SIMON DIEDONG DOMBO UNIVERSITY OF BUSINESS AND

INTEGRATED DEVELOPMENT STUDIES, WA

DROUGHT RISK REDUCTION STRATEGIES AMONG SMALLHOLDER WOMEN FARMERS IN NANDOM MUNICIPALITY, GHANA

SALIFU IBRAHIM TIANI

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BY

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THESIS SUBMITTED TO THE DEPARTMENT OF ENVIRONMENT AND RESOURCE STUDIES, FACULTY OF INTEGRATED DEVELOPMENT STUDIES, SIMON DIEDONG DOMBO UNIVERSITY OF BUSINESS AND INTEGRATED DEVELOPMENT STUDIES, IN PARTIAL FULFULLMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY DEGREE IN ENVIRONMENT AND RESOURCE MANAGEMENT

SEPTEMBER, 2024

DECLARATION

Student

I hereby declare that this thesis is the result of my own original work except for citations which had been duly acknowledged and that no part of it has been presented for another degree in this University or elsewhere:

Candidate' Signature:…… Date:……

Candidate's Name: Salifu Ibrahim Tiani

Supervisor Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision by the Simon Die Dong of Business and Integrated Development Studies.

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ABSTRACT

In Ghana, women are the dominant force in the agricultural sector, comprising more than half of the labor force. Their pivotal role ensures food security within the country. However, women face challenges in accessing essential resources like agricultural inputs, hindering their ability to mitigate natural hazards such as drought. The impact of drought on women farmers is compounded by their role as subsistence farmers. this study sought to assess the current drought risk scenario and the capacity of women farmers to cope with drought. The study adopted the pragmatic research philosophy and employed a cross-sectional research design and a mixed-methods approach. The study employed the simple random sampling method to select survey participants and the purposive sampling to select focus group discussion participants. Data was collected from a sample of 379 respondents using a survey and focus group discussions with smallholder women. First, the study revealed that smallholder women farmers exhibit diverse perceptions regarding the origins and impacts of drought, with some attributing it to human activities and others to natural causes. Smallholder women recognize the significant impact of drought on their agricultural practices and livelihoods, including difficulties in planting and growing crops, sub-optimal crop growth, and unpredictable rainfall patterns. In addition, the study revealed that there is a significant impact of drought on the agricultural activities of smallholder rural women and climate change exacerbates these challenges, with drought, irregular rainfall, and extreme weather directly impacting agricultural productivity and livelihoods. The study also revealed the multifaceted consequences of drought, such as reduced crop yields, livestock losses, and disruptions to traditional farming methods. Also, the study revealed that smallholder women use gardening, off-farm employment, adjusting planting times, cultivating short-season crops, crop rotation, early harvesting of crops and other strategies as vital strategies for building drought resilience. However, strategies, such as crop insurance and water use restrictions, even though mentioned, showed lower adoption rates by women farmers. Finally, the study revealed that smallholder women identified limited access to financial resources, inadequate training, gender inequality and decision-making power, fragmented institutional support and climate variability and uncertainty as constraints they encountered in their efforts to reduce drought risks. These constraints intersect to shape the vulnerability of women farmers to drought-related challenges. The study recommends that the government through the MoFA should expand the coverage of its policies such the PFJ and 1V1D to include the construction and rehabilitation of water infrastructure and integration of climate-smart agricultural technologies into existing programs, to support smallholder women in adapting to climate change and mitigating drought impacts. The study also recommends enhancing agricultural extension services of the MoFA and providing customized support to empower smallholder women with the knowledge, resources, and tools necessary to thrive amidst environmental uncertainties.

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DEDICATION

This thesis is dedicated to my wife, children and the entire Tiani family.

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter provides a background to the study under investigation. The chapter clearly describes the problem being studied. It also outlines the study's research questions and objectives, including its significance and scope.

1.1 Background of the Study

Drought represents a significant weather-related risk that arises from an extended period of insufficient rainfall during the rainy season (Todmal, 2019). It is widely acknowledged that climate change is the primary factor contributing to the heightened occurrence of extreme events such as drought. The consequences of drought include water scarcity in the soil (Mishra & Singh, 2010; Todmal, 2019), impacting various sectors, with agriculture-dependent communities bearing the brunt of its effects (Mishra & Singh, 2010).

The severity of drought's impact is notably amplified in semi-arid regions compared to other areas (Garcia-Franco et al., 2018). This heightened vulnerability arises from factors such as diminished vegetation cover and the degradation of ecosystems (Tarasov et al., 2013). Semi-arid regions have historically experienced land use practices that have degraded their soils, reducing soil organic matter levels. Consequently, the heightened risks of drought and fluctuations in rainfall due to climate change present significant threats to agriculture within these regions (Sommer et al., 2011; Nhemachena et al., 2020).

Droughts pose significant challenges to ecosystems and food security, particularly in highly vulnerable regions such as sub-Saharan Africa. A key consequence of drought

in semi-arid areas is crops' diminished productivity and output (Ngongo & Haryati, 2021). This reduced agricultural yield affects local economies and exacerbates food security concerns, as crop production in these regions consistently falls short of meeting demand (Ngongo & Haryati, 2021; Yosef & Asmamaw, 2015).

Defining drought accurately remains challenging, with the complexity of recognizing its onset and severity. The transition from welcoming clear days after rain to growing concern as dry days persist underscores this uncertainty (Wilhite, 2000; Minucci, 2020). As Vogt et al. (2018) define, drought risk encompasses the potential for economic losses and damages during and post-drought. Yadav and Lal (2018) highlight the pivotal role of rural women farmers in Africa as primary observers and the most vulnerable group to drought impacts. Their vulnerability stems from limited alternative livelihood options and ownership rights, particularly regarding land and property (Ncube et al., 2018). This vulnerability is particularly acute in semi-arid regions like Ghana, where the livelihoods of rural women are consistently pressured by recurrent droughts and other natural hazards (Yadav & Lal, 2018).

Globally, there has been a significant rise in economic damages caused by natural disasters over the years. Domeisen (1995) noted that from the 1960s to the 1980s, these damages tripled from US$40 billion to US$120 billion. Subsequently, Carolwicz (1996) pointed out that in the 1990s, this trend continued with economic damages reaching US$400 billion. Specifically in the United States, between 1992 and 1996, losses from natural disasters averaged a staggering US$54.2 billion per week (Carolwicz, 1996).

Moreover, the impact of drought has also been increasingly severe in terms of economic, social, and environmental costs. While it's challenging to quantify this trend

precisely due to limited historical data, White and Haas (1975) estimated that annual crop losses in the Great Plains region of the United States due to drought were around US$700 million. By 1995, the US Federal Emergency Management Agency (FEMA) estimated that annual losses attributable to drought had risen significantly to US$6-8 billion (FEMA, 1995).

Climate change is expected to significantly influence the hydrological cycle, affecting water resource availability, flood and drought risks, and agricultural output. The scarcity of water resources, especially in warm, arid, and semi-arid regions, poses a critical challenge to global food security, with drought emerging as a primary threat, as evidenced by historical famines (Youssef et al., 2012). Unlike other natural disasters like floods or earthquakes, droughts unfold gradually over time, making pinpointing their onset and cessation challenging. This slow accumulation of drought effects, which can persist for years beyond the event itself, has led to drought being described as a "creeping phenomenon" (Wilhite, 2000).

Droughts are common in many sub-Saharan African nations due to extreme rainfall variability in arid and semi-arid regions and the limited soil moisture retention capacity in most soils. This vulnerability is exacerbated by factors like rain-fed agriculture and livestock being vital components of GDP, inadequate infrastructure, and low per capita income (Hulme, 1992). Reduced rainfall directly impacts sectors like agriculture, livestock, hydroelectric power generation, and other water-dependent activities. Africa has a history of rainfall fluctuations, with notable severe droughts in the early 1900s and again from the 1950s onward, including the significant droughts in West Africa in 1984 (Nicholson et al., 2018).

Since 1988, there has been a notable sequence of favorable years in the Sahel region, often accompanied by floods, leading some to interpret this as the end of the Sahelian drought period. However, it's essential to understand that rainfall patterns will continue to fluctuate, resulting in both good and bad years persisting (Gommes & Petrassi, 1996). Researchers have identified general regional trends in terms of variability, including inter-annual and intra-seasonal rainfall patterns, along with trends that may be upward or downward. Additionally, there is a persistence factor, reflecting the inertia affecting climatic variables across different time scales, where good and bad years are not random but tend to occur in clusters (Nicholson et al., 2020).

Due to the finite nature of the world's water resources, the increasing pressure of food demand due to a rapidly growing population is expected to exacerbate the impacts of drought (Somerville & Briscoe, 2001). The severity of drought is influenced by various factors such as the frequency and distribution of rainfall, evaporation rates, and the capacity of soils to retain moisture (Wery et al., 1994). When there is a deficiency in soil water, crop yields are adversely affected due to factors such as reduced absorption of photosynthetically active radiation by the canopy, decreased efficiency in utilizing radiation, and a lower harvest index (Earl & Davis, 2003; Su et al, 2020).

Meteorological data on rainfall patterns, which demonstrate trends in the district's climate and the occurrence of extreme weather occurrences, as the drought in this example. In general, there has been some annual variation in the amount of rainfall. Among the instances that stand out and are still vivid in the interviewees' memories are the. Drought in 1982–1983 destroyed livelihoods and forced people to eat a wide variety of plants and animals that were customarily associated with taboo. The significant variations in precipitation between 2011 and 2013(350 and 250 mm respectively) provide evidence that a drought may transpire in a specific year and heavy rains in another. 3 years' precipitation trends thus from 2011 to 2013. Ghana Meteorological Department. (Wa) 2014, as cited Issac Agyemang; etal (2018).

Below are number of monthly recorded rainfall figures from April, 2020 to October, 2020 Ghana Meteorological Department (Wa. 2020)

April,	May,	June,	July,	August,	Sept,	Oct,
107.1	195.4	161	116.7	74.9	381.5	83

The figures below were recorded rainfall figures of the number times it rained in each month in 2021from February, 2021 to December, 2021 respectively. Ghana Meteorological Department (Wa. 2021).

Feb	Mar	April	May	June	July	August	Sept	Oct	Nov	Dec
5.3	53.9	87.2	192.2	130.5	233.3	331.5	217.4	111.1	5.0	11.0

However, despite the figures recorded above, the drought situation in the region in general and Nandom Municipality in particular has been worsening over the years. According to the Meteorological Department of the Upper West Region, the rains usually delay in starting and this makes it difficult for the farmers in the municipality to start their farming activities at the right time. The Department further explained that, the agricultural drought situation arises, when the rains fail to start from late June to Mid-July which constitutes the right time for planting. This situation often results in crops already planted by the farmers based on their experience dying creating difficult situations for the farmers.

For the purposes of this research, drought is considered to be a long period without water for agricultural activities during farming season, which affects smallholder rural women farmers. (Field; researcher's;2024)

1.2 Problem Statement

In Ghana, women constitute a significant portion of the agricultural workforce, accounting for over half of the labor force (Asitik & Abu, 2020). This highlights the essential role women play in ensuring food security within the country. However, their

access to critical resources such as agricultural inputs, land, and finance remains limited, significantly reducing their capacity to manage and mitigate natural disasters like droughts (Asitik & Abu, 2020).

Drought is a recurrent issue in the Nandom Municipality, located in the Upper West Region of Ghana, which is characterized by a semi-arid climate. The area experiences prolonged dry seasons that can last up to eight months, from October to May, severely impacting agricultural productivity (Nandom Municipal Department of Agriculture, 2020). Smallholder women farmers in Nandom, who primarily rely on rain-fed agriculture, are particularly vulnerable. These women typically cultivate small plots of land, often less than two hectares, with a focus on subsistence farming. The primary crops grown include millet, sorghum, maize, and groundnuts—staples that are highly susceptible to drought (Nandom Municipal Department of Agriculture, 2020).

The impact of drought on these women is profound due to their dependence on subsistence farming, where the yields are often barely sufficient to meet household consumption needs, with little or no surplus for sale or income generation. This vulnerability is exacerbated by the fact that these farmers have limited access to drought-resistant seeds, irrigation facilities, and other adaptive technologies that could help them mitigate the impacts of drought (Jarawura, 2013; Fagariba et al., 2018).

Previous research on drought mitigation in Ghana has generally overlooked the unique challenges faced by smallholder women farmers, especially in semi-arid regions like Nandom (Antwi-Agyei et al., 2012; Armah, 2011; Dwomoh et al., 2019). While Jarawura (2013) examined the phenomenon of drought-induced migration among young farmers from northern Ghana, and Fagariba et al. (2018) explored general drought adaptation strategies among rural farmers, these studies did not delve into the

specific experiences and resilience strategies of women who remain in their communities to continue farming under increasingly challenging conditions.

There is, therefore, a critical gap in understanding the specific drought risk reduction strategies that rural smallholder women farmers in Nandom employ to cope with the frequent and prolonged periods of drought. Recognizing the current climate change context and understanding these women farmers' strategies are crucial for developing effective interventions that enhance their resilience and sustain agricultural production in the region.

This study aims to address this gap by exploring the effects of drought on women subsistence farmers in Nandom and assessing the risk reduction strategies they adopt to enhance agricultural production. By focusing on the experiences of smallholder women farmers in this semi-arid region, the study contributes to the broader discourse on drought risk reduction and the resilience of vulnerable farming communities in Ghana.

1.3 Research questions

1.3.1 Main research question

How do women smallholder farmers in Nandom Municipality cope with drought risks?

1.3.2 Specific research questions

i. How do smallholder rural women farmers perceive drought risks?
ii. How does drought affect the farming activities of smallholder rural women farmers?
iii. How do smallholder rural women farmers reduce the effects of drought risks?

iv. What are the constraints to drought risk reduction strategies of rural women smallholder farmers?

1.4 Research Objectives

The main objective of the study is to assess the drought risk reduction strategies of smallholder rural women farmers in Nandom Municipality.

The specific objectives are:

i. To analyse the perceptions of smallholder rural women farmers about drought risks.

ii. To assess the effects of drought on smallholder rural women's farming activities.

iii. To examine drought risk reduction strategies of smallholder rural women farmers.

iv. To assess the constraints to drought risk reduction strategies among smallholder rural women farmers.

1.5 Significance of the Study

With increasing global surface temperatures, the possibility of more droughts makes this study imperative. The contribution of the study is evident in the following ways; in terms of knowledge, the study will generate information on the exposed assets and/or women to the effects of drought so as to enable rural women smallholder farers to adequately respond to risks posed by drought. Once more, this research aims to make a policy-based contribution aligned with Sustainable Development Goal 13. This goal emphasizes the urgent need for action to address climate change and its consequences, particularly by enhancing resilience and adaptive capabilities against climate-related

hazards and natural disasters worldwide. Additionally, the study will align with Ghana's 2013 National Climate Change Policy (NCCP-2013), which envisions a climate-resilient and sustainable economy. This policy framework emphasizes the importance of achieving sustainable development through low-carbon economic growth strategies for Ghana.

With regards to theory, the study is relied on the theory of planned behaviour which in its current form is very general in nature, and therefore will be contributing to ensure that, the theory includes the specific drought risks that rural smallholder farmers are faced with and how to reduce these risks to maximize their farm yields. The study will also provide information to enable policy makers both state and non-state actors to understand the intrinsic vulnerability of rural women farmers in semi-arid areas in Ghana in general and therefore, the Nandom Municipality in particular.

1.6 Scope of the Study

The study was conducted in these four communities of the Nandom Municipality; Gengengkpe, Monyupelle, Ketuo and Goziiri within the length of two years (2022-2024). The study generally assessed the drought risk reduction strategies of smallholder rural women farmers in the area. Specifically, the study analysed the perceptions of smallholder rural women farmers about drought risks. The study also assessed the effects of drought on smallholder rural women's farming activities. The drought risk reduction strategies of smallholder rural women farmers were also examined. Lastly, the constraints to drought risk reduction strategies among smallholder rural women farmers were also assessed.

1.7 Organization of the Study

The thesis is organized into five main chapters. Chapter one comprises of the study background, the problem statement for which the research intends to investigate, research questions and objectives as well as justification of the study. Chapter two consists of a review of literature relevant to this research, whiles chapter three entails the methodology (the study area, sampling techniques to be used and methods of data collection and analysis to achieve the relevant objectives). Lastly, chapter four presents the empirical results of the survey conducted and chapter five is made up of summary of the findings, conclusion and suggestions for policy recommendations and future research areas.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides a summary of the previous research that is pertinent to this topic. It discusses some terminologies and concepts, the state of drought across the globe, in Africa, and in Ghana, specifically how it has affected Ghana, the effects of drought on smallholder rural crop farmers, the different types of adaptation strategies for droughts and the barriers that prevent people from adopting adaptation strategies. Theories on how technology is adopted, a review of methods of other researchers used in similar works in the past and the results obtained are also presented in this chapter.

2.2 Definition of Key Concepts

This segment discusses concepts that are very relevant to the study. It also looks at some theories and concepts that other researchers who conducted similar studies in the past applied and the results obtained thereof, the advantages and shortfalls of these theories and concepts as well as how they can be relied upon to improve upon the theory and concepts that this study will use. This section defines and provides additional explanations for terms associated with this study. These terms include drought, risk, perceptions, adaptation, and restrictions to risk adoptive behaviour, as well as smallholder farmers.

2.2.1 Drought

Drought, as a recurring natural phenomenon, poses significant challenges due to its complexity and adverse impacts (Dai, 2013; Heim, 2002). It is commonly defined as a period of significantly reduced precipitation compared to the long-term average, lasting long enough to cause substantial hydrological impacts (IPCC, 2014). This condition,

marked by abnormal water scarcity, negatively affects agricultural productivity and ecosystem functioning (Naumann et al., 2021).

Different scholars offer nuanced perspectives on drought. Naumann et al. (2021) emphasize soil moisture deficits caused by various factors, while the IPCC (2021) defines drought as abnormally dry weather leading to hydrological imbalances. Loon et al. (2016) considers socioeconomic drought, which arises from increased water demand during water scarcity, adding complexity to drought's definition.

Droughts are categorized into meteorological, agricultural, hydrological, and socioeconomic types, each with distinct characteristics and impacts (Adisa et al., 2019). Meteorological droughts denote dry weather based on climatic norms, while agricultural droughts concern water deficits affecting crops. Hydrological droughts, as discussed by Wilhite and Glantz (1985), focus on streamflow inadequacy. Notably, these categories often intertwine but are crucial for understanding drought's multifaceted nature.

The ramifications of drought extend beyond environmental concerns, affecting society and the economy (Naumann et al., 2014). Climate change is expected to exacerbate drought frequency and severity (Asadieh & Krakauer, 2017; Trenberth et al., 2014), with agriculture bearing the brunt of these impacts (Dilley et al., 2005; UNDRR, 2019).

The socio-economic context significantly influences how drought impacts different regions, highlighting the importance of vulnerability and resilience in mitigating its effects (Meza et al., 2020). Rural areas, often reliant on agriculture, face disproportionate challenges during drought events (Carro et al., 2016).

For the purposes of this research, drought is considered to be a long period without water for agricultural activities during farming season, which affects smallholder rural women farmers. (Field; researcher's;2024)

2.2.2 Risk

The concept of risk in relation to natural occurrences like drought is a combination of hazard and susceptibility. While exposure to the hazard remains relatively constant, vulnerability changes dynamically based on societal factors such as technological advancements, legislative changes, population shifts leading to altered demands, and other related factors. Measures such as mitigation, preparedness, monitoring/early warning systems, and forecasting aim to reduce the risk associated with future droughts through a better understanding of hazards, reducing vulnerability, or a combination of both (Wilhite, 2000).

Wilhite (2000) posits that hazard and vulnerability are integral components of risk. Hazard represents the potential for a catastrophic event, while vulnerability refers to the likelihood of occurrence and its impact within a specific time frame and geographical area. Risks vary in intensity, duration, and spatial extent, with natural disasters like droughts affecting single or multiple locations either sequentially or simultaneously. From a meteorological perspective, droughts are natural phenomena, and altering their frequency or severity is challenging. Understanding and characterizing the risks associated with drought climatology are fundamental aspects of drought management (Wilhite, 2000).

2.2.3 Vulnerability

Vulnerability refers to an individual or group's capacity to anticipate, manage, withstand, and recover from the impacts of natural hazards. This concept encompasses

various factors that determine the level of risk faced by someone's life and livelihood due to specific events in nature or society (Wilhite, 2000). There exists a spectrum of vulnerability ranging from high to low, which can result from either voluntary or involuntary factors, such as significant exposure to risks, sociocultural influences, or a combination of both (Wilhite, 2000).

