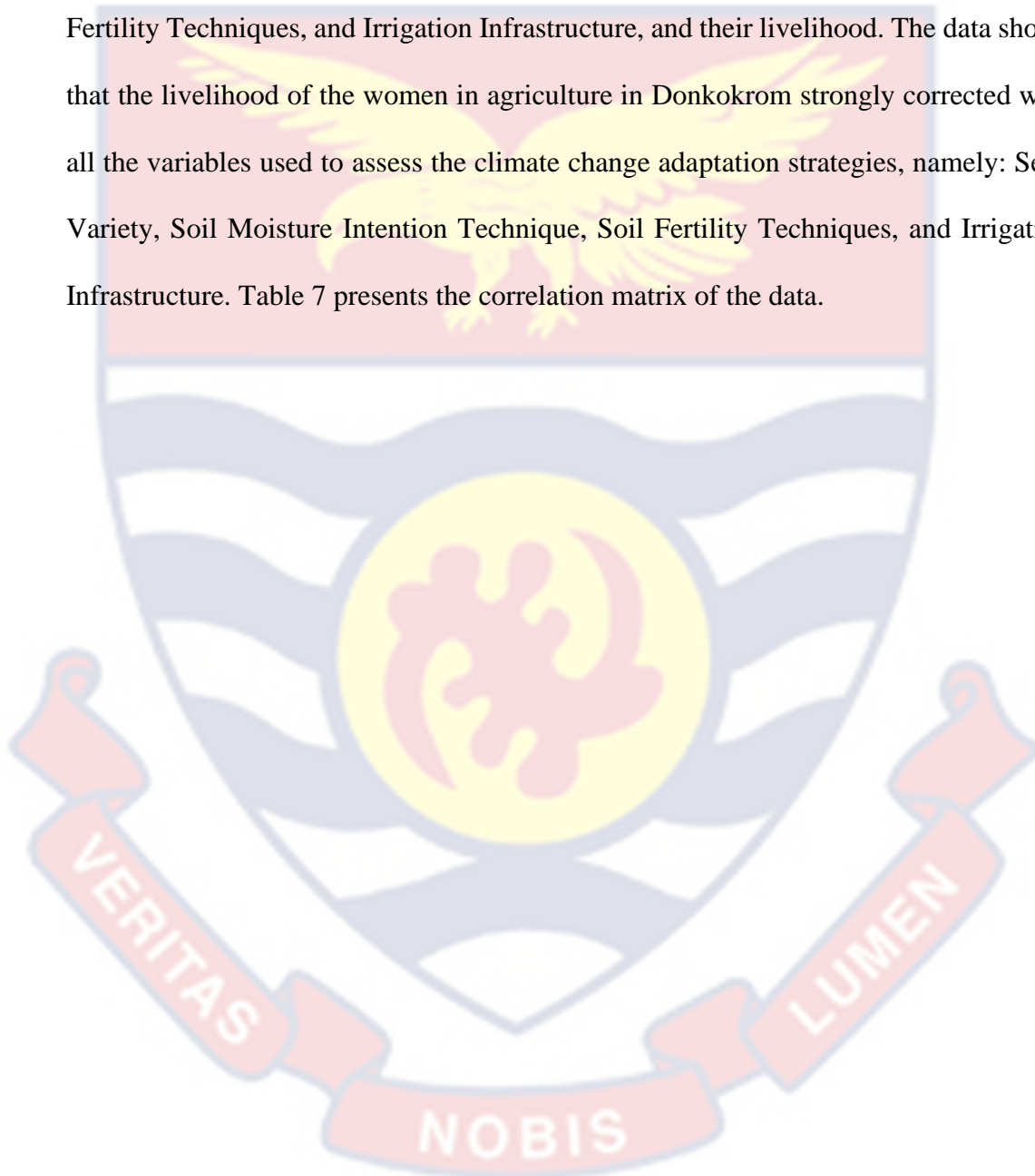


Table 7: Correlation Matrix

	Seed Variety	Moist	Fert	Irrig	Live
Seed Variety					
Soil Moisture Retention Techniques	0.317 *				
Soil Fertility Technique	0.194 *	0.285 *			
Irrigation Infrastructure	0.411 *	0.327 *	0.322 *		
The livelihood of Women in Agriculture	0.721 ***	0.679 ***	0.714 ***	0.791 ***	