According to the IPCC (2007), vulnerability to severe climatic events is defined as the extent to which a system lacks the ability to endure the adverse effects of climate change, variability, and extremes. Turner et al. (2003) further elaborates that vulnerability is determined by the degree of exposure a system faces. Additionally, vulnerability, as outlined by the IPCC (2007) and Adger (2006), encompasses factors such as atmospheric conditions, the frequency and intensity of climate fluctuations, the system's sensitivity, and its capacity to adapt.

Timmerman (1981) emphasizes the complexity of vulnerability as a topic and advises caution in discussing it concerning current events unless done rhetorically. However, Liverman (1990) points out that vulnerability is often linked with concepts like resilience, susceptibility, and adaptability, indicating its multifaceted nature.

2.2.4 Smallholder Farmer

A smallholder farmer is typically characterized as an individual who cultivates a variety of crops and raises livestock on a relatively small plot of land. This farming approach heavily relies on limited labor to produce crops and animal products for household consumption and income generation (Van Averbeke et al., 2011; Herrero et al., 2014). These farmers typically manage land ranging from 1 to 5 hectares, cultivating a diverse range of crops such as horticultural produce, cotton, tobacco, and maize (Muimba-Kankolongo, 2018). They often face challenges in accessing infrastructure, human and

financial resources, as well as modern agricultural equipment and technologies (Ruwanza et al., 2022).

For the purposes of this study, smallholder women farmers denote women who are into farming with hectares between 1-5 and raising of animals, mainly to feed the family and to generate minimal income. They basically rely on the benevolence of the rains to carry out their farming activities. They mostly face a lot of challenges such as access to fertile lands, financial resources and labour among others. (Field work, 2024)

Despite these challenges, it is crucial to acknowledge the significant role that smallholder farmers play in global food security. Studies estimate that smallholder farmers in sub-Saharan Africa alone contribute between 75 and 80 percent of the region's food supply (Antonaci et al., 2014; Nyambo et al., 2019), making a substantial impact on both household welfare and food security (Saint Ville et al., 2015; Tembo et al., 2014). Although they are key contributors to food security, it is concerning that only 12% of the world's arable land is utilized by smallholder farmers (Lowder et al., 2016), highlighting the significant levels of marginalization they face in agricultural landscapes.

2.2.5 Risk Perception

Developing and implementing strategies for reducing catastrophe risks relies heavily on how individuals perceive and assess these risks (Sattar & Cheung, 2019). There exists a notable gap between the risk perceptions of the general population and the risk assessments made by experts (Garvin, 2001). This disparity often impedes the effective implementation of programs and policies aimed at reducing catastrophe risks. Local perspectives play a crucial role in understanding individual exposure to climate threats,

which is essential for formulating and executing successful policies (Guodaar et al., 2021).

Farmers' daily observations of environmental conditions and their local knowledge contribute significantly to risk perception. However, when it comes to perceiving climate change, the inherent variability in day-to-day weather can make it challenging for farmers to discern long-term trends (Habtemariam et al., 2016), leading to diverse perceptions of climate change. Additionally, observations are often separated by time, and memories of past events—both individual and collective—can be flawed or imprecise (Song et al., 2021). This distinction highlights the difference between factual knowledge (semantic) and personal recollections of events or experiences (episodic) (Plate, 2017).

2.2.6 Coping

Various definitions of coping have been explored in the scholarly literature, alongside distinctions between coping and adapting. Yilma et al. (2014) describe household reactions to shocks as drought coping, while Kelly et al. (2005) defined it as a short-term survival strategy within the prevailing socioeconomic context. Additionally, Adger et al. (2003) define adaptive capacity as a system's ability to modify its attributes to better handle external stresses, whether current or anticipated. Empirically, there is often significant overlap and ambiguity regarding the actions categorized by researchers as coping or adapting (Karuku et al., 2019).

Despite the importance of broader economic, political, and structural adjustments to mitigate drought impacts, many smallholder farmers rely on autonomous coping strategies based on their personal circumstances rather than large-scale interventions and policies. Smith et al. (2009) emphasize the need to understand farmers' perceptions

of drought and how these perceptions influence their actions. Climate-related perceptions play a vital role in shaping farmers' decisions to cope or not cope, with research indicating that responses are influenced by individuals' perceptions, especially when challenges surpass previous experiences (Eakin et al., 2010; Castellanos et al., 2010; Laweless et al., 2015).

Improving development initiatives and climate-related policies that historically marginalized women (Kanji et al., 2007) and minority groups necessitates incorporating diverse perspectives (Bedasso et al., 2017). Individual and household responses to drought are influenced by factors such as personal views, knowledge, cultural beliefs, and experiences (Onumah et al., 2016).

2.2.7 Adaptation

The term "adaptation" encompasses strategies aimed at mitigating, preparing for, and addressing the future impacts of climate change. It also involves adjusting current behaviors to reduce vulnerability in various areas, communities, and among farmers (Wreford et al., 2010). Adaptation plays a crucial role in enhancing the resilience of sensitive systems and reducing the risks posed by disasters such as drought and water scarcity, thereby safeguarding economic, social, and ecological systems (Inkani, 2015).

There are two main approaches to adaptation: action-based and resilience-based measures (Stringer et al., 2009). Action-based measures focus on how institutions and social organizations respond to environmental challenges, while resilience-based measures emphasize capacity-building within socioeconomic systems. Both approaches are important for effective adaptation strategies.

Adaptation can also be classified as either public or private (Tompkins & Eakin, 2012). Private adaptation involves individual farmers' efforts to respond to drought, which not

only reduces their own vulnerability but also improves the overall performance of the agriculture sector. Various private adaptation measures exist, including irrigation, water storage in basins, cultivating drought-resistant crop varieties, replenishing aquifers, and desalinating seawater (Duinen et al., 2015b). Farmers and producers' organizations often employ these measures to mitigate climate-related risks and capitalize on economic opportunities.

On the other hand, "public adaptation" refers to government responses that support private adaptation initiatives (Duinen et al., 2015b). These responses may include financial incentives, removing institutional barriers, or raising public awareness. Public adaptation is essential for addressing challenges that cannot be adequately tackled through individual efforts alone, requiring coordinated actions by governments, NGOs, and other organizations.

2.2.8 Restrictions to Risk Adoptive Behaviours

Individuals would be better equipped to make informed, proactive decisions and achieve effective economic drought risk management if they possessed perfect foresight of future drought risks, flawless early warning systems, and were free from socioeconomic constraints (B. Waldman et al., 2020). However, in reality, assumptions of perfect information and sufficient investment capacity often do not hold true when examining actual adaptation responses (Schlüter et al., 2017). Stakeholders' risk perceptions, past experiences, emotional responses such as fear or worry, perceived self-efficacy, and perceived behavioral control all introduce biases into the rational decision-making process concerning economic adaptation (van der Veen et al., 2016). Consequently, adaptation decisions are frequently influenced by these factors.

There is a growing body of research aimed at understanding the various factors that influence the decision-making process regarding the implementation of adaptation strategies (Chudasama et al., 2017).

2.2.9 Gender and Climate Change

Because of limited means and opportunities, women tend to make fewer changes than men. Women often do the bulk of the composting and vermiculture work, which is a barrier to implementing new farming practices. This trend suggests that gender conventions are being accommodated rather than challenged by new CSA practices (Jost et al., 2015; Huyer, 2016).

Women, often responsible for providing for their families and working in agricultural fields, are frequently marginalized and omitted from conversations about addressing the impacts of climate change. Research indicates that women constitute a significant portion of the global impoverished population and are particularly susceptible to the repercussions of climate change on their access to natural resources (Dankelman, 2011). According to UNAIDS (2009), women in numerous nations bear the primary burden of climate change due to their predominant presence in the agricultural sector, coupled with limited opportunities to enhance their living standards or generate income.

Thus, they are more likely to become poor. In many societies, women are not included in discussions about the allocation of land and other resources that are essential to their survival (Okali & Naess, 2013). Women's social, economic, and political liberties are constrained by the superior social authority and freedoms men enjoy. Men in drought-stricken areas, for instance, may decide to move away from the house as a means of adjusting to the situation (Okali & Naess, 2013; UN, 2009; Benhin, 2008). At the household level, women are in charge of water management, which means they are the

ones to go out and gather water for their family every day. Women and children often suffer the brunt of the costs associated with poor sanitation because water from faraway sources is often insufficient and tainted (UN, 2009). Women's health challenges can restrict their capacity to support their families. Consequently, women and children frequently experience hunger because they must wait until the men and boys have eaten before receiving their meals (Heise et al., 2019).

In many countries, women contribute significantly to both labor and talent, which plays a crucial role in driving economic progress (Doss, 2011). Given their extensive experience in providing for their families, women often possess valuable expertise in agriculture compared to men. However, despite this expertise, women's perspectives are frequently overlooked in the development and execution of climate policies, even though they offer a wealth of knowledge and adaptive strategies (Nellemann, 2011).

Studies have indicated that when women and men have equal access to resources, the outcomes are mutually advantageous (Teklewold et al., 2013; Okali & Naess, 2013; Doss, 2011). Women are highly motivated to contribute their skills and resources to benefit their families and communities. Furthermore, due to their strong reliance on local environments, women in developing and least developed regions are particularly vulnerable to the impacts of climate change (Quan, 2011).

Additionally, women face significant economic disparities, with a 30-80% pay gap in economic activity and earnings attributed to factors such as limited education and training (Nellemann, 2011; World Bank, 2011). These inequalities further underscore the importance of considering and empowering women in policies and initiatives related to climate change and economic development.

2.2.10 Droughts in Ghana

In Ghana, a significant portion of the population, approximately 55%, is employed in rain-fed agriculture, which contributes around 30–40% of the country's foreign exchange earnings and constitutes about 35% of its GDP (Lolig et al., 2014). However, Ghana's vulnerability to climate change and unpredictability is notable due to its location in the tropics. Situated with the Atlantic Ocean to the south, Ghana is exposed to diverse oceanic impacts and atmospheric fluctuations (Dovie, 2010; EPA, 2009). Climate change projections indicate that the country is expected to experience more variable rainfall patterns and higher temperatures in the coming years (IPCC, 2007). Since 2010, there has been an average temperature increase of 0.25 degrees Celsius in agroecological areas, accompanied by a decline in rainfall, particularly in zones like the Guinea and Sudan Savannah regions (Asare-Kyei et al., 2015; Derbile et al., 2022). Ghana, situated in the delicate Sudanian Savannah ecological zone, has recently faced severe disasters such as floods and droughts (Asare-Kyei et al., 2015; Derbile et al., 2022). Consequently, Ghana is among the African nations most vulnerable to various natural disasters induced by environmental changes, including climatic variability (Acheampong et al., 2014; World Bank, 2011).

Drought in Ghana has historical linkage to some folk stories and festivals to mark such spells. Some households believed that drought was due to their belief in a deity who had the ability to both cause and prevent rain (Lolig et al., 2014). They consequently requested help from and made offerings to the "rain gods" in order to ask for rain during times of drought as a coping strategy. Such sacrifices are made using funds provided by the community. The country remains vulnerable to drought episodes especially in the northern part which experiences unimodal rainfall with much unpredictability. A World Bank study (2010) on precipitation forecast reveals a cyclical pattern over the

period 2010-2050 for all regions of the country with high rainfall levels followed by drought every decade or so.

Several significant droughts have affected Africa at different periods, spanning from 1910 to 1983. Tandoh (1985) documented drought occurrences in West Africa, including Ghana, during distinct periods: 1910-1920, 1939-1949, and 1968-1983. Notably, within the 1939-1949 drought period, droughts were observed in Navrongo from 1940-1949 and in Kumasi from 1939-1950. Kete Krachi experienced a prolonged dry spell from 1950 to 1983, lasting 34 years, with a specific 24-year drought period. Similarly, Wa in the Upper West region faced a dry spell from 1946 extending into 1961, while Accra's spell began in 1935 and ended in 1959.

The 1983 drought in Ghana is regarded by the government as the most severe in the nation's history (Owusu & Waylen, 2009). This drought had devastating effects, destroying farmlands and significantly reducing water levels at the Akosombo dam, leading to electricity rationing. This crisis deepened Ghana's economic challenges (Dei, 1988), with the dam losing a substantial portion of its water supply, impacting hydroelectric power generation and affecting countries like Ghana, Benin, and Upper Volta, which relied on it for 65% of their electricity.

The preceding ten-year drought before 1982-1983, considered the worst in a century (Dei, 1988), forced people in towns and villages to travel long distances for potable water due to severe shortages. The persistently low humidity levels, dropping below 10% during the extended dry season and reaching the southern coastal regions, exacerbated the situation. The country faced one of its most severe harmattan seasons between 1982 and 1983, reflecting the dire impact of poor rainfall during that period.

During the extended drought period from August 1982 to May 1983, and the subsequent intense harmattan dryness, Ghana experienced a series of bush fires that inflicted significant damage on field crops like plantain, yam, cocoyam, cassava, and cocoa fields (Owusu, 2018). The extent of the damage caused by these bush fires has not been fully quantified. Media reports during 1983 and 1984 highlighted widespread bush fires that consumed property, agricultural lands, and even claimed human lives nationwide. Out of the nation's 1.8 million hectares of cultivated land, it is estimated that hundreds of thousands of hectares were devastated by these fires (Doyle, 1983: 821). Additionally, there are unconfirmed reports suggesting that over 300,000 acres of farmland, primarily cocoa farms representing about 40% of Ghana's food and cash crop output, were lost due to the fires (Owusu, 2018).

Based on previous assessments, the agriculture sector in this country has suffered adverse effects from drought conditions. The country's increasingly hot and dry climate has significantly impacted sustainable agriculture (Armah et al., 2011; Dietz et al., 2013, 2021). Ajzen's theory of planned behavior (1985) suggests that people modify their behaviors to achieve goals. In response to the catastrophic consequences of drought, farmers in Ghana are adapting their farming practices (Derbile et al., 2021).

The Northern Savannah agroecological zone relies heavily on agriculture as its primary source of income but is vulnerable due to its erratic rainfall patterns and frequent droughts (UNDP, 1997; CIDA, 1999; EPA, 2012). Consequently, droughts significantly affect the ability of local residents to sustain themselves (Dietz et al., 2004; Laube et al., 2008; Van de Giesen et al., 2010), especially in food production compared to other regions (MoFA, 2007; EPA, 2012). The region's uni-modal rainfall regime and heightened intra-seasonal rainfall variability contribute to its susceptibility to drought

compared to other zones in the country (Dietz et al., 2004). Climate change is exacerbating these challenges by increasing rainfall variability and the frequency of droughts in northern Ghana (EPA, 2000). The erratic rainfall patterns in northern Ghana have led to severe droughts, impacting livelihoods negatively (Hesselberg & Yaro, 2006; Van der Geest, 2011).

In recent years, the Upper West Region, like other northern regions of Ghana, has faced recurring droughts and floods, severely impacting crop and livestock production as well as rural livelihoods. Drought, defined as a situation where the soil's water content no longer meets the needs of a specific crop (Lolig et al., 2014), has become increasingly unpredictable and prolonged in northern Ghana. Agricultural drought, as termed in this study, affects expected crop yields (Wu & Wilhite, 2004), particularly affecting households reliant on rain-fed agriculture.

The consequences of these recurring droughts and floods have been food shortages, increased agricultural commodity prices, and environmental degradation. Unfortunately, adaptation policies in the region have not adequately addressed these challenges (EPA, 2012; Yaro, 2013). To foster effective adaptation, this research argues for integrating local perceptions into adaptation policies.

Currently, drought and flood impacts are primarily managed through ad hoc relief distributions in Ghana, offering limited long-term resilience for affected households (Derbile et al., 2021). Sustainable solutions require institutionalized approaches such as Environmental Change Adaptation Planning (ECAP) based on an understanding of smallholder farmers' environmental sensitivities (Derbile et al., 2021).

Reducing household vulnerabilities and dependence on aid involves enhancing coping and adaptation strategies. Coping strategies, seen as short-term measures, contrast with

longer-term adaptation strategies (Yaro, 2010). This study focuses on exploring how smallholder women farmers in the Nandom Municipality of the Upper West Region cope and adapt to drought conditions, aiming to improve their welfare and resilience.

2.3 Theoretical Review

This section reviews key theories related to climate change, drought risk, and adaptation strategies that have informed previous studies. The theoretical frameworks discussed here provide a foundation for understanding the adaptive behaviors of smallholder farmers in response to drought, which ultimately guides the selection of an appropriate theory for this study. This review culminated in the choice of the Theory of Planned Behavior (TPB) as the most suitable framework for analyzing drought risk reduction strategies among smallholder women farmers in Nandom Municipality.

2.3.1 Theory of Planned Behaviour (TPB)

The Theory of Planned Behavior (TPB) is a psychological framework developed by Icek Ajzen in 1991. It is an extension of the Theory of Reasoned Action, which posits that human behavior is largely guided by behavioral intentions, which are shaped by an individual's attitudes and perceived social pressures. TPB expands on this by introducing the concept of perceived behavioral control, which accounts for the degree to which people believe they have control over their actions. TPB has become widely applicable across a range of fields, including public health, environmental management, economics, and agriculture, to explain the decision-making processes behind various human actions.

Key Components of TPB

Attitude Toward the Behavior

Attitude refers to the individual's overall positive or negative evaluation of a specific behavior. It is shaped by beliefs about the likely outcomes of the behavior and the perceived value of those outcomes. For example, in the context of this study, smallholder women farmers in Nandom Municipality may hold positive attitudes toward drought risk reduction strategies if they believe that these strategies will improve their crop yields and food security. Conversely, if they perceive the strategies as costly, time-consuming, or ineffective, their attitude may be negative, which could discourage them from adopting them. Understanding farmers' attitudes toward drought risk reduction is crucial in identifying what drives or hinders the adoption of adaptive behaviors.

Subjective Norms

Subjective norms refer to the perceived social pressure to perform or not perform a specific behavior. These norms are shaped by an individual's beliefs about whether important people in their life, such as family members, community leaders, or peers, approve or disapprove of a particular behavior. In the context of drought risk reduction, subjective norms might include the influence of community expectations regarding farming practices or the influence of local agricultural leaders promoting certain risk reduction strategies. If smallholder women farmers believe that the people around them expect them to adopt certain drought management practices, they may feel more compelled to do so, even if they have personal reservations. On the other hand, if there is little social support or encouragement, adoption rates may remain low.

Perceived Behavioral Control

Perceived behavioral control is a key addition in the TPB framework, distinguishing it from earlier models like the Theory of Reasoned Action. It refers to an individual's perception of their ability to successfully perform a given behavior, taking into account both internal factors (such as knowledge and skills) and external factors (such as access to resources or institutional support). This is particularly relevant to smallholder women farmers in drought-prone areas like Nandom Municipality, where external constraints, including limited access to water-saving technologies, financial resources, or market information, may hinder their ability to adopt drought risk reduction strategies. The perception of control, or lack thereof, plays a crucial role in shaping behavioral intentions. Even if farmers have positive attitudes toward drought adaptation strategies and face social encouragement, if they feel they lack the resources or capabilities to implement these strategies, they may still be reluctant to adopt them.

Together, these three components—attitude, subjective norms, and perceived behavioral control—influence the individual's behavioral intention, which is the direct precursor to behavior. A strong intention to adopt a specific behavior is more likely to result in the actual performance of that behavior, provided that the individual perceives themselves as having sufficient control over the situation.

Relevance of TPB to the Study

The Theory of Planned Behavior provides a comprehensive framework for analyzing the drought risk reduction behaviors of smallholder women farmers in Nandom Municipality, Ghana. This study focuses on understanding how these farmers perceive drought risks, what strategies they adopt to mitigate these risks, and the challenges they face in implementing effective adaptation measures. TPB is well-suited for examining

these behaviors because it incorporates both individual cognitive factors and external social and environmental influences, making it particularly useful in exploring the multi-faceted nature of decision-making in agricultural contexts.

Attitudes and Perceptions of Drought Risk

The first objective of this study is to analyze the perceptions of smallholder women farmers regarding drought risks. TPB's focus on attitudes directly aligns with this objective, as attitudes toward drought risk will influence farmers' decisions to adopt risk reduction strategies. Farmers with a high perception of the risk of drought may be more motivated to take preventive actions if they believe these actions will reduce their vulnerability. On the other hand, farmers who have experienced inconsistent rainfall in the past and have found drought mitigation strategies ineffective may hold negative attitudes toward adopting new strategies, hindering their proactive engagement.