Moist = Soil Moisture Retention Techniques, Fert = Soil Fertility Technique, Irrig = Irrigation Infrastructure, Live = The Livelihood of Women in Agriculture

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Testing of Hypothesis

In order to conduct hierarchical regression, the researcher first checks if the data meet the multicollinearity assumption and Tolerance. It is widely reported among scholars such as Tabachnick and Fidell, (2019) that the Variance Inflation Factor (VIF) and Tolerance are essential value ranges to check the two assumptions. The current data revealed that VIF values ranged between 2.987 to 3.415 and the Tolerance values were between 0.533 to 0.915. These ranges meet the criteria set out (Tabachnick & Fidell, 2019).

After assumptions have been met, the researcher used SPSS version 20 to conduct hierarchical multiple regression to test the impact of climate change adaptive strategies on the livelihood of women in agriculture in Donkokrom. In step 1, the researcher controls the demographic variables of the respondents. The final step saw the introduction of climate change adaptive strategies – Seed Variety, Soil Moisture Retention Techniques, Soil Fertility Techniques, and Irrigation Infrastructure into the model. The results of the model revealed that the overall model demonstrated a statistical significance ($F = 32.122$, $p < .001$). The independent and controlled variables together accounted for 31.20% ($R^2 = .312$) variance in the livelihood of the women in agriculture in Donkokrom.

In the first step, the demographic characteristics that were controlled did not reveal any statistical significance on the dependent variable – the livelihood of the women in agriculture in Donkokrom ($F = 1.411$, $p = .257$).

The independent variables – Seed Variety, Soil Moisture Retention Techniques, Soil Fertility Techniques, and Irrigation Infrastructure into the model were introduced into the model in the second step. The model revealed a statistical significance ($\Delta F =$

30.711, $p < .001$), accounting for the 24.10% variance in the livelihood of the women in agriculture in Donkokrom ($\Delta R^2 = .241$)

All four climate change adaptation strategies – Seed Variety, Soil Moisture Retention Techniques, Soil Fertility Techniques, and Irrigation Infrastructure, employed by the women in agriculture in Donkokrom recorded statistical significance.

At the specific variable recordings, the result shows that Seed Variety recorded a Beta ($\beta = .212$). This implies that a unit increase in Seed Variety improves the livelihood of the women in agriculture by 21.2% ($\beta = .212$, $t = 4.129$, $p < .001$). The data of Soil Moisture Retention Techniques also revealed a Beta ($\beta = .201$). It shows that a unit increase in Soil Moisture Retention Techniques increases the livelihood of women in agriculture by 20.1% ($\beta = .201$, $t = 4.012$, $p < .05$). The result of Soil Fertility Techniques demonstrated that a unit increase positively influences the livelihood of women in agriculture 31.1% ($\beta = .311$, $t = 5.312$, $p < .001$). Finally, the data on Irrigation Infrastructure shows that a unit increase in it enhances the livelihood of women in agriculture by 38.90% ($\beta = .389$, $t = 6.112$, $p < .001$). The findings of this study support the research of Khatri-Chhetri, Regmi, Chanana, and Aggarwal, (2020) conducted in Nepal regarding how farmers adopt Climate-smart agriculture (CSA) to mitigate the impact of climate change on their farming activities in the country. In Sub-Saharan Africa, Jost, et al. (2016) conducted a cross-sectional study between Uganda, Ghana, and Bangladesh on climate change and adaptation of climate-smart agriculture (CSA) in smallholder farming communities within the countries. The study reported that women appear to be less adaptive to climate change because of financial or resource constraints. This demonstrates that female farmers are more vulnerable to climate change challenges in their farming activities. In Ghana, researchers have reported that climate change has become a critical challenge for agriculture in the country, affecting

the livelihoods of women, who are disproportionately affected due to their gender roles and responsibilities in agriculture. For instance, Assan, Suvedi, Schmitt Olabisi, and Bansah, (2020) used both qualitative and quantitative research methods to investigate the perspectives of men and women on changes of climate change in Ghana. The study reported that there are similarities in climate change perceptions between female and male respondents in terms of the negative impact of the phenomenon such as rising temperatures, shortened cropping season, and erratic rainfalls. Table 8 presents a hierarchical regression analysis for Climate Change Adaptive Strategies and the Livelihood of Women in Agriculture in Donkokrom in the Afram Plains.