Social Pressures and Community Norms

The second objective of the study is to assess the effects of drought on smallholder women's farming activities. Social pressures, represented in the TPB framework as subjective norms, play a critical role in determining how women farmers respond to drought. In many rural communities, farming decisions are influenced by cultural practices, family traditions, and the opinions of local leaders or agricultural extension officers. If drought risk reduction strategies are widely accepted and promoted within the community, farmers may feel socially obligated to adopt these measures. Conversely, if these strategies are not widely supported or are viewed as unconventional, farmers may resist adoption, even if they personally recognize their value.

Perceived Constraints to Drought Risk Reduction

The third and fourth objectives—to examine the drought risk reduction strategies of smallholder women farmers and assess the constraints they face—are closely linked to the concept of perceived behavioral control in TPB. This theory helps the study to investigate how farmers perceive their ability to implement drought risk reduction strategies. Farmers may encounter a range of barriers, such as limited access to credit, a lack of technical knowledge, or inadequate institutional support, all of which affect their perceived control over adopting drought mitigation measures. By understanding these perceived constraints, the study can identify key factors that prevent farmers from engaging in adaptive behaviors, despite having favorable attitudes or social encouragement.

Behavioral Intentions and Actual Adaptation

TPB also provides a framework for examining the behavioral intentions of smallholder women farmers. While intentions do not always translate into action, they are a significant predictor of behavior. Farmers who have strong intentions to adopt drought risk reduction strategies—based on positive attitudes, supportive subjective norms, and a high perception of behavioral control—are more likely to implement these strategies. The theory allows the study to explore how farmers' intentions, shaped by both personal and external factors, lead to actual adaptive behavior.

The interplay of drought and various stressors such as pest and disease outbreaks, rising agricultural input costs, inadequate infrastructure, and conflicts negatively impacts livelihoods (Gautier et al., 2016). However, different populations experience varying levels of drought based on their perception of the drought and their level of exposure. For instance, in Ghana, farmers in the Afram Plains region face severe drought spells

due to factors like limited land size, environmental degradation, increased input costs, and poor soil fertility (Westerhoff, 2009).

Numerous studies have highlighted that, psychological factors such as perceptions of climate risk, cognitive and motivational aspects like beliefs and values, and social factors like obligations, social pressures, and norms play a significant role in motivating people to adopt behaviors that can protect them from climate-related hazards such as droughts (refer to Figure 2.3). Consequently, some scholars suggest that more attention should be directed towards behavioral adaptations, particularly focusing on psychological factors to understand the motivation for adopting adaptation behaviors (Meinel & Hoferl, 2017; Kuhlicke et al., 2020).

At the organizational level, learning to adapt involves processes such as perceiving risks, evaluating potential solutions, implementing actions, and receiving feedback. This level of adaptive behavior adoption is shaped by institutional contexts encompassing social, cultural, political, and economic dynamics. Other influential factors for adaptive behaviors at this level include risk perceptions, risk framing, and organizational capabilities (Page & Dilling, 2020).

In conclusion the Theory of Planned Behavior offers a structured and comprehensive approach to understanding the decision-making processes of smallholder women farmers regarding drought risk reduction strategies. Its inclusion of attitudes, subjective norms, and perceived behavioral control makes it an ideal framework for examining how individual and social factors interact to influence adaptive behaviors. By focusing on the cognitive and social elements that shape smallholder women farmers' perceptions and actions, TPB helps address the study's key objectives, particularly in analyzing perceptions of drought risk, assessing the effectiveness of adaptation

strategies, and identifying constraints to their adoption. In summary, the Theory of Planned Behavior provides a robust theoretical foundation for this study. It allows for a nuanced exploration of how psychological, social, and contextual factors influence the adoption of drought risk reduction strategies among smallholder women farmers in Nandom Municipality, offering valuable insights for developing targeted interventions to enhance their resilience to climate change.

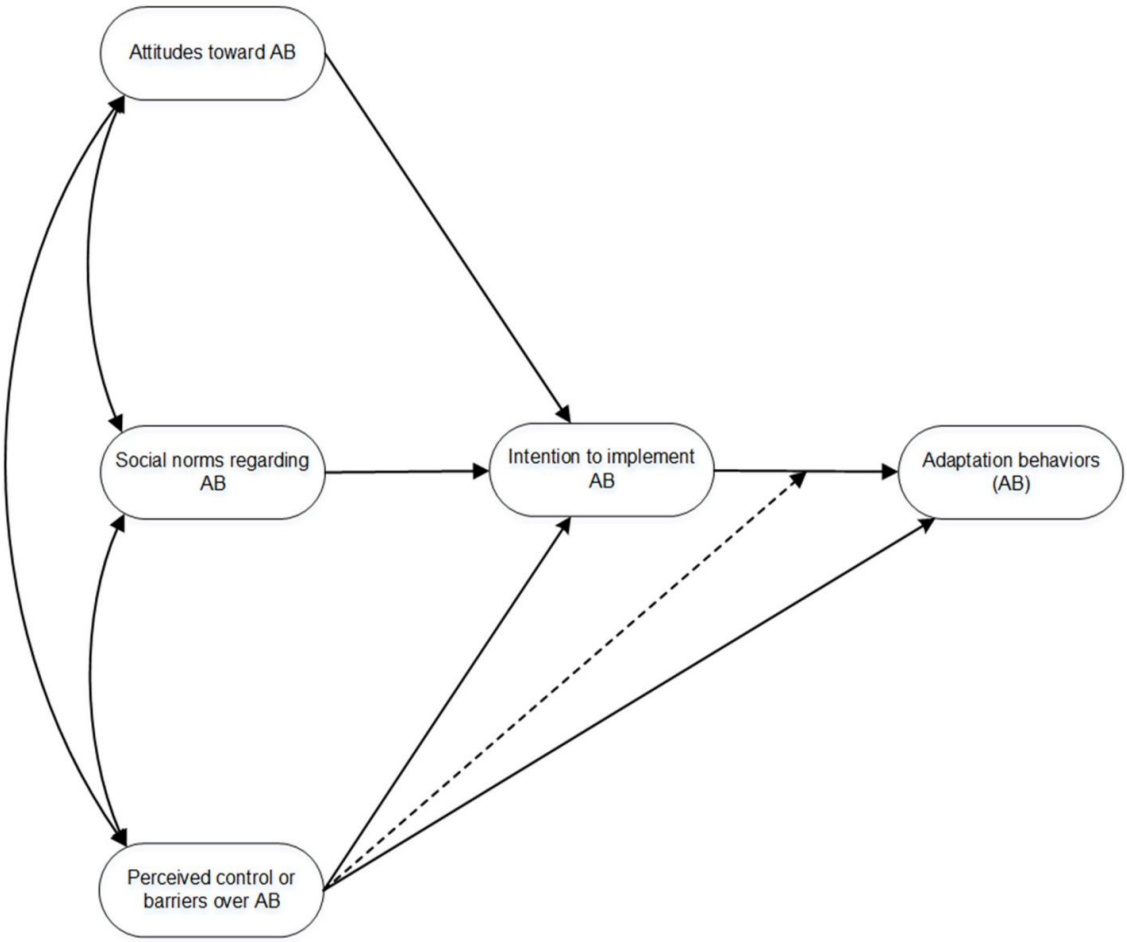

Figure 2.3: Graphical depiction of the TPB

Source: Jacob et al., 2021.

2.4 Empirical Review

2.4.1 Perceptions of Smallholder Rural Farmers about Drought Risks

There is a scarcity of information regarding how small-scale farmers manage and adjust at a local level, as well as the significance of perception in decision-making processes. Smallholder farmers often rely on "autonomous" methods based solely on their own knowledge and observations to adapt to their environment (Smithers & Smit, 2009). Their decisions are typically not based on extensive numerical data or cost-benefit analyses but are heavily influenced by their understanding and perceptions of climate change (Adger, 2003; Maule & Hodgkinson, 2002). The role of perception becomes particularly important when farmers face stress beyond their past experiences (Smit et al., 1996).

Studies across various regions such as the Sahel, the Nile basin of Ethiopia, Zambia, and semi-arid central Tanzania indicate that most farmers are aware of climate variability and extremes (Mertz et al., 2009; Deressa et al., 2011; Nyanga et al., 2011; Slegers, 2008). However, recent research suggests that mere awareness of climate change does not always translate into adaptive actions (Kahan et al., 2012; Lemos et al., 2012; Weber, 2010). Some experts argue that recognizing climate change is the initial step in the adaptation process (Deressa et al., 2011; Gbetibouo, 2009; Maddison, 2006).

Various factors such as culture, education, gender, age, resource availability, and institutional frameworks influence people's awareness and perception of climate change (Hamilton, 2011; Milfont, 2012; Posthumus et al., 2010). Policymakers need to understand farmers' attitudes towards adaptation investments, as local-level responses are integral to effective adaptation (Mertz et al., 2009; Tschakert, 2007).

While there's agreement on the importance of local-level actions, there is limited research on factors affecting smallholder perception and coping with climatic variability. Suggestions to enhance smallholders' adaptation capacity include integrating adaptation into national development agendas, building on existing farmer practices, and considering diverse environmental and socioeconomic contexts (Boko et al., 2007; Mertz et al., 2009; Ziervogel et al., 2006b).

Adaptive strategies are proactive measures taken in response to expected or actual climatic changes, while coping mechanisms are reactive responses to immediate threats like drought (Thomas et al., 2007). Farmers' awareness and understanding of climate change drive their decisions to adapt, highlighting the importance of tailored adaptation techniques for different regions (Moyo et al., 2012; Kihupi et al., 2015).

Farmers' coping and adaptation tactics are influenced by their perceived knowledge of climate change, emphasizing the need for increased awareness and recognition of changing climatic conditions (Adger et al., 2005). Failure to adapt to climate fluctuations can increase vulnerability among agricultural communities (Li & Geng, 2013; Li et al., 2017). Understanding farmers' perceptions and adaptation strategies at the local level is crucial for assisting them in addressing climate change challenges (Shemdoe, 2011; Kassie et al., 2013). However, there is a notable lack of literature on farmers' perceptions and adaptation plans in highly vulnerable areas like the northern region of Ghana, highlighting a critical research gap in understanding and supporting local adaptation efforts.

While recognizing the significance of local insights in adapting to climate variability and change and the need to integrate these into adaptation initiatives, the northern savannah agroecological region has been relatively overlooked, despite increased

attention in recent times (Bioversity, 2009; Yaro, 2013). Moreover, rather than adopting a comprehensive approach that encompasses perceived changes related to climate change along with other aspects like causation crucial for adaptation, most studies have predominantly focused on climate pattern changes that support climate science.

Simply acknowledging the reality of climate change and providing generalized explanations, as highlighted in various climate change studies, may not suffice for formulating effective policies. Instead, policy-making can benefit from specific and comprehensive insights into each climatic parameter. This study, situated in the Nandom Municipality of Ghana's Upper West Region within the northern Savannah agroecological zone, delves into how rural farmers perceive drought, aiming to provide more precise inputs for policy formulation.

2.4.2 Effects of Drought on Smallholder Rural Farming Activities

Drought stands out as a significant climate extreme that severely impacts livelihoods, particularly in dryland regions (Jarawura, 2014). Its effects on smallholder farmers have been long-standing and extensively documented in various empirical studies focused on understanding the implications of climate change, especially in low-income countries (Gebretsadik, 2012; Nhemachena et al., 2014). These studies employed diverse research methodologies to analyze how climate change affects rural economies, with a specific emphasis on agriculture.

For instance, Reid and Vogel (2006) utilized the DFID Sustainable Livelihoods Framework to investigate challenges faced by small-scale farmers in the Muden District of KwaZulu-Natal, revealing significant impacts of climate change on farmers' livelihoods. Similarly, Phuong (2012) conducted a study in Vietnam using qualitative methods, highlighting gender-specific impacts of climate change on farmers, with

women facing greater negative effects due to social factors. Mpandeli et al. (2015) focused on South Africa's Sekhukhune District, demonstrating how low and erratic rainfall adversely affects smallholder farmers' crop yields, contributing to food insecurity.

The vulnerability of smallholder farmers to drought is compounded by limited resources and adaptive capacity (Ruwanza et al., 2022). In contrast, commercial farmers often have better resources and infrastructure, such as advanced irrigation systems, financial stability, and access to technology, enabling them to mitigate drought impacts more effectively (Mpandeli, 2006).

Sub-Saharan Africa's heavy reliance on agriculture as a primary economic sector makes it highly susceptible to climate change impacts (Jones & Mann, 2004; IPCC, 2007). Changes in precipitation patterns and increased temperatures have been observed, leading to reduced agricultural productivity and increased risks from pests and diseases (Ludi & Py, 2009; Kabubo-Maria, 2008; Brander, 2010; Okunishi et al., 2012).

In countries like Ghana, where agriculture plays a crucial role in the economy, climate change-induced alterations in rainfall patterns have directly affected crop yields and planting seasons (MoFA, 2008; Stutley, 2010; Mendelsohn et al., 2006). These shifts have implications for food security, livelihoods, and overall economic stability (Tonah, 1993; Mensah-Bonsu, 2003; Fosu-Mensah, 2013).

In summary, climate change exacerbates the challenges faced by smallholder farmers, posing significant threats to food security, economic stability, and rural livelihoods in Africa and other vulnerable regions globally (Ampaabeng & Tan, 2012). Efforts to enhance resilience and adaptation among agricultural communities remain crucial in mitigating these adverse impacts.

2.4.3 Drought Management and Reduction Strategies among smallholder farmers

A substantial body of research highlights the potential of adaptive techniques to mitigate the adverse impacts of drought (Duinen et al., 2015a, b). Thus, there is a critical need to enhance farmers' adaptive capacity towards drought (Komba & Muchapondwa, 2015). Otitoju and Enete (2016) argue that adaptation can enhance flexibility, reduce risks from climate hazards, and capitalize on emerging climate-related opportunities. It also plays a vital role in sustaining regional productivity and securing food, income, and livelihoods.

Failure to adapt to climate change can hinder agricultural progress and exacerbate vulnerabilities in local and national economies (Nhemachena et al., 2014; Pakmehr et al., 2021). Recognizing this, there is a call for the development of effective drought solutions, given the potential shocks to both people and economies (Baudoin et al., 2017).

Williams et al., (2018) stress the importance of establishing effective drought coping, adaptation, and recovery strategies at various levels, including individual, household, community, and governmental levels. Past responses to drought have often been reactive, such as relief programs, which have been criticized for their limited effectiveness and lack of incentives for long-term behavioral changes (Dai, 2011).

Experts advocate for proactive adaptation measures to enhance drought resilience, such as drought monitoring and ecological restoration (Crossman, 2018). In Africa, local adaptation strategies, like reforestation and adjusting crop planting times, have been implemented (Zhou et al., 2016). However, for proactive measures to succeed, they

require robust institutional support, sound policies, and active participation from stakeholders (Baudoin et al., 2017).

During periods of drought, farmers often implement a range of agricultural and technical practices, such as adjusting fertilizer use, adopting drought-tolerant crop varieties, and cultivating crops that require less water. These strategies are crucial given the uncertainty of rainfall patterns, especially as agriculture plays a key role in sustaining the world's growing population. The severe droughts experienced in the Sahel regions of West Africa during the 1970s highlighted the necessity of robust institutions capable of providing weather and climate information services, as well as building the capacity of stakeholders in the region (Gautier et al., 2016).

As a response, the AGRHYMET Regional Center was established in 1974 as a specialized institution under the Permanent Interstates Committee for Drought Control in the Sahel (CILSS). This center was tasked with training groups to monitor various environmental conditions crucial for agriculture during the rainy season. Since its inception, there has been increased awareness among farmers regarding optimal planting times, suitable crop varieties, fertilizer application, and other strategies aimed at mitigating the impacts of drought (Partey et al., 2018).

Many farmers now leverage technology such as smart mobile phones to access agricultural advisory services, aiding their decision-making processes. In addition, practices like drip irrigation, planting pits, crop diversification, and policy initiatives focused on drought resilience have gained traction among farmers (Zougmore et al., 2016).

Smallholder farmers across Africa employ diverse strategies to reduce drought risks in their agricultural activities. These include building terraces to facilitate cultivation and

prevent soil erosion, pre-season water collection in pits, well-digging for irrigation, mulching, adopting conservation agriculture, and using drought-tolerant crop varieties (Tegemeo Institute, 2004; 2007; 2010).

Research on climate change adaptation practices underscores several critical factors influencing farmers' decisions. These include the characteristics of available technologies, farmers' risk perceptions and attitudes, knowledge dissemination through networks and extension services, institutional support, financial access, and policy frameworks such as land security. Socio-demographic factors like household size, gender of the household head, and age also play significant roles in adaptation strategies (Shikuku et al., 2017).

Studies focusing on Kenyan farmers have identified similar drivers and barriers to adaptation, including socio-economic factors like poverty levels, off-farm income, farm expenditure, food budgets, and human capital (Bryan et al., 2013; Tongruksawattana, 2014; Mohammad et al., 2010; Murgor et al., 2013). These insights contribute to understanding the complex dynamics of climate change adaptation in agricultural contexts.

2.4.4 Drought Risk Reduction Strategies of Smallholder Rural Farmers

Many countries in sub-Saharan Africa face heightened vulnerability to climate change due to their heavy reliance on agriculture and limited adaptive capacity (Bryan et al., 2013). The impacts of climate change are evident in Africa through shorter growing seasons, leading to significant parts of marginal agriculture becoming unproductive (Boko et al., 2007). Despite global efforts to study climate change, uncertainties persist regarding the frequency and intensity of adverse weather events (Mutekwa, 2009).

Numerous studies globally, including those by Deressa et al. (2009), Mertz et al. (2009), and Hisali et al. (2011), have examined how smallholder farmers adapt to changing climates and the importance of climate change adaptation in Africa. These studies generally find that farmers recognize climate change and are taking various steps to adapt to its impacts.

The distinction between coping and adaptation has been extensively discussed in the literature. For example, Yilma et al. (2014) view drought coping as immediate household responses to shock impacts, while others like Dercon (2002), Eriksen et al. (2005), and Pelling (2011) define coping as short-term survival strategies under existing socio-economic conditions. Coping strategies, although typically short-term, can evolve into longer-term solutions (Mpandeli et al., 2015). Taylor et al. (2010) note that households develop coping mechanisms to reduce vulnerability to pressures and shocks such as droughts, floods, and coastal erosion. These coping strategies differ from adaptation strategies as they are crisis-driven, quick, short-term, and primarily focused on immediate survival, often at the expense of the resource base (Taylor et al., 2010).

The term "coping strategies," as described by DFID (1999), encompasses a range of activities and decisions individuals use to achieve livelihood objectives in vulnerable situations like climate change. In essence, coping mechanisms can be seen as livelihood strategies within a subsistence framework and vice versa.

On the topic of drought adaptation, researchers have explored various definitions and strategies. For instance, Melka et al. (2015) emphasizes the proactive nature of adaptation, while Agesa et al. (2019) and Migosi et al. (2012) highlight the importance of long-term changes in coping mechanisms. Adger et al. (2003) provide another

perspective, defining adaptation as the capacity of a system to modify its properties to better handle current or anticipated external stresses.

Furthermore, adaptation strategies encompass a wide range of responses to climatic conditions aimed at reducing vulnerability (IPCC, 2001; Adger et al., 2002). Adger et al. (2002) argue that adaptation helps minimize risks associated with hazards by reducing social vulnerability. Adaptation can take different forms, including reactive, concurrent, anticipatory, spontaneous, or planned approaches (Smithers & Smit, 1997; Smit et al., 2000).

In practical terms, strengthening the resilience of farm households involves planning and implementing adaptation methods to mitigate the impacts of climate change. Short-term tactics may include activities like cultivating animals and vegetables for food and exploring additional sources of income beyond farming. Medium-term strategies, as suggested by Bhuiyan et al. (2010), involve adjustments in crop varieties, seed quality, irrigation techniques, and planting schedules to address climatic risks.

For long-term resilience, options such as farm diversification, as discussed by Karim et al. (2017), play a crucial role. This approach helps farmers navigate extreme weather events like droughts, floods, and heatwaves by increasing their non-agricultural income streams. These varied adaptation strategies collectively contribute to building resilience in the face of climate challenges.

Adaptation, as defined by the Intergovernmental Panel on Climate Change (IPCC) (2007) and supported by Deressa et al. (2008), encompasses changes in both natural and human systems in response to climatic influences, aimed at reducing harm or seizing opportunities. Below et al. (2010) identified various adaptation strategies

employed by farmers, totaling around 104 practices broadly categorized into farm management and technology; farm financial management; diversification of farm and off-farm activities; government interventions in infrastructure, health, and risk reduction; and knowledge management, networks, and governance (Osbahr et al., 2010).