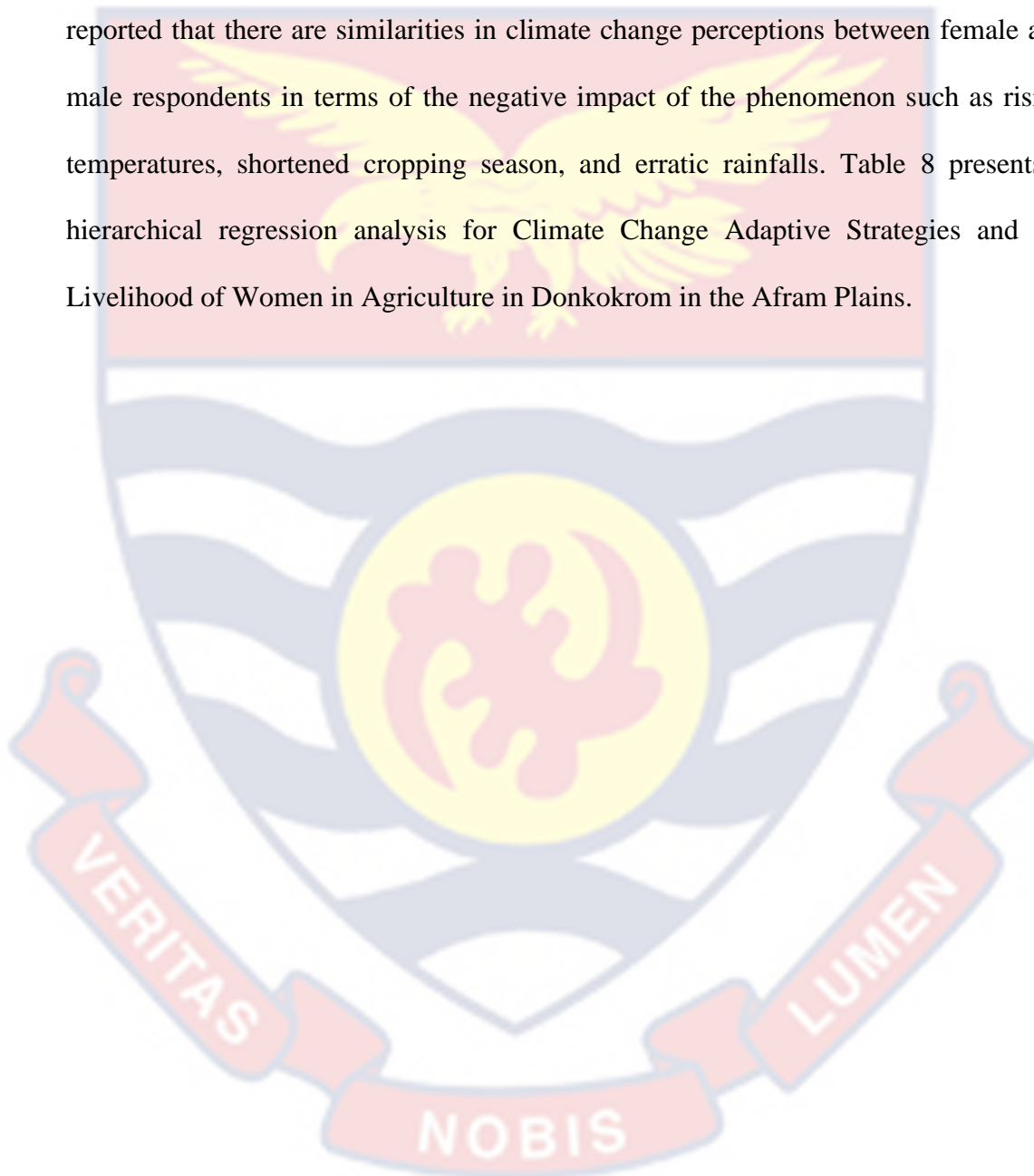


Table 8: Climate Change Adaptive Strategies and Livelihood of Women in Agriculture

Model	B	SE	Beta (β)	T	P
Age	.132	.305	.041	.478	.755
Years in Farming	.095	.314	.043	.321	.564
Secondary Occupation (YES)	1.115	1.501	.034	.748	.513
Seed Variety	.493	.185	.212	4.129	.000
Soil Moisture Retention Techniques	.571	.201	.201	4.012	.004
Soil Fertility Techniques	.712	.256	.311	5.312	.000
Irrigation Infrastructure	.399	.316	.389	6.122	.000

Model 1: $R = .191$; $R^2 = .037$; $R^2 = .037$; Adjusted $R^2 = .010$; $F(3, 81) = 1.411$; $p = .257$;

Model 2: $R = .525$; $R^2 = .512$; Adjusted $R^2 = .312$; $\Delta R^2 = .241$; $\Delta F(5, 79) = 30.711$, $p < .001$

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATION

Introduction

This chapter discusses the Summary of Findings, Conclusion, and Recommendation for policymakers and other stakeholders.