Asbahr et al. (2010) highlight crop variety adjustments and livelihood diversification as primary adaptation techniques widely used by farmers across the continent. However, the selection of specific adaptation measures is influenced by diverse contextual factors (Gbetibouo et al., 2010; Hisali et al., 2011; Below et al., 2012). Other adaptation strategies include planting alternative crop types, mixed cropping, water conservation practices, and transitioning from farming to non-farming activities during extreme heat periods (Gbetibouo et al., 2010). Some farmers have opted for heat-resistant crops like cowpea. Employing low-cost strategies such as adjusting planting dates and diversifying crops is common, while more expensive measures like installing irrigation systems are pursued by a minority (Below et al., 2012), indicating adaptation choices are often constrained by financial capabilities.

Turpie and Visser (2013) echo this sentiment, noting that crop diversity and adjusting planting and harvesting schedules are viable approaches to climate change adaptation. However, distinguishing between coping and adaptation actions can be challenging, as they often overlap and share unclear boundaries in research classifications (Agesa et al., 2019; Opiyo et al., 2019; Gichangi & Gatheru, 2018). This study aims to encompass all activities and strategies under the broader framework of coping with drought.

According to Smit et al. (2000), coping refers to individuals' abilities to navigate, absorb, adjust to, and recover from drought impacts. Babi et al. (2005) define coping

strategies as actions or activities employed by farmers or households in response to sudden livelihood failures. Coping is a multifaceted, dynamic, and often nonlinear process (Quandt, 2021), involving the balancing of immediate adversities and sometimes incorporating various livelihood strategies as drought conditions persist (Mpandeli et al., 2015).

Addressing significant climatic changes may require larger-scale reforms at regional, national, or even global levels, as coping strategies have their limitations. Responses to climate change effects are situated within broader regional, national, and international contexts, thus being influenced by these contexts (Adger et al., 2003). Understanding how individuals adapt to various livelihood strategies within larger ecological and political-economic environments is crucial (Ribot, 2010). It's worth noting that studies have highlighted the existence of winners and losers when dealing with changing climatic conditions (Ribot, 2010; Taylor, 2013).

Managing stress and shocks due to climate change is not a new concept; many communities and individuals have historically coped with various shocks to endure and even thrive during difficult times (Quandt, 2021). Despite the importance of larger-scale economic and political transformations to address drought impacts, many smallholder farmers often rely on autonomous coping strategies based on their own experiences and conditions rather than on broader interventions or policies.

Therefore, this research emphasizes understanding how farmers perceive drought and how they respond to those perceptions, focusing on the most personal level of coping mechanisms, which is the individual. People's actions are influenced by their perceptions, especially in situations where stresses surpass their previous experiences (Quandt, 2021). Recognizing the significance of climate-related impact perceptions is

crucial in understanding how farmers cope or fail to cope (Tucker et al., 2010; Tanner et al., 2015; Soetanto et al., 2016).

Improving development efforts and climate-related policies and practices requires including diverse perspectives and addressing historical exclusions, such as those faced by women and underrepresented groups (Kanji et al., 2007; Bedasso, 2016). Focusing on individuals in this study allows each participant to share their unique experiences without being aggregated or anonymized. Individual and household decisions regarding drought coping strategies are influenced by factors such as perceptions, knowledge, culture, and attitudes (Quandt, 2019; Bene et al., 2016).

Quandt (2021) identified four primary categories of coping strategies employed during droughts: diversification of livelihoods, longer-term adaptation of livelihood strategies (especially related to agriculture), temporary coping methods, and erosive coping methods with detrimental long-term consequences. Individuals and households decide on coping strategies based on their experiences, knowledge, and available opportunities and resources (Quandt, 2021).

Livelihood diversification emerges as a crucial coping mechanism for smallholder farmers and households. Opiyo et al. (2015) emphasized the significance of livelihood diversification as a response to drought. This strategy enables risk distribution across time, geography, and sectors, expanding access to resources and livelihood options that vary in sensitivity to climatic shocks like drought (Quandt, 2021). However, scholarly discussions debate the merits of specialization versus diversification in livelihoods. Some studies (Eriksen et al., 2005) have critiqued livelihood diversification, highlighting cases where it strained household resources. Nonetheless, for many

individuals and households, livelihood diversification remains a primary strategy for coping with drought (Quandt, 2021).

Another significant coping strategy is the long-term adaptation of livelihood activities among smallholder farmers (Quandt, 2021). This includes transitioning to more drought-resilient agricultural practices such as embracing irrigation and drought-tolerant crop varieties (Quandt & Kimathi, 2015; Agesa et al., 2019).

Short-term coping strategies like casual labor, fodder collection, livestock sales, and reliance on wild/traditional foods also play a role in drought coping for smallholder farmers. These reactive strategies, as termed by Twyman et al. (2007) and Macon et al. (2016), are applied in response to drought for immediate survival, contrasting with longer-term proactive strategies (Quandt, 2021). Although casual labor is categorized as a short-term coping mechanism, it can sometimes evolve into a component of longer-term livelihood strategies or diversification efforts (Quandt, 2021). Studies in various regions such as South Africa, Tanzania, and Uganda have highlighted the utilization of casual labor as a response to climate change impacts (Dassanayake et al., 2018; Van Aelst & Holvoet, 2016; Cooper & Wheeler, 2017).

The fourth category of coping mechanisms discussed in studies is erosive coping, which involves livelihood alternatives that reduce the likelihood of a person or household securing a stable future (van der Geest et al., 2004). It's important to note the overlap between the terms "erosive coping" and "maladaptation." Maladaptation, first introduced by Smit (1993), refers to activities aimed at minimizing vulnerability to climate change but inadvertently impacting other systems, sectors, or social groups negatively (Barnett & O'Neill, 2010). However, these terms often refer to different scales in empirical usage (Barnett & O'Neill, 2010; Juhola et al., 2016). Erosive coping

pertains to individual or household livelihood activities, while maladaptation encompasses larger scales such as community planning, government policies, and regional infrastructure. "Erosive coping" better describes the coping mechanisms used by households and individuals that are neither environmentally nor economically sustainable.

Although research on erosive coping is limited, some studies have examined it (Opondo, 2012; Yaffa, 2013; Ahmed et al., 2013). Three significant erosive coping mechanisms against drought have been identified: relying on food assistance, grazing animals in protected areas, and charcoal production (Yaffa, 2013). However, these strategies have drawbacks such as increasing dependency on aid, conflicts with wildlife and conservation officials, and unsustainable resource use.

Farmers employ various coping strategies to mitigate drought risks, including direct seeding, zero tillage systems for soil moisture conservation, selling livestock during drought stress, and shifting to less water-intensive crops like sorghum (Mpandeli et al., 2015; Patt & Gwata, 2002; Adger et al., 2002). However, challenges such as limited access to inputs, markets, and technology hinder these practices, especially for smallholder farmers in low- and middle-income countries (Downing, 2004).

IFAD (2010) emphasizes that adaptation alone cannot fully address climate change impacts. Understanding climate change and supporting local populations in dealing with its implications are crucial. External interventions such as developing drought-resistant varieties, improving weather forecasts, providing financial services, promoting mixed farming, and enhancing rural transportation are advocated by Below et al. (2010) and Osbahr et al. (2010) to complement farmers' efforts in responding to climate change.

2.4.5 Constraints to Drought Risk Reduction among Smallholder Farmers

Adapting to climate change poses complex challenges that vary widely depending on specific circumstances and contexts. Farmers' decisions regarding climate change adaptation strategies are influenced by a range of factors, including social, economic, and environmental considerations (Bryan et al., 2013). It is crucial to support African farmers in developing effective adaptation strategies such as investing in irrigation facilities, adopting resilient crop varieties, and utilizing modern farm machinery.

Successful climate change adaptation in the agricultural sector requires a coordinated effort between private initiatives and government policies (Duinen et al., 2015a, b). Farmers globally have shown remarkable adaptability in responding to challenges like drought, which has reduced their vulnerability and enhanced overall agricultural performance. Governments also play a crucial role by implementing public adaptation measures, including funding support, infrastructure development, education initiatives, and awareness campaigns (Duinen et al., 2015b).

Despite these efforts, farmers encounter diverse obstacles in adapting to climate change, which vary across countries. For instance, Satishkumar et al. (2013) identified personal, institutional, and technical barriers faced by farmers in India. Personal constraints include traditional beliefs, low literacy levels, and a lack of knowledge about resilience-building strategies. Institutional challenges involve limited access to extension services, information sources, and credit facilities. Environmental constraints encompass issues like the unavailability of drought-tolerant crop varieties and insufficient access to weather forecasting information.

A recent study by Fagariba et al. (2018) highlighted the challenges faced by farmers in northern Ghana in adapting to climate change impacts. The study identified

unpredictability as the most significant barrier to effective adaptation, along with several other issues such as inadequate government support, lack of reliable weather information, land tenure challenges, high input costs, shortage of extension officers, and poor soil fertility. Similarly, Otitoju and Enete (2016) pointed out four major challenges confronting food crop farmers in south-western Nigeria regarding adaptation techniques, including land constraints, societal norms and beliefs, high input costs, and limited access to climate information and early warning systems.

Addressing these challenges requires improved communication and collaboration between policy makers and scientists, as emphasized by Evers and Pathirana (2018). Ige et al. (2021) identified various obstacles hindering the implementation of drought mitigation strategies, such as inadequate funding, labor shortages, poor extension services, lack of climate-resilient crop varieties, and unreliable agro-meteorological data.

Dumba et al. (2021) highlighted water scarcity as a critical limitation for farmers' ability to cope with drought impacts, particularly due to reduced irrigation possibilities. This scarcity, exacerbated by decreasing precipitation in specific agroecological zones, contributes to the financial constraints that hinder farmers' adaptation efforts (Owusu & Waylen, 2009). Lack of financial resources also hampers the adoption of drought-resistant seed varieties, as noted by Fisher et al. (2015) and Pardoe et al. (2016). Additionally, limited access to climate-based information, such as weather forecasts, further complicates smallholder farmers' adaptation strategies, particularly in regions like sub-Saharan Africa (Naab et al., 2019).

2.5 Conceptual Framework

The Theory of Planned Behavior (TPB) is based on three fundamental factors: attitude toward the behavior, subjective norm toward the behavior, and perceived behavioral control. These elements collectively influence an individual's motivation to engage in a specific behavior. While attitude and subjective norm provide motivation, the primary intention to perform the behavior arises when there is a strong sense of perceived control over that behavior (Ajzen, 2020). Within the framework of TPB, attitude toward the behavior is shaped by accessible beliefs about the behavior. These beliefs are subjective probabilities that performing the behavior will lead to a favorable outcome. Subjective norm encompasses both injunctive and descriptive normative beliefs. Injunctive beliefs relate to the individual or group's subjective probability of performing the behavior, while descriptive beliefs involve the influence of important others who perform the behavior. Perceived behavioral control encompasses accessible beliefs about control factors, including skills, abilities, time availability, financial resources, cooperation, and other relevant variables (Fishbein & Ajzen, 2010). These factors collectively contribute to an individual's perceived ability to control and execute the desired behavior.

Drought risk management and adaptive behaviors are evaluated using specific indicators, as highlighted by various studies. For example, Wheeler et al. (2013) emphasized the importance of distinguishing between planned and actual adaptation measures, noting that each carries significance in its implementation. They developed an adaptive index as the dependent variable, considering variables such as expansive strategies (e.g., land purchase, increasing irrigated area), accommodating strategies (e.g., improving irrigation efficiency), and contractive strategies (e.g., selling land). Roesch McNally et al. (2016) focused on farmers' intention to adopt specific

agricultural practices like no-till farming and cover crops, which are considered "selected production and conservation measures." Similarly, van Duinen et al. (2015) studied motivation for adaptation and identified twelve measures categorized as field-scale, farm-level, and joint measures that directly address drought risk.

Differentiating between ex-ante and ex-post measures, Van Winsen et al. (2016) found that less risk-averse farmers tend to opt for ex-ante measures, which contrasts with conventional expectations. Meraner and Finger (2017) explored a range of risk management measures categorized into on-farm agricultural measures, on-farm non-agricultural measures, and off-farm measures. Other studies, such as van Haden et al. (2012), Roche (2016), and Li et al. (2017), have developed indices or examined specific factors like new irrigation practices, proactive/reactive measures, and the number of adaptation measures without categorization, respectively.

Moreover, various independent variables are used in the literature to measure farmers' adaptive behavior regarding drought risks. These include threat appraisal, risk attitude, previous drought experience, coping appraisal, belief in climate change, social influence, socio-economic and demographic characteristics, knowledge, information, institutional incentives, and insurance options. These diverse studies collectively contribute to understanding the multifaceted nature of farmers' adaptive behaviors and the complex array of factors influencing their responses to drought risks. Based on the three factors underlying TPB, the model is constructed in Figure 3.3.

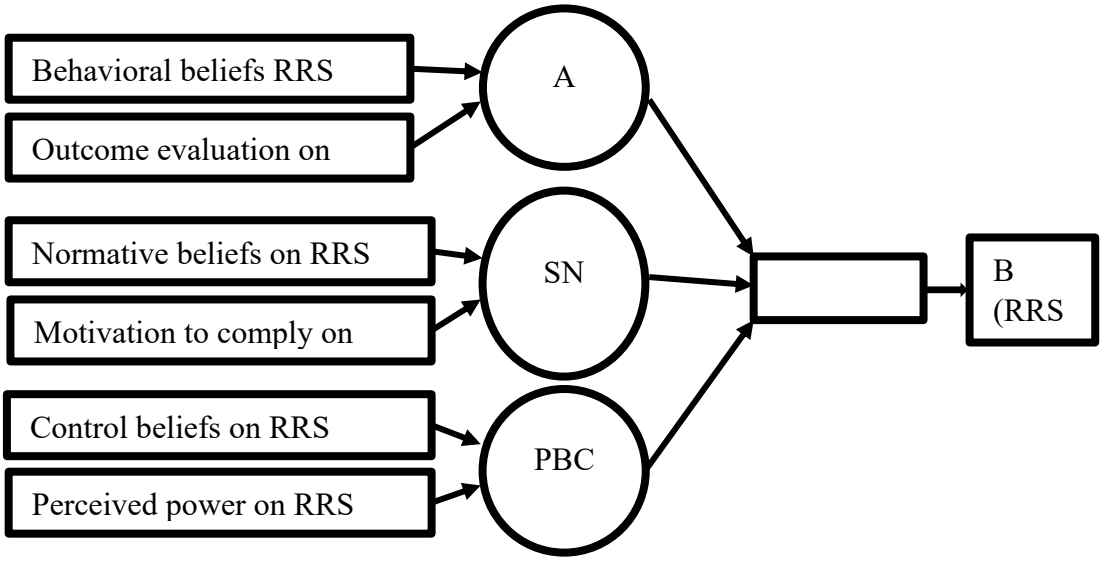

Figure 2.1: Conceptual model

Source: Adapted from Ajzen, 2019b

A =attitude

SN = subjective norms

PBC = perceived behavioural control

B = Behaviour = RRS = reduction strategies

Equation one shows regression model involving RRS and A score, SN score, PBC score and Intension score

B (RRS): $\beta 0 + \beta 1 \times$ Gender $+ \beta 2 \times$ Age $+ \beta 3 \times$ Marital status $+ \beta 4 \times$ Education $+ \beta 5 \times$ Main occupation $+ \beta 6 \times$ Household size $+ \beta 7 \times$ Dependents $+ \beta 8 \times$ Experience $+ \beta 9 \times$ A score $+ \beta 10 \times$ SN score $+ \beta 11 \times$ PBC score $+ \beta 12 \times$ Intention score $+ \varepsilon it$ (1).

CHAPTER THREE

STUDY AREA AND METHODOLOGY

3.1 Introduction

This chapter covers the research methodology used for the study. It introduces the study area and presents the research design, data and sources, target population, sample size and sampling procedure, research instruments, and pre-testing of instruments. It also covers the data collection process as well as data processing and analysis. Related ethical issues are also considered.

3.2 Study Area

3.2.1 Location

The research is being conducted in Nandom Municipality, situated in the Upper West Region of Ghana. Geographically, the Municipality is positioned in the north-western part of the Upper West Region of Ghana, bounded by Longitude 2°25 W and 2°45W and Latitude 10°20 N and 11°00 N (GSS, 2021). It shares borders with the Lambussie District to the east and the Jirapa Municipality to the south, while the northern and western boundaries adjoin the Republic of Burkina Faso (refer to Figure 3.1) (GSS, 2021). Covering a total area of 567.6 square kilometers, this constitutes approximately 3.1% of the total land area of the Region (GSS, 2021).

The Municipality comprises 88 communities, with 86% of its population residing in rural areas. The population density is estimated at about 89 individuals per square kilometer, making it the most densely populated municipality in the region. Its proximity to Burkina Faso positions it strategically for international interactions and exchanges, albeit presenting challenges related to the migration of Fulani herdsmen from the Sahel region into the district.

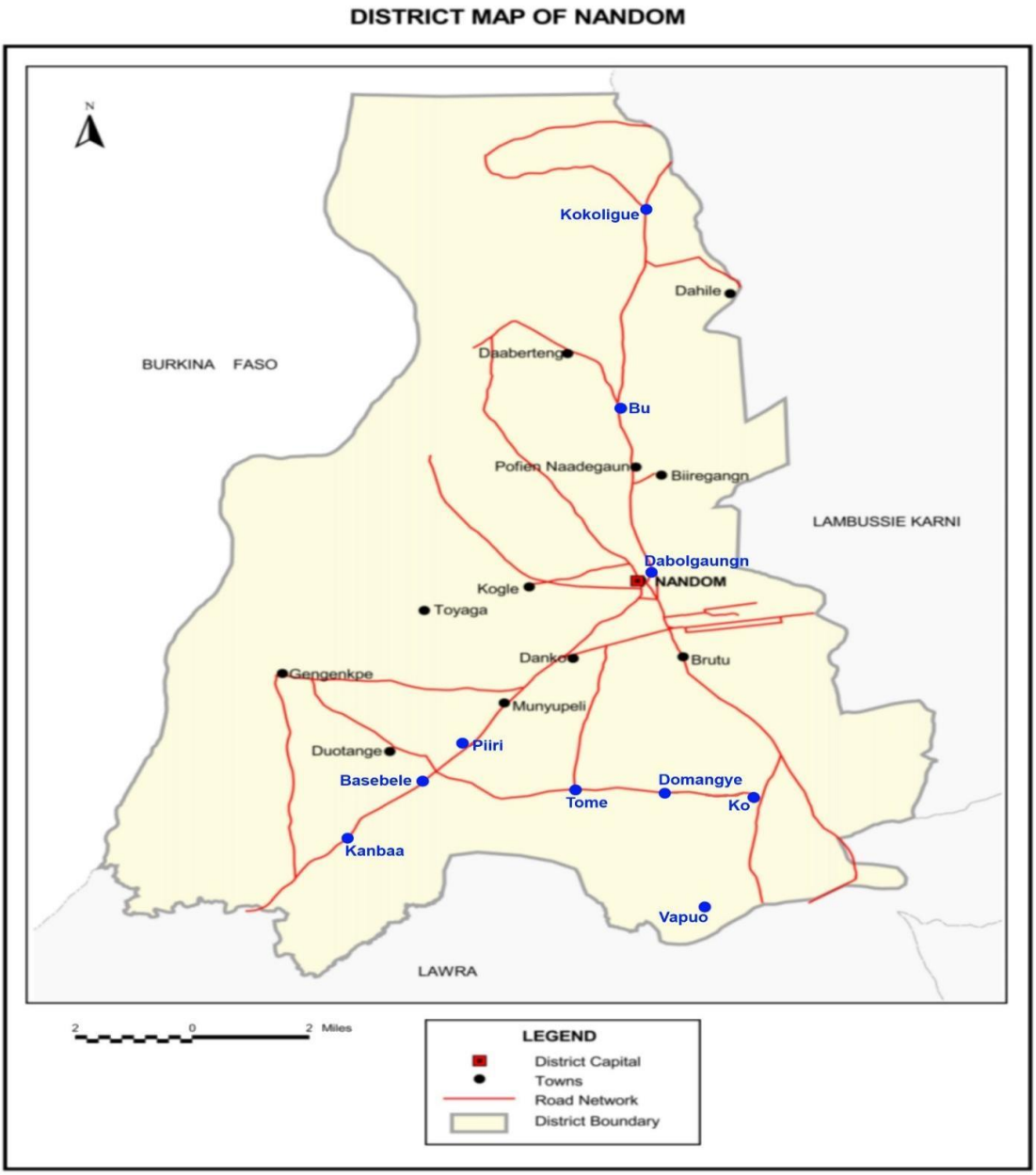

Figure 3.1: Map of Nandom Municipality

Source: Adapted from Ghana Statistical Service (GSS) (2021)

3.2.2 Topography and physical characteristics

The Municipality's landscape is gently undulating, situated around 180 meters above sea level with occasional isolated hills. According to GSS (2021) this relatively flat terrain is favorable for infrastructure development like roads, utility lines, and construction projects. However, the Municipality lacks significant water bodies due to

a low underground water table. Natural water sources are limited to a few interconnected streams flowing into the Black Volta River that traverses the area (GSS, 2021). The Black Volta is seen as a potential site for aquaculture, while existing dams and dugouts support various needs like irrigation, domestic use, and animal husbandry (GSS, 2021).