Summary of Findings

The study set out to investigate the impact of climate change on the livelihood of women in agriculture in Donkokrom. The data shows that the majority of the respondents have some level of knowledge regarding climate change. In terms of the weather pattern, the majority of the respondents indicated that for the last 10 years, access to rainfall patterns has Changed/alterd while only a few of them opined that they don't know. In terms of their knowledge regarding the cause of the changes in the rainfall patterns in Donkokrom, most of the respondents indicated that changes are caused by climate change-related reasons while the minority selected other related issues such as superstition/religion while ten members indicated other reasons. For their own intervention in terms of how they plan their farming activities as the result of the altered rainfall patterns, the majority of the women farmers indicated that they do not do anything while some of them stated that they adapt their farming practices to the changes. Regarding the issues regarding how the women farmers get access to weather information, most of the farmers indicated that selected Radio, Television, and Agric Extension Officer respectively.

In addition, the second objective of the study: *“To determine the adaptation strategies the women farmers use in the combatting of climate change”*, The data revealed that the majority of female farmers in the region employ soil improvers (compost/manure) and mixed cropping as the main adaptation strategies in combatting

climate. The next adaptation strategies include Soil improvers (inorganic fertilizer) and Planting in valleys/wetlands. The following adaptation strategies follow chronologically, namely: Rainwater harvesting/ Irrigation, Early planting, Early harvesting, and Same crop two or more times. However, The least adaptation strategies used by the farmers are Late and Early maturing varieties.

For the third objective: “To identify the challenges woman farmers face”, the result revealed that the majority of the women farmers select bushfires as the major challenge they face in their farming activities; followed by the rising day temperature, floods, Persistent drought, Early cessation of the rainy season, less rain during the rainy season, Erratic rainfall during the rainy season, Rising night-time temperatures, Late onset of the rainy season, More rain during the rainy season, and the uncertain onset of the rainy season.

Finally, the impact of climate change adaptive strategies on the livelihood of the farmers revealed that all the independent variables – Seed Variety, Soil Moisture Retention Techniques, Soil Fertility Techniques, and Irrigation Infrastructure significantly improved the livelihood of the women farmers in the country. however, the demographic variables did not show any statistical significance.

Conclusion

The purpose of the study was to investigate how climate change has affected the livelihoods of female farmers in Donkokrom. The results show that a majority of the farmers have some level of awareness of climate change. For instance, the majority of participants said that access to rainfall patterns has changed over the past decade concerning weather pattern changes, with only a small percentage expressing otherwise. In terms of the explanation for the causes of these changes in Donkokrom's

rainfall patterns, the majority of them pointed to variables associated with climate change such as drought, etc. A few of them cited alternative explanations including superstition or religion.

In addition, a significant portion of the women farmers in Donkokrom who were surveyed about their farming practices said that they had not changed them in response to the altered rainfall patterns, however, others claimed to have adjusted their farming practices to take into account the patterns in rainfall. Most female farmers said they relied on sources including radio, television, and agricultural extension officers to get information about the weather.

The study's second goal was to investigate the adaptation strategies used by female farmers to deal with the effects of climate change. The data analysis shows that the usage of soil enhancers like compost and manure, as well as the use of mixed cropping, are the main adaptation strategies women farmers use in Donkokrom. The study also discovered that using inorganic fertilizers and growing crops in marshes or valleys are common strategies. Rainwater collecting, irrigation, early planting, early harvesting, and growing the same crop repeatedly are the following tactics in order of occurrence. The use of late and early maturing crop varieties, on the other hand, was one of the least popular approaches.

The study's third purpose was to identify the challenges faced by female farmers because of climate change. The findings revealed that bushfires, rising daytime temperatures, floods, protracted droughts, the early end of the rainy season, less rain during the rainy season, erratic rainfall patterns during the rainy season, rising nighttime temperatures, the delayed onset of the rainy season, too much rain during the rainy

season, and uncertainty regarding the start of the rainy season are the challenges faced by the female farmers.

Finally, the impact of climate change adaptive strategies on the livelihood of the farmers revealed that all the independent variables – Seed Variety, Soil Moisture Retention Techniques, Soil Fertility Techniques, and Irrigation Infrastructure significantly improved the livelihood of the women farmers in the country. However, the demographic variables did not show any statistical significance.

Recommendation

The purpose of the study was to investigate how climate change has affected the livelihoods of female farmers in Donkokrom. Based on the conclusion from the study, the following recommendation was put forward for the stakeholders:

The Ministry of Agriculture should intensify education and training for female farmers regarding the issues of climate change. For instance, this study revealed that the majority of female farmers in Donkokrom have noticed shifts in rainfall patterns over the past decade and their attribution of these changes to climate change-related factors, particularly drought and other pertinent variables, signifies the valuable understanding farmers possess regarding the complex drivers of environmental transformations. Therefore, the Ministry should tailor interventions and policies aimed at building climate resilience in the agricultural sector.

Furthermore, the Ministry of Agriculture through its extension activities must educate women farmers in Donkokrom to alter their perception regarding the causes of changes in the rainfall pattern since some of them attributed it to variables including superstition or religion. Hence, their unwillingness to alter their farming practices.

In addition, the Agric extension officers in Donkokrom should intensify their information dissemination activities regarding climate change and its impact on farming activities since most female farmers said they relied on sources including radio, television, and agricultural extension officers to get information about the weather.

Also, the Ministry of Agriculture should promote knowledge-sharing and capacity-building initiatives among women farmers in Donkokrom regarding the utilization of soil enhancers like compost and manure, alongside mixed cropping, and other sustainable and environmentally friendly farming practices such as inorganic fertilizers and cultivation in marshes or valleys in enhancing agricultural productivity in the country.

Furthermore, while farmers in Donkokrom have embraced techniques like rainwater collection, irrigation, and early planting, efforts should be made to raise awareness about the benefits of late and early-maturing crop varieties by providing accessible information about the phenomena.

Finally, based on the significant relationship between climate change adaptation strategies and the livelihood of female farmers in Donkokrom, it is recommended that the Ministry of Agriculture and other stakeholders prioritize and amplify the implementation of climate change adaptive strategies such as Seed Variety, Soil Moisture Retention Techniques, Soil Fertility Techniques, and Irrigation Infrastructure which have demonstrated a substantial positive impact on women farmers' livelihoods to enhance agricultural productivity and resilience in Ghana.