The interconnected water systems aid in water drainage, reducing the risk of flooding except in low-lying areas. While these water bodies support dry season agriculture, they also pose challenges for road construction and community access during the rainy season (GSS, 2021). Many rivers and streams are perennial but may shrink to intermittent pools or dry up entirely in the dry season, impacting their potential for year-round farming support (GSS, 2021).

According to GSS (2021) the Municipality falls within the Guinea Savannah vegetation belt, characterized by grasses interspersed with fire-resistant trees like Shea and Baobab. These trees fulfill local needs for firewood, construction materials, and livestock enclosures. The climate is tropical continental, typical of northern Ghana, with high temperatures year-round. Rainfall is concentrated in a single season, allowing for crop cultivation mainly from May to September/October. The dry season presents opportunities for preservation industries using natural sunlight (GSS, 2021).

However, reliance on seasonal farming leads to income limitations during the dry season, prompting some residents, including youth and adults, to migrate southward for better opportunities (Warner et al., 2012). Enhancing irrigation infrastructure and diversifying livelihood options are crucial for sustaining local economies. The Municipality's soil composition includes sandstone, gravel, mudstone, alluvium, granite, and shale, influencing housing construction and agricultural practices (GSS,

2021). These soils support cereals and root crops with proper management and fertilization, offering potential for improved agricultural productivity with sustainable practices and adequate water management.

3.2.3 Population characteristics

Among individuals aged 15 and above, 43.6 percent are actively involved in the economy, encompassing both employed and unemployed individuals, while 39.28 percent are economically inactive, which includes those not employed, not seeking employment, or unavailable for work (GSS, 2021). Furthermore, within the economically active group, 45.7 percent are men, whereas 41.1 percent are women, indicating a higher rate of economic inactivity among women compared to men (GSS, 2021).

Moreover, the data reveals that 63.2 percent of men are employed in the agriculture sector, while 57.8 percent of women work in skilled agricultural, forestry, and fishing occupations. This underscores agriculture's significant role as the primary source of livelihood for the population (GSS, 2021). To summarize, 60.7 percent of the Municipality's population is engaged in agriculture (GSS, 2021).

3.2.4 Governance system

The governance structure within communities in the Nandom Municipality is primarily based on traditional governance. In this system, the traditional priest holds the responsibility of safeguarding the land's deities, while the chief serves as the overall leader of the community (Kpieta & Bonye, 2012). Decisions regarding community matters are typically made by the chief, along with queen mothers and elders, in consultation with key opinion leaders. However, when it comes to issues related to land and economic trees, the chief and elders have limited authority (Kpieta & Bonye, 2012).

Ownership and management of land-related matters are mainly the responsibility of the tengdaana or tengdaabas, who are the rightful owners of the land. Consequently, they handle issues pertaining to land sales and other land-related concerns (Balwin, 2016). Additionally, the assemblymen, who are elected through the local governance system, act as intermediaries between the community and the central government (GSS, 2021). They represent the government at the local level, oversee local development projects, and advocate for developmental initiatives from both governmental and non-governmental organizations (Oduro-Ofori, 2011).

3.2.5 Economic activities

The main economic activity of the inhabitants of Nandom Municipality is farming notwithstanding the fact that a large percentage of them are also into dawadawa processing, shea butter processing, pito (a local beer) brewing, traditional or local cloths weaving, smocks and *koosie* making as their main livelihood activity (GSS, 2021). Many food crops such as cereal and grains [maize (*Zea mays*), millet (*Pennisetum glaucum*), sorghum (*Sorghum bicolor*) and rice (*Oryza sativa*)], legumes [cowpea (*Vigna unguiculata*), groundnuts (*Arachis hypogaea*), bambara beans (*Vigna subterranea*), root and tubers [yam (*Dioscorea sp*.), cassava (*Manihot esculenta*), potatoes (*Solanum tuberosum*) and vegetables [pepper (*Capsicum sp*.), pumpkin (*Cucurbita sp*.), kenaf (*Hibiscus cannabibus*), okra (*Abelmoschus esculentus*) are commonly cultivated (Dery et al., 2020). Additionally, trees such as dawadawa (*Parkia biglobosa*), baobab (*Adansonia sp*.), rosewood (*Aniba rosaedora*), neem (*Azadirachta indica*), mango (*Mangifera indica*) and shea (*Vitellaria paradoxa*) are common and their trunks, leaves and fruits serve as sources of households' livelihoods either by direct consumption or sales for income. All the crops are rain-fed between May and October (GSS,2021). There is therefore an extended dry season of six months from

November to April. Livestock that are reared by many households are poultry, goats, cattle, sheep and goats which are mainly kept under extensive system.

3.3 Methodology

3.3.1 Research Philosophy

In this study, the research philosophy adopted is pragmatism, which aligns well with the mixed-methods approach used to investigate drought risk reduction strategies among smallholder women farmers in Nandom Municipality, Ghana. Pragmatism is particularly suited to research that seeks to solve practical problems by drawing on both quantitative and qualitative data, recognizing that the complexity of real-world issues often necessitates a flexible and adaptive approach (Creswell & Creswell, 2018).

Pragmatism, as a research philosophy, is grounded in the idea that the value of research lies in its ability to produce practical outcomes. Rather than adhering strictly to a single philosophical stance, pragmatists advocate for a research approach that is responsive to the needs of the research problem at hand. This philosophy allows for the integration of different methods and perspectives, which is crucial when addressing multifaceted issues like drought adaptation strategies (Morgan, 2007).

The adoption of pragmatism in this study is driven by the understanding that drought risk reduction is a complex, context-dependent challenge that cannot be fully understood through a single methodological lens. By employing a mixed-methods approach, this research acknowledges the strengths of both quantitative and qualitative data in providing a comprehensive understanding of the strategies employed by smallholder women farmers. This approach aligns with the pragmatic view that truth is not an absolute, but rather something that is tested and refined through practical application (Johnson & Onwuegbuzie, 2004).

Moreover, pragmatism supports the use of triangulation—a key methodological feature of this study. As Patton (1990) and Wilk (1993) suggest, triangulation enhances the credibility of research findings by cross-validating results from multiple methods. This is particularly important in studies like this, where the research problem is multifaceted and requires a nuanced understanding that can only be achieved through the combination of different data sources and analytical techniques.

Pragmatism also resonates with the epistemological stance of this research, which views knowledge as something that is contextually dependent and subject to continuous refinement (Creswell & Creswell, 2018). This perspective allows the researcher to present findings that are both explanatory within the specific context of Nandom Municipality and potentially generalizable to broader populations facing similar challenges (Gordon, 1991). By recognizing that human behavior is shaped by both external determinants and individual agency, as noted by Burrell and Morgan (1979), this study is able to explore the interplay between environmental factors and the adaptive strategies of farmers in a way that is both practical and theoretically robust.

In conclusion, the pragmatic research philosophy provides a solid foundation for this study, enabling the researcher to address the research problem with methodological flexibility and rigor. By integrating quantitative and qualitative methods, the study not only captures the breadth of data necessary for generalization but also the depth of understanding required to fully appreciate the lived experiences of the participants. This approach ensures that the research outcomes are both credible and practically relevant, contributing valuable insights into drought risk reduction strategies in Ghana.

3.3.2 General Research Approach

Holden and Lynch (2004) argue that when making methodological decisions in research, it's crucial not to isolate them from the social science phenomenon being studied and the researcher's philosophical stance. They emphasize that different philosophical perspectives exist within the science of study, but extreme perspectives can be limiting. Holden and Lynch (2004) advocate for a middle-ground approach to philosophy, asserting that researchers can effectively align philosophy, methodology, and research problems through this balanced approach.

The evolution of society is often viewed through contrasting lenses: either as an outcome of the present state ("what is") or as a result of potential future states ("what might be"). Burrell and Morgan (1979) present two opposing perspectives: a regulatory view that sees society as logically developing and a radical transformation view that portrays society in constant conflict, with individuals striving to break free from societal constraints. These differing views underpin broader philosophical movements like modernism and post-modernism, leading to diverse schools of thought with sometimes contradictory ideas (Burrell & Morgan, 1979).

Additionally, the scientific component of research can adopt either a subjective or objective investigative technique, each rooted in distinct philosophical presuppositions about reality, knowledge, human nature, and methodology. These assumptions are interconnected, meaning a researcher's ontology influences their epistemology, which then shapes their understanding of human nature (Burrell & Morgan, 1979). This philosophical diversity has given rise to categorizations such as positivism, which emphasizes objectivity and the independence of reality from the researcher, and constructivism or interpretivism, which emphasize subjectivity and the researcher's

active role in knowledge generation. Pragmatists, on the other hand, seek a middle ground by integrating elements from both positivist and constructivist perspectives.

According to proponents of objectivism, research can be conducted independently of the observer's perspective, and researchers' personal interests, values, and beliefs should not influence the subjects they study or the methodologies they use (Holden & Lynch, 2004). They argue convincingly that researchers should be able to set aside their personal biases and preferences when making research and methodological decisions (Holden & Lynch, 2004). Any suggestion otherwise implies that social scientists often employ biased reasoning and mishandle factual evidence to support pre-existing beliefs (Remenyi et al., 1998).

Objectivists assert that they maintain independence from the subjects they study and are neither influenced by them nor do they influence them (Gordon, 1991: 664). As summarized by Hunt (1993), objectivists achieve objectivity by ensuring that theories, laws, and explanations can be empirically tested and verified through observation and experimentation by different competent investigators with varying attitudes, opinions, and beliefs. Objectivists share the primary goal of natural scientists: to uncover causal explanations and fundamental principles that elucidate patterns in human social behavior (Easterby-Smith et al., 1991). They typically use a hypothetico-deductive approach to generalize findings from large sample sizes.

In contrast, subjectivists such as Weber, Hanson, Kuhn, and Feyerabend argue that researchers are inherently biased due to their backgrounds, status, interests, beliefs, skills, values, and resources. Consequently, they cannot achieve objectivity in their observations, the subjects they study, or the methodologies they employ (Hunt, 1993). Kuhn, as interpreted by Hunt (1993), believed that research findings are influenced by

the interpretive aspect of scientific observation, shaping what researchers perceive. He argued that observations are theory-laden and incommensurable, making objectivity in science unattainable (Hunt, 1993). Subjectivists advocate for active researcher involvement and argue that phenomenologists aim to minimize the distance between the researcher and the subject of study (Hussey & Hussey, 1997: Pp34). Subjectivists prioritize understanding social phenomena within their contexts rather than focusing solely on measurement. They seek to comprehend and explain issues based on the meanings people attribute to specific circumstances (Easterby-Smith et al., 1991; Hughes & Sharrock, 1997). Rejecting reductionism, subjectivists emphasize examining topics comprehensively from various perspectives, believing this approach is essential for grasping complex phenomena (Hirschman, 1986: Pp40).

However, objectivism has faced increasing criticism as an inadequate approach for analyzing topics in social science. Critics of objectivism argue that its success in explaining natural phenomena has not translated effectively to the complexities of social science (Holden & Lynch, 2004). They suggest that subjectivism, which focuses on the subjective experiences of individuals, is better suited for studying social science topics due to their inherent human complexities.

Proponents of subjectivism argue that approaches grounded in nominalist ontology and related epistemologies offer better explanatory power in understanding social phenomena (Holden & Lynch, 2004). However, subjectivism is not without its own criticisms. Detractors point out that subjectivism lacks a replacement for objectivism's methodology, which they see as a significant weakness (Hughes & Sharrock, 1997). Moreover, issues such as relativism and incommensurability are viewed as significant challenges within subjectivist perspectives.

The pragmatic philosophical perspective was adopted for this study, which acknowledges that there are multiple ways of understanding reality due to the existence of multiple realities (Saunders et al., 2012; Collis et al., 2014; Wilson, 2010). This perspective guided the use of multiple data collection tools and method triangulation in the current study, allowing for a comprehensive exploration of the diverse realities encountered in social research.

3.3.3 Research design

When the chosen approach does not align well with the research problem, it can cast doubt on the credibility of the results. To ensure more robust findings, experts in research methodology recommend employing a combination of quantitative and qualitative methodologies, a practice known as triangulation (Patton, 1990; Brannick & Roche, 1997). Gill and Johnson (1997) argue that using multiple methods leads to corroborated research outcomes by internally cross-validating results, a sentiment echoed by anthropologist Richard Wilk who emphasizes the necessity of a multi-method approach due to the potentially conflicting outcomes of different investigative methods (Wilk, 1993).

Wilk's advocacy for triangulation stems from the divergent conclusions often found in ethnographic studies, reflecting varying perspectives. However, achieving triangulation requires adopting a balanced philosophical stance that allows for considering situational and intentional factors in understanding human behavior (Burrell & Morgan, 1979).

This middle-ground perspective acknowledges that while reality has tangible aspects, human agency also shapes it. Similarly, the corresponding epistemological stance recognizes that knowledge is not absolute but rather subject to testing, refinement, and contextual explanation, as highlighted by Gordon (1991). Researchers are cautioned

against claiming absolute truth, instead encouraged to present their findings as contextually explanatory and potentially generalizable, recognizing that evidence serves to help us comprehend the world (Gordon, 1991: 604).

In this intermediate view, human nature is seen as both influenced by external determinants and driven by individual agency, contributing to the evolution and transformation of societal structures through ongoing interactions (Holden & Lynch, 2004).

A mixed-methods approach combines elements of post-positivism and interpretivism to effectively address complex research challenges (Fetters, 2016). This methodology provides a solid foundation, methodological flexibility, and the opportunity for in-depth case studies (Maxwell, 2016). By employing mixed-methods, researchers can explore research questions comprehensively (Enosh et al., 2014) and generalize their findings and implications to broader populations.

The quantitative component allows for data collection from a large sample size, enhancing the generalizability of the results. Conversely, the qualitative aspect captures the nuanced perspectives of individuals, providing a deeper understanding of the research context (Dawadi et al., 2021). By triangulating quantitative and qualitative data, researchers gain a more comprehensive understanding of the research problem and enhance the validity of their findings (Carter et al., 2014).

The integration of quantitative and qualitative methods is increasingly valued as it offers richer insights into research phenomena that may not be fully captured by using either method alone (Saville, 2012). This mixed-methods approach synergizes various data sources, allowing researchers to explore complex issues from multiple perspectives (Poth & Munce, 2020). It facilitates a holistic view of phenomena,

contributes to theory development, and overcomes epistemological barriers between quantitative and qualitative paradigms (Bergman, 2008).

The study adopted a mixed-methods research approach to comprehensively collect and analyze data on drought adaptation strategies, recognizing the strengths and limitations of both quantitative and qualitative methodologies (Dawadi et al., 2021).

3.3.4 Sources of Data

The researcher used both primary and secondary sources of data. The primary data was mainly field data collected by the researcher during the research from smallholder women within the study area. Also, qualitative data were collected from key informants such as women leaders, agriculture extension officers and NADMO officials using interview guides. The data collected included perceived drought risks, effects of droughts on smallholder rural women, drought resistance strategies and drought constraints. The secondary data was obtained from relevant published documents including journals, Nandom Municipal Assembly reports and other published and unpublished works.

3.3.5 Target population

The target population for this study included all smallholder women in the Nandom Municipality, women leaders, agriculture extension officers and NADMO officials. The study was designed to investigate the drought adaptation strategies that women smallholders' farmers employ to cope with the ever-changing climatic conditions. The target population enumerated above are people who have roles to play in supporting women smallholders hence their inputs to the study were crucial in coming to a scientific conclusion.

3.3.6 Sample size and sampling techniques

The sample size for the study was determined using the statistical formula at a significance level of five percent. This was chosen because, an acceptable error level traditionally is up to ± 0.05 or ± 0.10 (i.e., 5 or 10 percentage point). The sample size formula is given by Yamane (1967) as;

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

Where n= sample size; N= population and e = error or significance level

In this study, N = 7292 (female farmers in Nandom Municipality, GSS (2014) and e = 0.05

Therefore;

$$n = \frac{7299}{1 + 7299(.05)^2} = 379 \ldots\ldots (2)$$

The sample size for this study was 379 respondents. Convenience sampling was used to select the 379 respondents. Convenience sampling was chosen for this study due to its practicality in addressing the specific characteristics and logistical challenges of the research context. This technique allowed for the efficient collection of data from women smallholder farmers who were readily available, despite the time and resource constraints. While typically associated with qualitative research, convenience sampling was integrated into the mixed methods approach to complement the in-depth insights gained from qualitative data with broader quantitative perspectives, ensuring a comprehensive understanding of the research questions.

With this technique, women smallholder famers in the selected communities who are available for the study were contacted to administer the survey.

According to Kadam and Bhalerao (2010), conducting research on the entirety of any community is neither realistic nor possible under any circumstances. As a result, four communities were chosen from the population (communities in the Nandom municipal). This group has a smaller number of members (a smaller size), but it still adequately represents the population from which it is drawn. This allows for accurate conclusions to be drawn about the population based on the results that are obtained. The selection of an appropriate sample size is an essential component of any empirical research endeavor that seeks to draw conclusions about a population based on a subset of that population (Adcock, 1997). The selection of the study communities—Ketuo, Munyupele, Goziri, and Gengenkpe—was based on a systematic approach to ensure both representativeness and diversity. Gengenkpe community and Munyupele community were randomly chosen from the 20 largest communities in terms of population, as identified by the Ghana Statistical Service (GSS) in 2014, to capture insights from more populated areas. In contrast, Goziri community and Ketuo community were included to represent smaller or mid-sized populated communities, offering a broader perspective on the region's social, economic, and cultural dynamics. This combination allowed the study to explore different community contexts comprehensively.

Also, the sample for the qualitative part (interviews and focus group discussions) of the study was based on data saturation (Boddy, 2016). The sample for the qualitative part of the study, including interviews and the single focus group discussion, was determined based on the principle of data saturation. Although only one focus group discussion was conducted, the decision to use data saturation as a guiding criterion was justified by the depth and richness of the data obtained, which was sufficient to capture the key themes and insights relevant to the research objectives. Participants of the

interviews and focus group discussions were selected purposively. According to Trochim (2006), when using purposive sampling, the researcher selects samples while keeping a specific criterion in mind. The researcher made a conscious decision to sample officials of NADMO, women farmers/leaders, female extension these individuals because they were in possession of the information that is essential to the accomplishment of the research objectives and aims (Tongco, 2007)

3.3.7 Data collection methods and tools

The study used interviews, questionnaires, observation, documents and records and focus group discussion to collect data.

3.3.7.1 Questionnaires administration

A questionnaire contains written questions for respondents. Kumar (1992) defines a questionnaire as a written document containing a series of questions on the study's topic. Schvaneveltd (1985) defined a questionnaire as a data-gathering device that stimulates responses to printed (pre-arranged) questions. Surveys commonly collect data through questionnaires. This survey collected data on farmers' drought adaptation practices. Before use, it was pretested. Pretesting (or pilot testing) determines a questionnaire's usefulness. The pretest is done before the final questionnaire distribution. Pretesting was used to refine questionnaire design and uncover population-specific inaccuracies (Reynolds et al., 2017).

It is a dry run of the complete study process (Green et al., 1988). The questionnaire pretest is similar to test marketing in new product development (Churchill, 1991). Pre-testing improves the questionnaire and seeks perfection. Once the final questionnaire is printed, no changes may be made. Corrections are expensive and challenging for the researcher. To pre-test the questionnaire, it was distributed to the small holder farmers

so the researcher can revise it. The pre-test included verbal contact with the sample population concerning ambiguous, tough, and overlapping questions (Kumar, 1992). The sample filled out the questionnaire first, then discussed incomprehensible questions with the researcher. Formal pre-testing is essential for questionnaire design. Pre-testing helps researchers' record, simplify, and transform questions. The procedure entails creating the questionnaire, debating it with colleagues, and disseminating it among a small population sample. This helps with clarity, technical or professional vocabulary, question order. Burton (1990) says pretesting may go through several iterations, but this is required for questionnaire design. Pretesting, or a pilot survey, is recommended before finalizing the questionnaire. In this study, the pretest was conducted in Nadowli since famers in both localities have homogenous characteristics. Matrix and scale rating questions were designed to illicit responses from smallholder farmers on their perceptions on drought adaptation strategies in the Nandom Municipality.