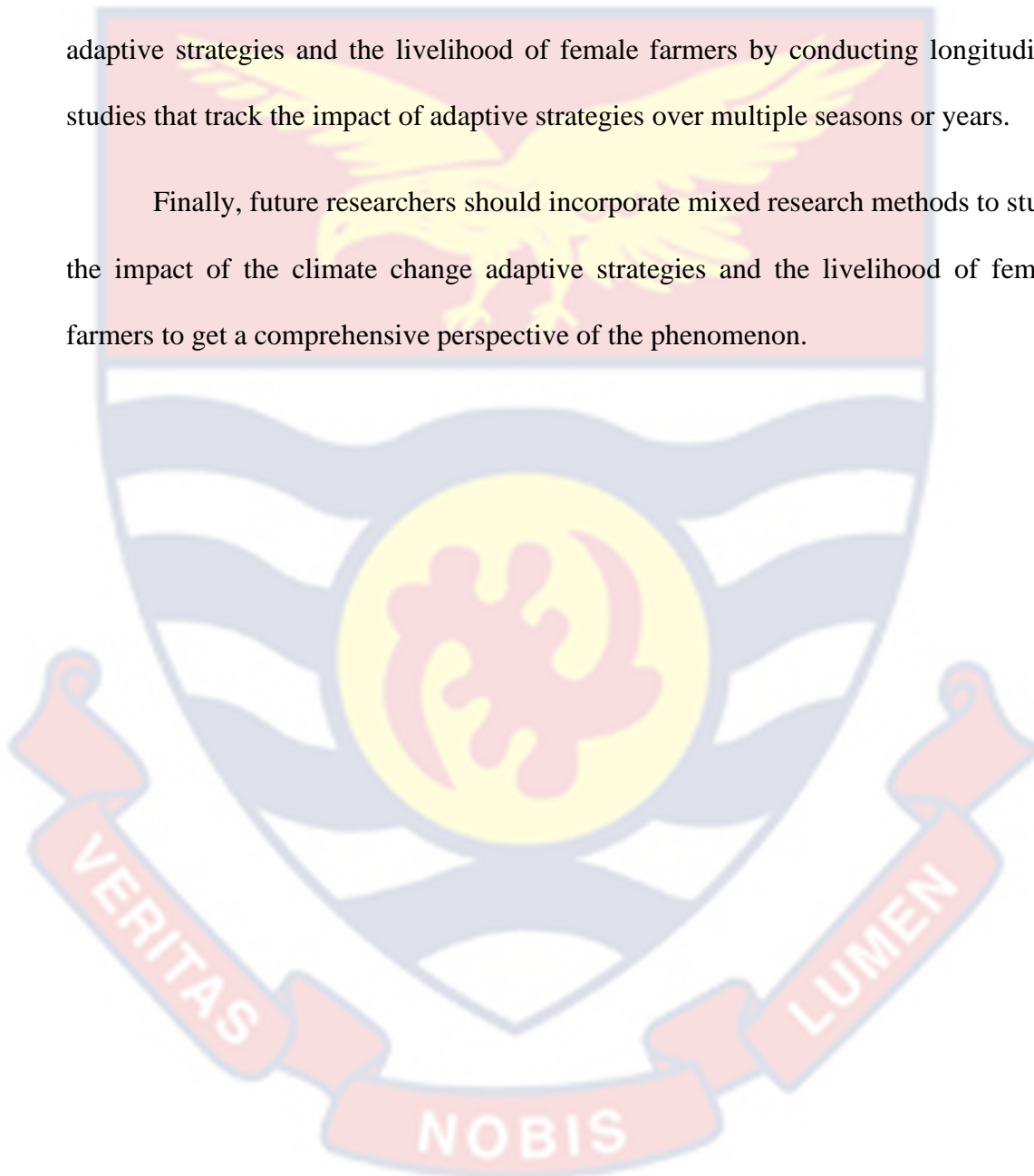
Recommendation for Future Researchers

First, while the demographic variables in this study did not demonstrate statistical significance on the livelihood of women farmers in Donkokrom, there may

be subtler nuances at play. Therefore, future researchers should consider researching how the demographic variables influence the climate change adaptive strategies of the farmers in Donkokrom.

Second, future researchers should extend the scope of the climate change adaptive strategies and the livelihood of female farmers by conducting longitudinal studies that track the impact of adaptive strategies over multiple seasons or years.

Finally, future researchers should incorporate mixed research methods to study the impact of the climate change adaptive strategies and the livelihood of female farmers to get a comprehensive perspective of the phenomenon.



REFERENCES

- Abid, M., Schneider, U. A., and Scheffran, J. (2016). Adaptation to climate change and its impacts on food productivity and crop income: Perspectives of farmers in rural Pakistan. *Journal of Rural Studies*, 47(A)
- Adiku, S. G. K., Van de Sande, A. J., Kessler, A., & Hessel, R. (2020). Impact of climate change on women's livelihoods in the Upper East Region of Ghana. *Sustainability*, 12(10), 4254.
- Amuzu-Sefordzi, B., Amanor-Boadu, V., Yeboah-Assiamah, E., & Obeng, F. (2020). Gender dynamics in climate-smart agriculture: A case study of maize farmers in the eastern region of Ghana. *Climate*, 8(3), 34.
- Assaduzzaman, M., Filatova, T., Lovett, T. C., and Frans. H. J. M. (2023). Coenen, Gender-Ethnicity Intersectionality in Climate Change Adaptation in the Coastal Areas of Bangladesh, *Sustainability*, 15, 4, (3744). 10.3390/su15043744,
- B.E. George Dimitov (2019), Effect of Climate Change on Women, *International Journal Of Multidisciplinary*.
- Bhattarai, U., Dhakal, B., & Thapa, G. (2020). Gendered Vulnerability to Climate Change in Agriculture: A Review of the Literature. *Sustainability*, 12(22), 9484.
- Brandth, B. (2002). On the Relationship between Feminism and Farm Women. *Agriculture and Human Values*. 19. 107-117. 10.1023/A:1016011527245.
- Bryman, A. (2016). *Social research methods*. Oxford University Press.
- Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Creswell, J. W., and Creswell, J. D. (2018). *Research design: qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Cumhur Aydinalp and Malcom S Cresser, (2008), *American-Eurasian J Agric. & Environ. Sci.* 3(5): 672-676,2008.
- Doss, C., Meinzen-Dick, R., Quisumbing, A. R., Theis, S., & Zaki, M. (2020). Women in agriculture: Four myths. *Global Food Security*, 26, 100416.
- FAO & CARE International. (2019). Good Practices for Integrating Gender Equality and Women's Empowerment in Climate Smart Agriculture Programmes.
- FAO. (2018). The State of Food Security and Nutrition in the World 2018. Rome: FAO.