3.3.7.2 Interviews

A qualitative research technique known as "in-depth interviewing" involves conducting lengthy one-on-one interviews with a respondent to learn more about the viewpoints of the respondent on a certain concept, phenomenon, or circumstance (Patten, 2017). Interviews are generally regarded as flexible which allows the researcher to delve deeper into topics to have a clearer view of the respondent's attitudes and feelings of a subject matter. The interview is a crucial method of data collection that involves verbal exchanges between the researcher and the subject. Alamri (2019), observes that interviews are flexible, which encourages participants to provide more personal information. This helps to improve the quality of the qualitative data. Interviews refer to a set of pre-planned questions which provide guidance, as the researcher discusses with the interviewees or respondents regarding the topic (Alamri, 2019). With the aid

of this useful tool, the researcher probed the respondent's thoughts, emotions, and viewpoints in a productive way on drought adaption strategies in the Nandom Municipality. The researcher used interviews in a manner that elicit data from the study respondents which other techniques would not have accurately done (Alamri, 2019). Interviews also offer an opportunity to the interviewer to probe further into the ideas, sentiments, and thoughts that underlie the responses provided by the respondents. The researcher used an interview guide to help in the collection of data from the respondents in the study (Alamri, 2019).

3.3.7.3 Key informant interviews

The key informants' interview was also employed by the researcher for gathering data in order to meet the study objectives. The researcher used the key informants' interview to obtain primary or firsthand data from some selected respondents in the study area. The rationale for using the key informants' interview in large part is due to the rich experience or the wealth of knowledge that is in the custody of those recruited. The researcher found it useful to tap from the rich knowledge the selected respondents or "experts" (Bernard, 2018). The researcher made arrangements with the key informant's and conduct the interviews with them separately at venues of their respective choices. Bernard (2018), described key informants in a study as likely to have expertise in a particular field or about a particular topic or organization.

3.3.7.4 Focus group discussions

Mishra (2016) outlines focus group discussions as a method of group interviewing where a moderator guides a small group, typically comprising 10 to 12 individuals, in an informal discussion about various topics. The discussion's direction is generally planned beforehand, and moderators often use a guide to ensure all relevant subjects

are covered. This approach is valuable for gathering insights from individuals with similar backgrounds or experiences on specific topics of interest.

The choice of focus group discussions in this research stems from their effectiveness in delving deeply into social issues (Mishra, 2016). Rather than using a statistically representative sample, this method intentionally gathers data from a select group. To ensure meaningful data collection aligned with the study's objectives, the researcher arranged focus group discussions in a conducive setting. This allowed participants to freely express their thoughts and opinions.

According to Mishra (2016), focus group discussions are instrumental in uncovering shared opinions and the underlying meanings behind them. They facilitate a comprehensive understanding of participants' experiences and beliefs. Additionally, the researcher considered focus groups to be cost-effective and used them to explore diverse perspectives on drought adaptation strategies among participants.

3.3.8 Data analysis

Following the completion of fieldwork, data cleansing, coding, and entry processes, data analysis was conducted. The study employed descriptive statistical tools to present quantitative data results, aiding in further statistical analysis by calculating measures of central tendency, dispersion, skewness, and other relevant statistical measures.

Descriptive analysis involves describing a phenomenon based on our perceptions, aiming to understand the circumstances and establish standards (Waliman, 2011). Its objective is to lay the groundwork for discovering new insights by documenting existing realities, such as drought adaptation strategies among rural smallholder farmers in this study. The collected data were organized, tabulated, depicted, and described within this descriptive framework.

This type of study design often diverges from a formal research hypothesis and is guided by one or more research questions (Travers, 1978). Because it paints a detailed picture of a specific event or phenomenon, descriptive analysis provides a foundational understanding that can inform and initiate further quantitative research (Travers, 1978). Instead of testing the expected link between variables, this approach is used to characterize the variables. Its primary goal is to describe; it does not forecast the future or establish cause and effect (Jamie, n.d.). Before doing an experiment, exploratory research, or inferential research, or both, is frequently conducted in order to identify the precise variables to be manipulated as well as the causes of some events. A deeper examination, known as an inferential analysis, aims to explain why a phenomenon is the way it is. It gives us knowledge to comprehend phenomena' underlying causes, link phenomena together, and forecast future behaviour. Neutrality and objectivity are two features of descriptive research that are important to note. Prescriptive research, which is normative in nature and is concerned with the question of how reality should be, is distinct from this (Waliman, 2011). This kind of analysis serves as a great starting point for exploratory analysis since it allows us to establish baselines for how we perceive the world (Adams et al., 2007). If this is not carefully taken into consideration, the study may produce erroneous results. This sort of research, like certain other research designs, specifies specified objectives with sufficient precision to ensure that the data obtained or secondary data used are relevant (Kothari, 2004). For achieving that set of goals, data collection techniques, the use of secondary data already available, and descriptive research approaches are crucial. Whether descriptive analysis is appropriate will depend on the type of research question and research topic. Based on the research question and the methodology applied during the study, a descriptive study is created.

In addition, qualitative data analysis was conducted using thematic analysis. This analytical approach was necessary to summarize and interpret the extensive amount of textual data generated from interviews or observational data. The researcher identified connections among multiple themes, linking behaviors or ideas to respondents' experiences relevant to their strategies for adapting to drought (Lacey & Luff, 2009). The data and interpretations of complex findings from previous studies may have implications for policy or practice (Lacey & Luff, 2009).

In the realm of qualitative analysis, there are no instant solutions or "quick fixes." The approaches to analyzing qualitative data are diverse, reflecting the varied methods employed by different qualitative researchers. This diversity is akin to how statistical software such as the Statistical Package for the Social Sciences (SPSS) does not prescribe which specific statistical tests to use for analyzing numerical data (Lacey & Luff, 2009). Many argue that this diversity is appropriate because qualitative research is inherently interpretive and subjective, involving direct engagement by the researcher rather than a detached approach (Pope & Mays, 2006).

Qualitative data collected in the field through interviews and focus group discussions were transcribed verbatim for subsequent analysis. Nearly all qualitative research endeavors entail some form of transcription, whether it involves field notes, focus groups, tape-recorded interviews, or video recordings. Summarizing notes from a tape recording is generally discouraged because it can introduce bias, with researchers inclining to include only the segments they find significant or interesting unless the transcription is done verbatim (Lacey & Luff, 2009).

So, non-verbal cues such as silence, which might indicate shame, emotional anguish, or simply a pause for thought, were be included in transcripts. Well, um, I suppose, and

similar phrases are crucial parts of speech and were not be disregarded. A spoken word may get additional meaning through laughter or gestures (Lacey & Luff, 2009).

After transcription, researcher organized material to make it conveniently accessible. Each interviewee was assigned a code or number or divided into sections labelled with the date or the context. It will be necessary to link pseudonyms and code numbers to the original informants in a secure file, but as with any research, these files were kept confidential and were deleted after the project was completed. Identifiable information such as names and other details were also eliminated from the transcripts (Lacey & Luff, 2009).

As I started to recognize themes or emergent notions, I engaged in recoding to create categories with clearer definitions (Lacey & Luff, 2009). I kept on collecting data until the point of "saturation"—when no new themes were found. Indexing would be followed by mapping and graphing using framework analysis. In reality, research investigations are frequently constrained by time and budget limitations, and analysis will be completed once all issues have been resolved (Lacey & Luff, 2009).

3.4 Ethical Considerations

In conducting this study on drought risk reduction strategies among smallholder women farmers in Nandom Municipality, Ghana, several ethical considerations were thoroughly addressed to ensure the protection of participants and the integrity of the research process.

Informed Consent: The purpose of the study was clearly explained to all participants, both in writing and verbally, before any data collection commenced. Written consent was obtained from those who were literate, while verbal consent was accepted from participants who were unable to provide written consent. This process ensured that all

participants voluntarily agreed to participate with a full understanding of the study's objectives and their role in it (Creswell & Creswell, 2018).

Confidentiality and Anonymity: The confidentiality of all participants was rigorously maintained. Identifiable information was either excluded or anonymized to protect the identities of the respondents. Additionally, all data collected were stored securely and were only accessible to the research team. Participants were assured that their responses would be used solely for academic purposes and would not be shared with any third parties (Wiles, 2013).

Minimization of Harm: The research was designed to avoid any physical, psychological, or emotional harm to the participants. The questions asked were formulated to be non-invasive and respectful of the participants' personal and cultural sensitivities. Care was taken to ensure that the participation in the study did not expose the women to any social or economic risks, and the researchers remained vigilant to avoid any actions that could potentially harm the participants (Orb, Eisenhauer, & Wynaden, 2001).

Avoidance of Deception: The research process was conducted with full transparency. No information was withheld from participants that could have influenced their decision to participate. Deceptive practices were strictly avoided, ensuring that the integrity of the research process was upheld and that participants' trust in the research was maintained (Babbie, 2016).

Introduction and Documentation: An introductory letter was obtained from the Department of Environmental and Resource Studies (DERS), which provided a formal introduction of the researcher and outlined the purpose of the study. This letter was

presented to participants as part of the consent process to reinforce the legitimacy of the research and to ensure participants were fully informed (Israel & Hay, 2006).

By adhering to these ethical principles, the study ensured the protection of participants' rights and welfare, while also maintaining the credibility and integrity of the research process.

CHAPTER FOUR

DROUGHT RISK PERCEPTION AND MITIGATION STRATEGIES AMONG SMALLHOLDER WOMEN FARMERS

4.1 Introduction

This chapter delves into the results obtained from the fieldwork and provides a comprehensive discussion of the findings derived from the analyzed data. Initially, the background characteristics of smallholder women are outlined, setting the context for the subsequent discussions. The focus then shifts towards understanding various aspects related to drought risk perception and mitigation strategies among smallholder women farmers. first, the perception of smallholder women farmers. Secondly, the drought effects on the farming activities of smallholder rural women farmers. The chapter seeks to unravel the intricacies of smallholder women's experiences with drought. Through a detailed examination of the results and subsequent discussions, this chapter endeavors to contribute to a deeper understanding of the dynamics surrounding drought resilience among smallholder women farmers in the study area.

4.2 Background Information of Respondents

This section aims to provide background knowledge on the respondents' characteristics (Table 4.1). According to Creswell (2014), the goal of the background characteristics in any research project is to improve the results' validity and reliability. This background analysis was done to provide for unambiguous deductions and inferences and allow for generalization. These insights into education, household structure, and income levels provide a comprehensive foundation for examining drought risk reduction strategies.

Table 4.1: Background Information

Variables	N	Percent
Age		
20-29	100	26.4
30-39	125	33.0
40-49	70	18.4
50-59	53	14.0
60+	31	8.2
Total	**379**	**100**
Religion		
Christianity	379	100
Islam	0	0
Traditional	0	0
Total	**379**	**100**
Marital Status		
Never married	34	9.0
Married	283	75.0
widowed	62	16.0
Total	**379**	**100**
Level of Education		
No basic education	171	45.0
Basic education	124	33.0
Secondary education	73	19.0
Tertiary	11	3.0
Total	**379**	**100**
Household Size		
1-5 members	366	97.0
6-10 members	13	3.0
Total	**379**	**100**
Monthly Income		
Less than GHS2000	238	63.0
GHS 2000 – GHS 4000	141	37.0
Total	**379**	**100**
Farming Experience		
Less than 1 year	0	0
1-10 years	55	14.5
11-20 years	109	28.8
21 +	215	56.7
Total	**379**	**100**
Farm size in acres		
1-5	371	98.0
6-10	8	2.0
Total	**379**	**100**

Source: Fieldwork, 2023

The demographic profile of smallholder women farmers in the study exhibits a diverse age distribution, underscoring a multi-generational representation within the community. Notably, a considerable proportion falls within the younger age brackets,

with (N=100) 26.4% belonging to the 20-29 age range and 33.0% (N=125) falling into the 30-39 age category. As age increases, there is a gradual decline, with 18.4% (N=70) in the 40-49 range, 14.0% (N=53) in the 50-59 range, and 8.2% (N=31) for those aged 60 and above. Religiously, the study cohort (N=379) is characterized by exclusive adherence to Christianity, with no participants identifying as Muslim or adhering to Traditional Religious beliefs.

The marital status reveals a predominant majority of married participants (74.7%), alongside smaller proportions of never-married individuals (9.0%) and widowed participants (16.3%).

Regarding household sizes of smallholder women farmers, the majority of women (N=366), 97%, reside in relatively small households (1-5 members), and only (N=13) 3% reside with larger households ranging from 6 to 10 members on average.

According to Table 4.1, the data regarding income distribution of smallholder women farmers reveal that 62.8% earn less than GHS2000, while 37.2% fall within the GHS2000 – GHS4000 income range.

The data provided in Table 4.1 offers insights into the level of education among the smallholder women farmers. The largest proportion (N=171), 45.0%, have no basic education. Also, (N=124) 33.0% of smallholder women farmers have completed basic education and (N=73) 19.0% have completed secondary education. Lastly, (N=11) 3.0% of smallholder women farmers have attained tertiary education. The distribution of education levels highlights the diverse educational backgrounds of smallholder women farmers in the study area. Understanding these educational levels is crucial for tailoring drought risk communication and management strategies to the diverse educational capacities of the population (Dufty, 2020).

According to Table 4.1, there are no respondents with less than 1 year of farming experience in the study are. A percentage of 14.5 of the smallholder women farmers in the study area have 1 to 10 years of farming experience. These individuals may have a relatively moderate level of experience in agriculture. Additionally, 28.8% of the respondents fall within the category of 11 to 20 years of farming experience. These women likely possess a relatively substantial amount of experience in agriculture. The majority (56.7%) of smallholder women farmers in the study area have more than 20 years of farming experience. This group represents individuals with extensive experience in agriculture, suggesting a potentially high level of knowledge and expertise. This data is represented in figure 4.6, showing the distribution of farming experience of smallholder women. These results provide insight into the distribution of farming experience among smallholder women in the study area and can contribute to a better understanding of their perspectives on drought risk (Assan et al., 2018). Notably, most respondents have a considerable amount of farming experience, which may influence their perceptions and strategies related to drought mitigation and adaptation.

According to Table 4.1, (N=371) 98% of the smallholder women farmers had a farm size of 1-5 acres for cultivation of food crops, and (N=8) 2% had a farm size of 6-10 acres.

These detailed background information serves as a crucial basis for comprehending the demographic and socio-economic composition of smallholder women farmers participating in the study, laying the groundwork for a thorough analysis of their perceptions regarding drought risks. The data encapsulates valuable insights into various facets of the target population, presenting a nuanced understanding of their

socio-economic and personal characteristics. By delineating vital demographic variables such as age, religious affiliation, marital status, educational background, household size, monthly income, farming experience, and farm size in acres, the dataset furnishes a rich context for the subsequent examination of how these factors may interplay with the participants' perspectives on drought risks. Several studies have highlighted the significance of demographic factors in shaping individuals' perceptions of environmental risks (Owusu et al., 2019; Dumenu & Obeng, 2016). For instance, Owusu et al. (2019) found that age and educational background significantly influenced farmers' perceptions of drought severity and adaptation strategies. Similarly, Dumenu & Obeng, (2016) identified household size and income as key determinants of vulnerability to drought impacts among rural communities. By incorporating these demographic variables into the analysis, we can better understand the nuanced relationship between socio-demographic characteristics and drought risk perceptions. "This information paints a comprehensive picture of the surveyed population and provides the researcher with a framework to explore potential correlations and patterns within the dataset. The detailed breakdown of demographic attributes enables a more nuanced understanding of the smallholder women farmers' context, facilitating the identification of factors that might influence their perceptions of drought risks (Owusu et al., 2019; Dumenu & Obeng, 2016).

4.3 Drought Risks Perceptions of Smallholder Women Farmers

4.3.1 Perceptions of drought as man-made or natural disaster

The study aimed to assess the drought risk perceptions of smallholder women in the area by examining their level of agreement regarding whether drought is considered a man-made disaster. Women were asked if drought is a man-made disaster, and respondents were given three options: "Agree," "Disagree," and "Uncertain". The

results are shown in Figure 4.1. Approximately half of the respondents (N=189) 50.0% agreed that drought is a man-made disaster. This result suggests that a larger proportion of smallholder women farmers in the study area perceive drought as a result of human activities or influences. Also, (N=77) 20.0% disagreed with the idea that drought is a man-made disaster, which indicates that a notable portion of respondents believe drought is more of a natural occurrence, not significantly influenced by human activities. Lastly, (N=113) 30.0% of the respondents were uncertain about whether drought is a man-made disaster or not. This result suggests a level of ambiguity or lack of a clear consensus among this group regarding the causes of drought.

Regarding the Perception of Drought as a Natural Disaster, the study's findings revealed diverse perceptions among smallholder women regarding whether drought is a man-made disaster. Half of the respondents (50.0%) agreed that drought is a man-made disaster. This result indicates a substantial acknowledgment within the community that human activities play a significant role in drought occurrence. Dai (2013) supports this viewpoint, suggesting that anthropogenic factors such as deforestation, land-use changes, and climate change contribute to the increased frequency and severity of drought events. These factors may have direct implications for the agricultural practices of smallholder women, making them susceptible to the impacts of human-induced environmental changes.

On the contrary, 20.0% of respondents disagreed, asserting that drought is unnatural. Interestingly, 30.0% of the respondents expressed uncertainty about whether drought is a man-made disaster. However, this uncertainty could indicate a lack of awareness or information among smallholder women. Education and awareness campaigns focusing

on the relationship between human activities and drought could reduce this uncertainty (Birkmann, 2006).

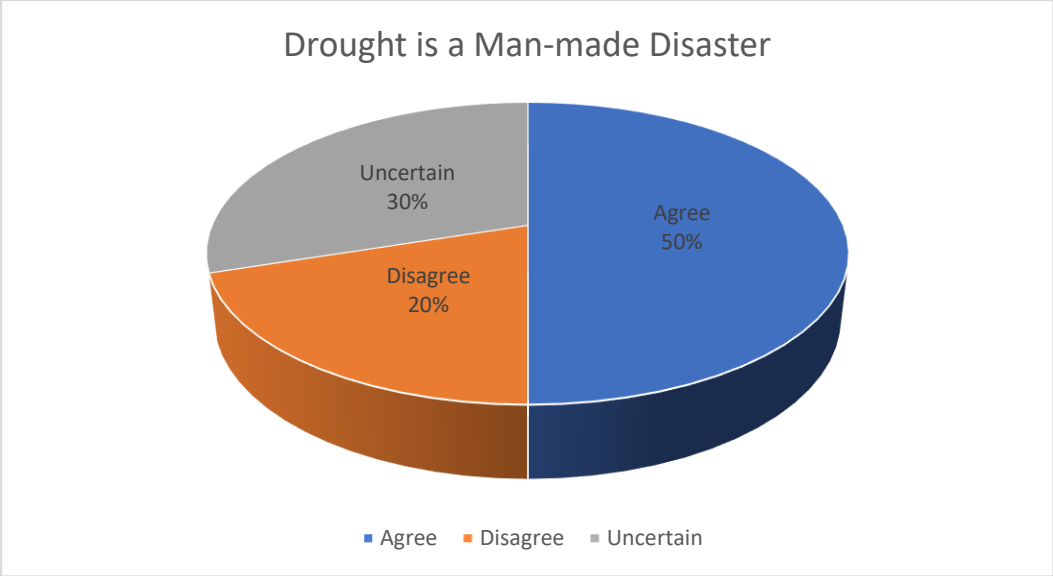

Figure 4.1: Perceptions of drought as a man-made disaster

Source: fieldwork, 2023

The study also assessed the drought risk perceptions of smallholder women in the area by examining their level of agreement regarding whether drought is considered a natural disaster. The women were asked if drought is a natural disaster, and respondents were given three options: "Agree," "Disagree," and "Uncertain". From the results in Figure 4.2, most smallholder women farmers (N=166), 44.0%, agreed that drought is a natural disaster, suggesting that they have acknowledge of the severity and impact of drought as a natural disaster. On the other hand, (N=110) 29.0% of the respondents disagreed with the statement that drought is a natural disaster. This indicates a portion of the smallholder women farmers do not perceive drought as a natural disaster, possibly suggesting differing perspectives or beliefs about the nature of drought and its classification as a disaster. Additionally, (N=103) 27.0% of the respondents were

uncertain whether drought is a natural disaster. This uncertainty may stem from a lack of clear understanding or awareness of the characteristics of drought as a disaster among this group of smallholder women.

Regarding the Perception of Drought as a Man-Made Disaster, the study's findings reveal insightful information about the smallholder women's perceptions of drought as a potential disaster. The primary focus was whether these women consider drought a man-made disaster. The results indicate a diverse range of opinions within the community. A significant portion of the smallholder women, constituting 44.0% of the respondents (N=166), agreed that drought is a natural disaster. This perspective aligns with Wilhite (2000), who emphasized drought's cyclical and climatic nature, attributing it primarily to atmospheric conditions and variability. It is crucial to acknowledge this perspective as it may influence the adoption of drought mitigation strategies. This assertion implies a widespread recognition among this group of women regarding the severity and impact of drought, aligning with the understanding that it is a naturally occurring phenomenon. This acknowledgment is crucial for formulating effective policies and strategies geared towards mitigating the impact of drought on smallholder women farmers.

Contrastingly, a notable percentage of respondents, 29.0% (N=110), disagreed with the statement that drought is a natural disaster. This divergence in perception suggests the existence of varying beliefs or perspectives within the community. Understanding these differences is essential for tailoring intervention strategies to address smallholder women's diverse needs and concerns. A noteworthy finding is that 27.0% (N=103) of the respondents were uncertain whether drought is a natural disaster.

The study highlights the diverse perspectives among smallholder women in Nandom Municipality regarding the origin of drought. These findings underscore the importance of tailoring drought risk reduction strategies to align with the community's perceptions and beliefs, ultimately enhancing the effectiveness and acceptance of such interventions.

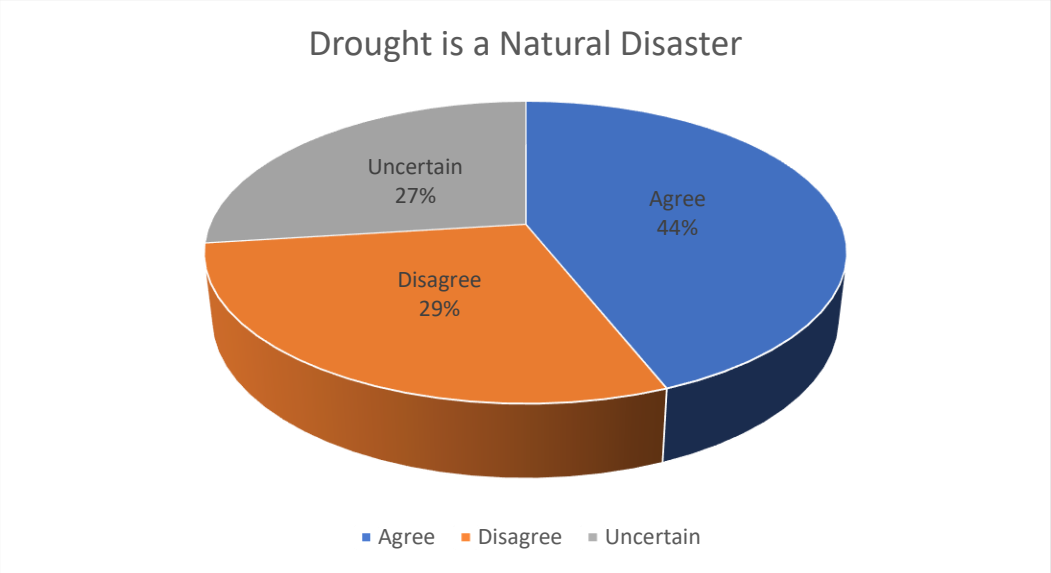

Figure 4.2: Perceptions of drought as a natural disaster

Source: fieldwork,2023

The data reveals a diverse range of perceptions regarding the nature of drought among smallholder women farmers in the study area. While a significant portion acknowledges it as a man-made disaster, a notable fraction disagrees, and a substantial number remains uncertain about the origins of drought. This variation in perspectives highlights the complexity of understanding and addressing drought risk perceptions in this population.

The findings regarding the perceptions of drought risk among smallholder women farmers in Nandom Municipality can be understood through the lens of the Theory of Planned Behavior (TPB). According to TPB, behavior is shaped by attitudes, subjective

norms, and perceived behavioral control. In this case, the varying perceptions of drought as either a man-made or natural disaster reflect the attitudinal component of TPB. Women who perceive drought as man-made may have a more proactive attitude towards adopting risk reduction strategies, as they might feel that human actions can influence and mitigate its effects. Conversely, those who see drought as a natural disaster might view it as inevitable and beyond their control, potentially reducing their motivation to adopt preventive measures. The uncertainty expressed by a significant portion of respondents (30% man-made, 27% natural disaster) aligns with the subjective norms and perceived behavioral control components of TPB, suggesting that these women may lack clear social guidance or the necessary resources to confidently decide on appropriate drought mitigation actions. Therefore, the study underscores the need to address these perceptions through community education and capacity-building efforts to enhance both knowledge and perceived control, ultimately leading to better adoption of drought risk reduction strategies.

4.3.2 Smallholder women perceived occurrence of drought

The study analyzed smallholder women's perceptions of drought risks in the Nandom Municipality, Ghana. The findings revealed three prominent themes in their perceptions: the perceived unpredictability of drought occurrence, the regularity of annual drought, and the variable drought duration. These themes provide valuable insights into the complex dynamics of how smallholder women farmers understand and experience drought in their communities. The study sought to find out how smallholder women farmers perceived the occurrence of drought in the various communities. After analyzing the responses, the following themes emerged:

- Perceived unpredictability of drought occurrence
- Regularity of annual drought

- Variable duration of droughts

The quotes below were obtained from focus group discussions in the various communities:

> "*This time we cannot tell the exact number of times that drought occurs in this community, sometimes once or twice, it can be at the beginning of the rainy season of even in the middle, so we can say that it occurs 2 times in a season"* (FGD Discussant, Goziri Community, 2023).
>
> *"This time, almost every year we experience drought in this community"* (FGD Discussant, Gengenkpe Community, 2023).
>
> *"Droughts occur 1 or 2 times. Sometimes it lasts longer and other times too it does not last long"* (FGD Discussant, Munyupele Community, 2023).
>
> *"Every year, our community typically faces a period of drought"* (FGD Discussant, Ketuo Community, 2023).

4.3.2.1 Perceived unpredictability of drought occurrence

Smallholder women farmers consistently convey a nuanced perception of the unpredictability surrounding the occurrence of drought in their communities. The first quote underscores the challenge of pinpointing the exact frequency of drought events, emphasizing the variability inherent in their occurrence. The use of "sometimes once or twice" and the mention of different timings, such as "at the beginning of the rainy season or even in the middle," illustrates the complexity and uncertainty associated with drought events.

The second quote further contributes to this theme by introducing the element of temporal unpredictability. The acknowledgment that droughts "occur 1 or 2 times" is accompanied by an awareness of their variable duration, with the added insight that sometimes these events "last longer" while at other times they "do not last long." This

variability in the duration of droughts adds another layer to the smallholder women farmer's perception of these events.

The thematic analysis reveals that smallholder women farmers view drought occurrences as inherently unpredictable. The variability in both the frequency and duration of droughts contributes to a sense of uncertainty, emphasizing the need for adaptive strategies and resilient approaches to cope with the unpredictability of drought events in their agricultural practices. This complexity and uncertainty underline the need for adaptive strategies and resilience to cope with the unpredictability of drought events in their agricultural practices. This finding aligns with Adaawen (2021), who highlighted the challenge of predicting drought occurrences due to their complex and variable nature.

4.3.2.2 Regularity of annual drought

Smallholder women farmers consistently underscore the recurring nature of drought, with the theme of annual occurrence permeating their responses across diverse communities. The shared sentiment across the focus group discussion reflects a collective awareness that, virtually every year, their communities grapple with the challenges posed by drought.

The first quote encapsulates the pervasive nature of drought, using the phrase "almost every year." This choice of language emphasizes the frequency and regularity of drought events within the community. It implies a near-annual expectation of facing drought-related adversities, suggesting an entrenched pattern that shapes the farmers' experiences.

The second quote reinforces this theme by stating that drought is a yearly phenomenon in the community. The term "every year" conveys a sense of predictability and

certainty, highlighting the farmers' acknowledgment that drought conditions consistently mark a specific period of each year. This shared perception contributes to a collective understanding and anticipation of the challenges associated with drought annually.

The emergence of this theme underscores the significance of considering drought as a routine, recurring event rather than an isolated occurrence. This perception suggests the need for sustained, long-term approaches to drought risk reduction, considering it a routine, recurring event within the agricultural calendar of these smallholder women. Similarly, Ankrah et al. (2023) have documented the regularity of drought as a yearly phenomenon, aligning with the present study's findings. Recognizing drought as a recurring event is crucial for developing sustainable and targeted strategies that address the ongoing challenges smallholder women farmers face.

4.3.2.3 Variable duration of drought

In articulating their experiences with drought, smallholder women farmers reveal a nuanced understanding of the variable duration of this climatic event. The quotes above encapsulates their acknowledgment that droughts are not uniform in their temporal characteristics. Instead, there exists a spectrum in which some occurrences extend over more prolonged periods while others are temporary.

This recognition of drought duration variability underscores these climatic challenges' complex nature. The smallholder women farmers convey an awareness that drought is not a monolithic phenomenon but rather a dynamic and diverse set of conditions. Some instances of drought persist for an extended duration, potentially posing more severe and prolonged threats to agricultural productivity and livelihoods. Contrastingly, there

are periods when drought is transient, fleeting in its impact, and may not inflict as sustained a disruption.

According to Ahmadalipour et al. (2019), acknowledging variable drought duration implies that a one-size-fits-all approach to drought risk reduction may be insufficient as it underscores the necessity for adaptive strategies that can flexibly respond to the diverse temporal manifestations of drought. Additionally, understanding this variability contributes to the broader comprehension of the multifaceted challenges faced by smallholder women farmers, informing the development of targeted interventions that can address both short-term crises and more prolonged periods of water scarcity (Yiran & Stringer, 2016). This theme highlights the importance of crafting resilient strategies that account for the diverse temporal dynamics of drought events as perceived by the smallholder women in the study.

The findings from the study on smallholder women's perceptions of drought risks in Nandom Municipality align with the Theory of Planned Behavior (TPB), which emphasizes the role of attitudes, subjective norms, and perceived behavioral control in shaping behavioral intentions. The smallholder women farmers' perceptions of the unpredictability, regularity, and variable duration of drought reflect their attitudes toward drought risk and highlight their recognition of the persistent threat posed by these events. Their awareness of the unpredictability and frequency of drought occurrences aligns with the attitudinal component of TPB, as their experiences shape their attitudes toward adopting drought risk reduction strategies. The shared sentiment of annual drought across communities indicates the influence of subjective norms, as the regularity of drought has become a collective experience, contributing to social pressures and expectations around managing drought. Finally, the variable duration of drought reflects the farmers' perceived control over managing drought risks. While they

acknowledge the challenge posed by prolonged droughts, their ability to adapt to shorter, less severe droughts highlights the perceived behavioral control element of TPB. These perceptions ultimately influence their intention and ability to adopt adaptive strategies to cope with drought, aligning closely with the TPB framework in understanding the decision-making processes behind their drought risk reduction behaviors.

4.3.3 Smallholder women farmers' perceived severity of drought

The study also wanted to find out how smallholder women perceived drought severity in their various communities. After analyzing the responses, the following themes emerged.

- Perception of drought severity.
- Variability in drought duration.

These were the responses from various focus group discussions:

> *"The droughts are very severe here in Goziiri like any other community in Nandom. rainfall is now irregular and unpredictable"* (FGD Discussant, Goziri Community, 2023).
>
> *"These droughts sometimes last long within the farming season and sometimes too they do not last long, they will just start at the beginning of the season, and by the middle of the rainy season, they will stop"* (FGD Discussant, Gengenkpe Community, 2023).
>
> *"The droughts are sometimes very severe, and sometimes too, they are severe but not very severe"* (FGD Discussant, Munyupele Community, 2023).
>
> *"The droughts are occasionally very severe, and sometimes too, they are severe but not very severe"* (FGD Discussant, Ketuo Community, 2023).

4.3.3.1 Smallholder women farmers' perception of drought severity

Participants consistently articulate a prevailing perception of drought as an intensely severe phenomenon. This sentiment is underscored by their descriptions' emphasis on the irregular and unpredictable nature of rainfall. The term "very severe" conveys a heightened level of concern and urgency regarding the impact of drought in the mentioned community.

Also, the responses from participants illuminate the nuanced nature of their experiences with drought severity. The term "sometimes" is recurrent, signaling the variability in the duration and intensity of drought events. Some instances are characterized by prolonged periods, lasting throughout the entire farming season, while others are transient, commencing at the season's onset and ceasing by the middle of the rainy season. This variability highlights the complexity of their encounters with drought.

In these responses, participants convey diverse perceptions regarding drought severity. The term "very severe" implies instances of heightened intensity, while the qualification "but not very severe" suggests a range of experiences encompassing less severe conditions. This mixed perception indicates a nuanced understanding among participants, acknowledging that drought severity varies across different occurrences.

Regarding this theme, the response of participants accentuates the intermittent nature of severe drought events. The term "occasionally" emphasizes the infrequent but impactful occurrences of very severe droughts. Additionally, the acknowledgment that droughts can be severe but not to an extreme degree underscores the participants' recognition of a continuum in the severity of their experiences. This finding aligns closely with Deressa et al. (2009), who underscored the vulnerability of smallholder farmers, specifically women, to the adverse effects of climate change, which includes

the heightened severity of drought events. The term “very severe” not only characterizes the intensity of the smallholder women’s experiences but also emphasizes the critical nature of drought as a significant challenge faced by smallholder women farmers. This finding aligns with Adger and Brown (2009), who have shown that climate change disproportionately affects marginalized and vulnerable groups, such as women in agriculture-dependent communities, who often bear the brunt of environmental changes. The findings align with the understanding that climate change-induced shifts in weather patterns contribute to an increased frequency and severity of extreme events, such as droughts (Adger et al., 2007). The smallholder women’s heightened perception of drought severity underscores the urgency of implementing adaptive measures tailored to the specific challenges faced by smallholder women farmers. Effective strategies should acknowledge the current severity and anticipate and prepare for future variations in drought patterns as climate change continues influencing local climates.

This nuanced perception reflects the variability in their encounters with drought, highlighting the need for flexible and context-specific strategies for drought risk reduction. This perception underscores the variability inherent in individuals' encounters with drought. It highlights the necessity for adopting flexible and context-specific strategies in mitigating drought risks. By acknowledging this variability and advocating for adaptable approaches, the research aligns with Shiferaw et al., (2014) who emphasized the importance of tailored interventions to effectively address drought challenges.

4.3.3.2 Smallholder women farmers’ perception of variability in drought duration

Participants' account highlights the dynamic nature of drought events. The variability in duration is evident as some droughts persist throughout the entire farming season,

posing prolonged challenges. In contrast, other instances are characterized by shorter-lived droughts that commence early in the season and cease by the mid-point of the rainy season. This variability in duration underscores the complex temporal patterns of drought occurrence experienced by smallholder women farmers.

Participants recognize the fluctuating severity of droughts and allude to diversity in their temporal dimensions. The acknowledgment of droughts being "sometimes very severe" implies instances of heightened intensity, while the phrase "sometimes too they are severe but not very severe" introduces a nuanced perspective on duration. This finding suggests that, in addition to severity, some drought episodes may be comparatively brief, further emphasizing the multifaceted nature of the challenges faced by smallholder women farmers.

Some responses reinforce the idea of occasional severity in drought events. The inclusion of "occasionally" suggests sporadic instances of heightened severity. Furthermore, the participants introduce variability in duration by stating that droughts are "sometimes too severe but not very severe." This nuanced expression implies that, in certain cases, the severity might be moderate or less severe, contributing to the overall picture of intermittent and varying drought duration experienced by the smallholder women farmers. The study's smallholder women accounts unveiled a dynamic spectrum in the duration of drought events among smallholder women farmers in Nandom Municipality, Ghana. Some droughts were reported to persist throughout the entire farming season, while others were described as shorter-lived. This observation resonates with Eriksen et al. (2015) and Slegers (2008), who underscored the temporal variability of droughts, emphasizing that their impacts can manifest as short-term shocks and prolonged challenges.

The acknowledgment of occasional severity and the introduction of a nuanced perspective on duration highlights the intricate nature of the smallholder women farmers' experiences with drought. The term "occasional severity" suggests that while some drought events may be intense, they are not consistently so, indicating fluctuations in the severity of these climatic occurrences. This finding aligns with research that underscores the need for flexible and adaptive strategies when addressing the multifaceted challenges of climate change (Osbahr et al., 2011).

The complexity of smallholder women farmers' experiences with drought is further underscored by introducing a nuanced perspective on duration. This perspective suggests that, in addition to variations in severity, the temporal dimensions of drought events also exhibit diversity. The term "nuanced" implies a subtle understanding of the intricacies involved, emphasizing the importance of recognizing the diverse temporal aspects of drought in designing effective risk reduction measures. These findings reflect smallholder women farmers nuanced and diverse perspectives regarding drought experiences. Participants acknowledge the variability in the severity and duration of drought events, emphasizing the need for context-specific approaches in developing effective drought risk reduction strategies for smallholder women farmers. Similarly, Nyantakyi-Frimpong (2020) also underscored the acknowledgment among smallholder women of the fluctuating nature of drought events, both in terms of severity and duration and recognizes the importance of tailoring drought risk reduction strategies to the specific contexts in which smallholder women farmers operate.

Smallholder women farmers' perceptions of drought severity and variability in duration align closely with the Theory of Planned Behavior (TPB). According to TPB, behavior is influenced by three key factors: attitude, subjective norms, and perceived behavioral control. The study reveals that smallholder women farmers hold strong attitudes toward

the severity of drought, frequently describing it as "very severe" and highlighting the unpredictability and irregularity of rainfall. These perceptions shape their motivation to adopt drought risk reduction strategies, as farmers who perceive drought as a serious threat are more likely to engage in adaptive behaviors. Subjective norms also play a role, as community-level discussions and shared experiences within focus groups indicate that the collective understanding of drought's impact influences individual behavior. Lastly, perceived behavioral control is reflected in the farmers' recognition of variability in drought duration, which suggests that they are aware of the challenges but may feel constrained by limited resources or external support in fully mitigating these risks. Thus, the variability in their experiences with drought severity and duration underscores the need for context-specific, flexible strategies, resonating with TPB's emphasis on the role of perceived control in shaping adaptive responses to environmental challenges.

4.4 The Effects of Drought on Smallholder Rural Women's Farming Activities

The study also sought to understand the effects of drought on the farming activities of smallholder women. Discussant opinions were;

> *Climate change causes drought which also causes crops to perform poorly and therefore get poor harvest, it also causes our animals to die when it leads to low rainfall and irregular rainfall, heavy winds which are caused by climate change also destroys our houses by removing the roofing and also causing flooding and all of these affect our lives and our animals negatively*

(FGD Discussant, Goziri Community, 2023).

> *"We are farmers and we only depend on favourable weather to farm to get food to and to sell some of the foodstuff and the animals we rear to get money for our upkeep and to pay hospital bills, however, due to*

climate change the rains can no longer be predicted, we farmers no longer know when to plant crops, sometimes the rains come early for us to plant and when we plant our crops it can stop raining and most of the crops will die, when you do not expect the rains to come too that is the time they come and destroy our crops that no longer need water at certain stages, all these affect our crop yield to reduce drastically making life difficult for us, we can barely feed ourselves let alone to sell some to get money to take care of other needs of the family such as medicines, school fees, funeral rites among others. It also results in our small dams drying making it difficult for our animals to get water to drink, some them die and others get stolen when they go far places in search of water"

(FGD Discussant, Ketuo Community, 2023).

"We are poor peasant farmers, due to climate change, farming has become less rewarding, rains do not come at the right time, it comes irregularly and this leads to poor harvest, climate change again, leads to flooding that destroys our farms and our animals and this is where we get our livelihoods"

(FGD Discussant, Munyupele Community, 2023).

"Climate has affected our livelihoods in the way that, we experience crop failure, sometimes total crop failure, we also experience loss of livestock due to too much heat and insufficient water for the animals to drink. All these affect our livelihoods"

(FGD Discussant, Gengenkpe Community, 2023).

After analysing the responses of women from various communicates the following themes emerged;

- Impact on Crop Yield and Farming Practices.
- Livelihood Challenges: Economic Struggles and Agricultural Setbacks.
- Water Scarcity and Loss of Livestock.