- Food and Agriculture Organization (FAO). (2011). *The State of Food and Agriculture 2010-2011: Women in Agriculture*. Rome: FAO.
- Gbetibouo, G.A. (2009) *Understanding Farmers' Perceptions and Adaptations to Climate Change and Variability, the Case of the Limpopo Basin, South Africa*: IFPRI Discussion Paper 00849, IFPRI, Washington DC. <http://www.ifpri.org/publication/understanding-farmers-perceptions-and-adaptationsclimate-change-and-variability>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis: A global perspective*. Pearson Education.
- Hillman AJ. 2015. Board diversity. Beginning to unpeel the onion. *Corporate Governance. An International Review* 23(2):104-107.
- International Food Policy Research Institute (IFPRI). (2011). *Women in Agriculture: Closing the Gender Gap for Development*. Washington, D.C.: IFPRI.
- Karami E. 2012. Climate change, resilience and poverty in the developing world. In: *Culture, Politics and Climate Change Conference*. University of Colorado Boulder, USA
- Kopp, W., Abdallah, A. M., Kappes, H., Mersha, A., & Borchardt, D. (2019). Climate Change Impacts on the Health of Women in Agriculture: *A Review. Journal of Agromedicine*, 24(2), 109-118.
- Morse, S. and McNamara, N. (2013). *The Theory Behind the Sustainable Livelihood Approach*. 10.1007/978-94-007-6268-8_2.
- Ndivile Mokoena and Mara Dolan (2020), climate change and disproportionate Impact on Women, *Agricultural Workers in South Africa*.
- Nhemachena C, Nhamo L, Matchaya G, Nhemachena CR, Muchara B, Karuaihe ST, Mpandeli S. (2020). Climate Change Impacts on Water and Agriculture Sectors in Southern Africa: Threats and Opportunities for Sustainable Development. *Water*, 12(10):2673. <https://doi.org/10.3390/w12102673>
- Nyong, A., Adesina, F., and Osman Elasha, B. (2007). "The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel," *Mitigation and Adaptation Strategies for Global Change, Springer*, vol. 12(5), pages 787-797, June.
- Pedwell, C. (2006). Third-wave feminism: a critical exploration. *Feminist Review - Feminist Rev.* 82. 138-140. 10.1057/palgrave.fr.9400269.
- Polit, D. F. and Beck, C. T. (2021). *Nursing research: generating and assessing evidence for nursing practice. Eleventh edition*. Philadelphia, Wolters Kluwer.

- Rainard, M., Smith, C. J., and Pachauri, S. (2023). Gender equality and climate change mitigation: Are women a secret weapon?, *Frontiers in Climate*, 5, 10.3389/fclim.2023.946712,
- Samuel Nii Ardey Codjoe and George Owusu (February 2011), climate change/variability and food system: evidence from Afram Plains.
- Simotwo, H.K., Mikalitsa, S.M. and Wambua, B.N., (2018). Climate change adaptive capacity and smallholder farming in Trans-Mara East sub-County, Kenya. *Geoenviron Disasters*. 5(5) <https://doi.org/10.1186/s40677-018-0096-2>
- Glass C, Cook A, and Ingerson AR. (2015). Do women leaders promote sustainability? Analysing The Effect of Corporate Governance Composition Environmental Performance. *Business Strategy and Environment*.
- UN Women & UNEP. (2020). Think Piece: Gender and Climate Change in the Context of Covid-19. EmPower: Women for Climate Resilient Societies.
- Vahid Karim, Ezatollah and Marzieh etel (2019), Climate Change and agriculture: impact and adaptive response in Iran, Payame Noor University.
- Vahid Karimi, Ezatollah Karami, and Merzieh Keshavarz, (2018), impact and adaptive response in Iran, shiraz university.
- Watts, N., Adger, W. N., Agnolucci, P., Blackstock, J., Byass, P., Cai, W., ... & O'Neill, J. (2018). Health and climate change: policy responses to protect public health. *The Lancet*, 386(10006), 1861-1914.
- World Bank. (2014). Gender and Land Rights Database. Retrieved from <http://landportal.info/gender/land-rights>.

PART II: Awareness of issues regarding climate change among women in agriculture. Please, check the box as applied to you

CLIMATE CHANGE AWARENESS			
7. How would you access the rainfall patterns of this community within the last 10 years?	Changed/alterd	stayed the same	don't know
8. If altered/changed, what do you think has caused it?	climate change related reason	superstition/religion	Others
9. What do you do because of the altered rainfall patterns?	Adapt my farming practices to the changes	do nothing	Others
10. Do you have access to weather information?	YES	NO	don't know
11. What kind of weather information?	Rainfall	Temperature	Others
12. From which medium do you receive the weather information?	Radio	Television	Agric Extension officer

PART III: Climate change adaptation strategies. Please, check (/) the details as applied to you

A. Knowledge of seed variety

1. What is the main crop you have sown this season? _____
2. Do you know of other available varieties of this crop? Yes No
3. Which other varieties are available?
 - early maturing variety
 - drought resistance variety
 - flood-resistant variety
 - disease-resistant variety
 - other varieties
4. Why do you use it instead of other varieties?
 - don't know
 - drought resistance
 - flood resistant
 - disease resistant
 - other reasons

B. Knowledge of soil moisture retention techniques

1. Do you use know any technique(s) to retain soil moisture for your crops/plants, especially in times of drought? Yes No

2. Which soil moisture retention technique(s) do you use/know?

- mulching
 cover cropping
 other methods

C. Soil fertility techniques

1. Have you fertilised your farm for cultivation within the last five farming seasons?

- Yes No

2. How do you fertilise it?

- chemical fertiliser application
 organic composting
 organic manure
 others

D. Irrigation infrastructure

1. Do you irrigate your farm when there is drought? Yes No

2. Where do you obtain water for irrigation?

- river/stream
 lake
 dam
 Well/dugout
 tap water
 borehole
 others

Please, check (/) all adaptation strategies as applied to your farming activities

Adaptation strategies		
13. Soil improver (inorganic fertilizer)	YES	NO
14. Early planting	YES	NO
15. Early harvesting	YES	NO
16. Same crop two or more times	YES	NO
17. Planting on raised ridges	YES	NO
18. Soil water conservation/mulching	YES	NO
19. Mixed cropping	YES	NO
20. Drought resistant varieties	YES	NO
21. Late planting	YES	NO
22. Late harvesting	YES	NO
23. Early maturing varieties	YES	NO
24. Late maturing varieties	YES	NO
25. Planting in valleys/wetlands	YES	NO
26. Irrigation	YES	NO
27. Soil improver (compost/manure)	YES	NO
28. Rainwater harvesting	YES	NO

PART IV: Please, check (/) all challenges as applied to your farming activities

Challenges as applied to your farming activities		
12. Bush fire	YES	NO
13. Persistent drought	YES	NO
14. Less rain during the rainy season	YES	NO
15. More rain during the rainy season	YES	NO
16. Rising day temperature	YES	NO
17. Rising night-time temperatures	YES	NO
18. Early cessation of the rainy season	YES	NO
19. Late onset of the rainy season	YES	NO
20. The uncertain onset of the rainy season	YES	NO
21. Flood	YES	NO
22. Erratic rainfall during the rainy season	YES	NO

PART V: THE LIVELIHOOD OF WOMEN IN AGRICULTURE

1. The Food production from my farm in the last 5 years has
 - Decreased a lot
 - Decreased a little
 - Remain the same
 - Increase a little
 - Increase a lot
2. The Income from my farming activities in the last 5 years has
 - Decreased a lot
 - Decreased a little
 - Remain the same
 - Increase a little
 - Increase a lot
3. My Household Income from farming activities in the last 5 years has
 - Decreased a lot
 - Decreased a little
 - Remain the same
 - Increase a little
 - Increase a lot