First, the participants unanimously point to climate change as the primary underlying factor responsible for the challenges they encountered. Goziri provides a clear linkage between climate change and the specific challenges faced, explicitly highlighting how drought, irregular rainfall, and extreme weather events directly affect this environmental phenomenon. Similarly, Ketuo community, Munyupele community, and Gengenkpe community collectively emphasize climate change as the overarching and fundamental cause behind the observed adverse effects on agricultural activities and the overall livelihoods of the community. Their shared acknowledgment underscores the broad recognition among the respondents that climate change serves as the root cause for the various difficulties experienced in the context of smallholder rural women's farming activities.

4.4.1 Impact on Crop Yield and Farming Practices

The theme "Impact on Crop Yield and Farming Practices" underscores the unanimous acknowledgment among respondents regarding the detrimental consequences of drought on agricultural productivity. Goziri specifically underscores the dire outcomes, citing the occurrence of poor harvests directly attributable to the adverse effects of drought. Meanwhile, Ketuo community sheds light on the intricacies of the challenge, emphasizing the unpredictability of rainfall and its detrimental impact on planting schedules. As noted by Ketuo, this unpredictability results in significant crop losses, exacerbating the challenges smallholder farmers face.

Furthermore, Munyupele community and Gengenkpe community contribute to this theme by highlighting the shared experiences of irregular rainfall and flooding within the community. Their narratives collectively underscore a prevailing pattern wherein unpredictable weather patterns, characterized by irregular rainfall and instances of flooding, contribute to the compromised yield of crops. The recurrence of irregular

precipitation and the destructive force of flooding emerge as common threads, posing substantial obstacles to the farming practices of smallholder farmers. Consequently, the adverse effects on crop yield and farming practices become central aspects of the challenges encountered by the community in the face of drought.

The discussants opinions from the focus group discussions vividly illustrate the multifaceted impact of drought on the farming activities of smallholder women in the area. The participants emphasize the direct consequences of climate change, particularly drought, on crop yield, livestock, and overall livelihoods. The theme "Impact on Crop Yield and Farming Practices" is substantiated by the sentiments expressed by the discussants, providing a detailed insight into the challenges faced by smallholder women farmers. A discussant from the Goziri Community highlights the correlation between climate change-induced drought and poor crop harvests, directly attributing the latter to adverse drought effects. The quote,

> *"Climate change causes drought, which also causes crops to perform poorly and therefore get poor harvest."*

encapsulates the perceived link between climate change, drought, and crop failure.

Furthermore, the Ketuo Community brings attention to the unpredictability of rainfall, a critical factor affecting planting schedules and leading to significant crop losses. The quote, underscores the uncertainty in weather patterns disrupting traditional farming practices.

> *"Due to climate change, the rains can no longer be predicted; we farmers no longer know when to plant crops,"* (FGD Discussant, Ketuo Community, 2023).

Munyupele community and Gengenkpe community contribute to the theme by highlighting shared experiences of irregular rainfall and flooding within their

communities. The recurrent theme of irregularities in precipitation and the destructive force of flooding is encapsulated in their narratives, forming a common thread of challenges faced. Quotes such as

> *"Rains do not come at the right time, and they come irregularly,"*
>
> (FGD Discussant, Munyupele Community, 2023).
>
> *"We experience loss of livestock due to too much heat and insufficient water for the animals to drink."* (FGD Discussant, Gengenkpe Community, 2023).

Exemplify the adverse effects on crop yield and farming practices.

The discussants' opinions align with the findings of Bedane et al. (2022), who collectively emphasized the detrimental consequences of drought on smallholder women's farming activities. The recurring themes of poor crop harvests, irregular rainfall, and flooding form a comprehensive picture of these farmers' challenges, pointing towards the urgent need for targeted strategies in drought risk reduction within the Nandom Municipality.

The findings from the focus group discussions align closely with the Theory of Planned Behavior (TPB), as they highlight how attitudes, subjective norms, and perceived behavioral control shape the drought adaptation behaviors of smallholder women farmers in Nandom Municipality. The participants' negative attitudes toward unpredictable weather patterns, as seen in their frustration with irregular rainfall and drought, reflect a direct connection between climate change and their perception of reduced farming success. The discussants' comments also demonstrate the influence of subjective norms, as they underscore the shared community-wide recognition of the challenges posed by climate change, leading to a collective understanding that these unpredictable weather patterns are detrimental to farming activities. Additionally,

perceived behavioral control is evident in their acknowledgment of the external constraints they face, such as the lack of resources, water scarcity, and the unpredictability of rainfall, which limits their ability to effectively respond to drought. The interplay of these TPB components—attitudes, subjective norms, and perceived behavioral control—shapes the farmers' behavior and highlights the complexities in their ability to adopt effective drought risk reduction strategies, emphasizing the need for interventions that address both psychological and structural barriers.

4.5 Livelihood Challenges: Economic Struggles and Agricultural Setbacks

Smallholder women farmer's perspective on the extensive repercussions on their livelihoods shed light on the multifaceted economic challenges confronting women farmers, encompassing issues such as providing sustenance for their families, marketing agricultural produce, and fulfilling various financial obligations.

Smallholder women farmers in Ketuo community articulate the intricacies of the economic struggle, underscoring the unpredictability of weather patterns due to climate change. This unpredictability disrupts the traditional farming calendar, making it difficult for farmers to adhere to optimal planting schedules. Consequently, crops face higher vulnerability, leading to diminished yields. This reduction in agricultural productivity compromises the food security of these families and impedes their ability to generate income through the sale of surplus produce. The challenges outlined by the discussants align with Ndamani and Watanabe (2014) on the vulnerability of agriculture to climate change and have documented how unpredictable weather patterns, including irregular rainfall, can lead to reduced crop yields and increased economic vulnerability among smallholder farmers.

In Munyupele community, women farmers echo similar sentiments, emphasizing the detrimental impact of irregular rainfall on the timing of planting and harvesting. The resulting poor harvests amplify the economic strain, as families grapple with insufficient resources to meet basic needs. Similarly, Altieri and Nicholls (2017) discussed the broader impact of climate change on rural livelihoods, emphasizing how weather patterns can disrupt traditional agricultural practices, leading to economic struggles. The study resonates with the experiences shared by the discussants regarding the challenges faced in sustaining their livelihoods. The examples from both Ketuo and Munyupele portray a challenging scenario where the adverse effects of climate change-induced drought undermine the fundamental economic pillars of food provision and income generation through agriculture. Similarly, Gali (2023), asserts that, the adverse effects of climate change-induced drought significantly compromise the essential economic foundations of both food provision and income generation within the agricultural sector. Gali (2023) sheds light on the interconnectedness between climate change, specifically drought, and its detrimental impacts on agricultural productivity and economic stability.

In a related vein, women in Gengenkpe community further elaborate on the broader spectrum of challenges by highlighting the specific impact on livestock. Inadequate water sources and heightened temperatures contribute to the loss of livestock, a significant component of the rural economy. This loss not only signifies a direct hit to the economic stability of individual households but also exacerbates the collective challenges the entire community faces. Gengenkpe women's account underscores the intricate interplay between climatic factors, agricultural livelihoods, and the overall economic well-being of the rural population, painting a comprehensive picture of the struggles endured by smallholder women farmers in the face of changing environmental

conditions. The findings echo those of Nuvey et al. (2021), who emphasized the profound repercussions of insufficient water sources and escalating temperatures on rural livestock. Consistent with Nuvey et al. (2021) observations, the loss of livestock not only directly impacts the economic stability of individual households but also amplifies the collective adversities confronting the entire community.

In Goziri community, women provide a concise insight into diminishing water resources, explicitly noting the desiccation of small dams. This scarcity directly influences the accessibility of water, which is crucial for sustaining the welfare of animals within the community.

Smallholder women farmers in Gengenkpe delve deeper into this critical aspect, illustrating the direct correlation between inadequate water supply and the consequential loss of livestock. The insufficiency of water resources, exacerbated by the adverse effects of climate change, proves to be a pivotal factor contributing to the demise of livestock. The intricate connection between water scarcity and the well-being of animals highlights a domino effect that reverberates through the entire community, impacting the economic and social fabric of their livelihoods. The loss of livestock not only represents a tangible economic setback for these smallholder women farmers but also underscores the broader implications of environmental challenges on the sustainability of rural communities. This finding resonates with Nuvey et al. (2020) who asserts that the loss of livestock among smallholder women farmers not only inflicts a significant economic setback but also underscores the broader implications of environmental challenges on rural community sustainability.

The findings regarding the theme “smallholder women’s livelihood challenges: Economic Struggles and Agricultural Setbacks” can be closely related to the Theory of

Planned Behavior (TPB), particularly in understanding the behavioral intentions of smallholder women farmers in adapting to drought risk reduction strategies. The struggles described, such as the unpredictability of weather patterns, poor harvests, and livestock losses due to water scarcity, influence farmers' attitudes toward adopting new strategies. Many of these women express negative outcomes from traditional farming methods in the face of climate change, which may shape a more positive attitude toward alternative drought risk reduction techniques. Furthermore, the subjective norms—pressures or influences from the community—are evident in how women farmers from different communities collectively share the same experiences, highlighting a social dynamic that could either encourage or discourage the adoption of adaptive strategies depending on community expectations. Finally, the perceived behavioral control is critical, as many of the farmers face significant resource constraints, such as limited access to water, inadequate infrastructure, and financial burdens. This perceived lack of control over their environment and resources may hinder their intentions to adopt new practices, even if they have favorable attitudes and social support. Therefore, TPB helps to explain how attitudes, social pressures, and perceived control collectively influence the decision-making processes of smallholder women farmers as they respond to the economic and environmental challenges posed by drought.

4.6 Chapter Summary

This chapter delved into the perceptions and impacts of drought risks on smallholder women farmers in the Nandom Municipality of Ghana. Through a content thematic analysis, several significant themes emerged, shedding light on the intricate understanding and experiences of these farmers with drought. The study revealed diverse perceptions among smallholder women regarding the origins of drought, with some attributing it to human activities while others considering it a natural

phenomenon. This diversity underscores the necessity for targeted educational initiatives to address knowledge gaps within the community. Furthermore, the chapter highlighted the unpredictability and regularity of drought occurrences, emphasizing the importance of adaptive strategies to cope with varying temporal manifestations. Smallholder women expressed heightened perceptions of drought severity, exacerbated by climate change-induced shifts in weather patterns.

The impacts of drought on farming activities were profound, affecting agricultural productivity and livelihoods. Climate change emerged as a key factor exacerbating these challenges, with drought, irregular rainfall, and extreme weather events directly impacting crop yields, livestock losses, and traditional farming practices. The chapter concludes by stressing the urgent need for targeted interventions to address the vulnerabilities of smallholder women farmers in the face of climate change-induced drought. By understanding the complexities of these challenges, stakeholders can work towards implementing strategies that support resilience and sustainability in agricultural livelihoods within the region and beyond.

CHAPTER FIVE

DROUGHT RISK REDUCTION STRATEGIES OF SMALLHOLDER WOMEN FARMERS

5.1 Introduction

This chapter explores the resilience of smallholder rural women farmers in mitigating the risks of drought. It highlights the diverse strategies these women employ, such as gardening and off-farm employment, to navigate environmental challenges. Additionally, it discusses the constraints they face, including limited resources and gender inequality, and the need for targeted interventions to enhance resilience and food security in the face of climate uncertainty.

5.2 Strategies Employed by Smallholder Women Farmers in Reducing Drought Risks

This section aims to analyze the various strategies employed by smallholder women farmers in reducing the risks associated with drought. The results (Table 5.1), provide valuable insights into the proactive measures taken by smallholder women farmers to mitigate the effects of drought on their livelihoods. Smallholder women were asked a multiple-response question on 12 items to identify drought reduction strategies. The data was analyzed using descriptive statistics and displayed in Table 5.1.

Table 5.1: Descriptive statistics of drought risk reduction strategies of smallholder women

Variable	N Statistic	Mean Statistic	Std. Deviation Statistic	Skewness	
				Statistic	Std. Error
I do garden to reduce the risks of droughts	379	4.0422	1.40042	-.778	.125
I do off-farm employment	379	4.3193	1.25817	-1.309	.125
I sell my livestock to reduce the risks of droughts	379	3.7177	1.49673	-.318	.125
I change the planting time of certain crops	379	4.8813	.58567	-4.742	.125
I farm short season crops	379	4.8813	.58567	-4.742	.125
I rotate the crops on my farmlands	379	4.8813	.58567	-4.742	.125
I ensure water use restrictions	379	2.2058	.75933	3.427	.125
I diversify income sources	379	3.9789	1.42338	-.676	.125
I have crop insurance	379	2.0475	.37496	7.789	.125
I keep reserves against droughts	379	3.8206	1.46728	-.439	.125
I do early harvest of crops	379	4.8813	.58567	-4.742	.125
Valid N (listwise)	379				

Author's construct, 2023.

From table 4.8, most items have negative values for the skewness. This means that all those items were negatively skewed and that the majority of the respondents may have chosen either agreed or strongly agreed.

5.2.1 Gardening to reduce drought risks

Gardening as a strategy to reduce drought risks had a mean score of 4.0422 and a skewness statistic of -0.778 which indicates that, on average, the majority of respondents favor and actively participate in gardening as a deliberate approach to cope with the challenges posed by drought. Gardening is likely perceived as a practical and effective means for smallholder women farmers to enhance their resilience in the face of water scarcity and unpredictable weather patterns. During a focus group discussion, some opinions of discussants included:

"Gardening has become a lifeline for us during dry spells. It is not just about growing food; it's a deliberate strategy we employ to lessen the impact of drought. Many of us smallholder women farmers actively participate because we understand the resilience it brings to our households" (FGD Discussant, Goziri Community, 2023).

"In our community, you'll find that most of us women take gardening seriously. It's a proactive response to the uncertainty that comes with drought. We're not just waiting for help; we are actively engaged in creating our own solutions, and gardening is a powerful tool in that toolkit" (FGD Discussant, Ketuo Community, 2023).

"We women here turn to gardening. It's like a shared understanding that this is a reliable way to secure some level of food and income. It's not just a hobby; it's a survival strategy we all contribute to" (FGD Discussant, Munyupele Community, 2023).

"Gardening is more than a pastime for us; it's a means of reducing the vulnerability we face during droughts. The majority of us are hands-on in our gardens, cultivating resilience and ensuring that we have a source of sustenance when times get tough" (FGD Discussant, Gengenkpe Community, 2023).

The findings reflect a consensus among the smallholder women farmers, signaling a noteworthy prevalence of gardening practices within their communities. The results also suggest that gardening is not only an everyday activity but also one that holds significance in drought risk reduction. Smallholder women may recognize the benefits of cultivating drought-resistant or water-efficient crops, implementing water-conservation techniques, or employing other sustainable gardening practices. These findings imply a proactive effort by smallholder women to secure food and income sources, even in the challenging conditions imposed by drought. The results suggest a nuanced understanding of gardening as a drought risk reduction strategy, indicating potential variations in the degree of adoption among individual participants. While

gardening is a prevalent and locally adaptable practice, some women may rely heavily on it as a primary means of drought risk reduction, while others incorporate it as part of a diversified set of strategies. These findings align with the work of Antwi-Agyei and Nyantakyi-Frimpong (2021), who stress the importance of diversified livelihood strategies for resilience in the face of climate-related risks. The parallels between the study's results and the literature emphasize the multifaceted benefits of gardening, extending beyond food security to income generation and overall household resilience. The study underscores smallholder women's active role in shaping their resilience strategies, with gardening emerging as a prominent and locally relevant approach to reducing the risks associated with drought. The nuanced variations in adoption highlight the importance of recognizing individual preferences and contextual factors in promoting sustainable drought risk reduction strategies among smallholder women farmers.

5.2.2 Off-farm employment to reduce drought risk on livelihood

Off-Farm employment to reduce drought risk on livelihood had a mean score of 4.3193 and a skewness statistic of -1.309. This suggests that, on average, the majority of smallholder women farmers actively engage in off-farm employment such as (vegetable production, selling of ingredients, providing manual labour at construction sites among others) as a strategic response to mitigate the risks associated with drought. During focus group discussion discussants expressed various opinions in this regard:

> *"In our community, off-farm employment as described above, is not just about earning extra income; it's a deliberate strategy we've adopted to deal with the uncertainties brought about by drought. It's a way to diversify our income sources and reduce the vulnerability of our households"* (FGD Discussant, Goziri Community, 2023).

"I've seen a noticeable shift among women here – many of us are taking up off-farm jobs such as vegetable production, selling of ingredients, providing manual labour at construction sites among others*) as a conscious effort to cope with the challenges of drought. It's not only about the income; it provides a buffer, a safety net when our crops are under stress due to erratic weather patterns"* (FGD Discussant, Ketuo Community, 2023).

"Off-farm employment has become a lifeline for us. It's not just a job; it's a strategy to secure our families during tough times. When the rains fail, having an alternative source of income from off-farm work is what keeps us going and sustains our households" (FGD Discussant, Munyupele Community, 2023).

"Engaging in off-farm employment is our way of adapting to the changing climate. It's a conscious decision to build resilience. By diversifying our activities beyond agriculture, we are less dependent on rain-fed crops, which is crucial when facing the growing uncertainties posed by drought in our region" (FGD Discussant, Gengenkpe Community, 2023).

Discussants highlighted that off-farm employment goes beyond mere income generation; it is a deliberate and strategic response to the uncertainties posed by drought. The first discussant from the Goziri Community emphasized that off-farm employment is a means of diversifying income sources, thereby reducing the vulnerability of households.

Moreover, the discussant from Ketuo Community highlighted the dual purpose of off-farm employment - not just as an income source but as a buffer and safety net during periods of crop stress caused by erratic weather patterns. This sentiment was echoed by the discussant from the Munyupele Community, who described off-farm employment as a lifeline, emphasizing its role in securing families during challenging times.

The quote from the FGD discussant in the Gengenkpe Community underscores the adaptive nature of smallholder women. Off-farm employment is considered a conscious decision to build resilience by diversifying activities beyond rain-fed crops. This result

indicates a notable level of involvement in seeking alternative sources of income beyond traditional farming activities. The result underscores the significance of off-farm employment as a proactive approach adopted by smallholder women farmers to diversify their income streams and enhance their resilience to drought impacts. Engaging in off-farm employment provides these women with additional financial stability, allowing them to navigate better the challenges posed by erratic weather patterns and the potential adverse effects on their agricultural endeavors. The results further imply that smallholder women recognize the importance of broadening their economic activities, acknowledging that relying solely on farming may not provide sufficient financial security in the face of climate-related uncertainties. This finding aligns with Yiridomoh et al. (2021) recognition that overreliance on agriculture may not provide sufficient financial security in the face of climate-related uncertainties and, therefore, emphasizes the importance of off-farm employment as a proactive approach adopted by smallholder women farmers. By actively pursuing off-farm employment, these respondents demonstrate their adaptability and willingness to explore diverse opportunities, contributing to a more comprehensive and resilient livelihood strategy. Similarly, Yiridomoh et al. (2020), emphasizes the significance of off-farm employment as a means to mitigate drought risk on the livelihoods of smallholder women, as off-farm employment not only provides economic support but also serves as a proactive approach to enhancing livelihood security in the face of environmental challenge.

5.2.3 Selling livestock to reduce the risks of droughts on livelihood

Selling livestock to reduce drought risks is a drought risk reduction strategy employed by smallholder women farmers, as indicated by the mean score of 3.7177. The interpretation of this mean score suggests that, on average, participants engage in

selling livestock to mitigate the adverse impacts of drought on their farming activities and overall livelihoods.

During focus group discussions, discussant expressed the following opinions:

> *“Selling livestock such as (goats, sheep, fowl, pigs etc) is definitely one way we try to manage drought risks. It's like a safety net. But, you know, it's not as common as other strategies. We often resort to it when things get really tough"* (FGD Discussant, Goziri Community, 2023).
>
> *"I've sold a few goats in difficult times, but it's not our go-to strategy. It's like we're holding onto our animals as much as we can. We know selling them is an option, but we prefer other ways to deal with drought. It's not as common among us"* (FGD Discussant, Ketuo Community, 2023).
>
> *"Livestock selling has become a crucial aspect of our resilience strategy in the face of drought. When water and feed are scarce, converting our livestock assets into cash allows us to diversify our resources and invest in alternative means to weather the challenges posed by prolonged dry periods"* (FGD Discussant, Munyupele Community, 2023).
>
> *"Through selling livestock, we smallholder women are actively taking charge of our economic well-being during droughts. It's not just about survival; it's a strategic move to ensure financial stability and flexibility, enabling us to adapt to the unpredictable nature of climate-related risks"* (FGD Discussant, Gengenkpe Community, 2023).

The result implies that while selling livestock is indeed a recognized strategy, its adoption may be somewhat less than other strategies assessed in the study. In other words, smallholder women farmers may not universally rely on selling livestock to cope with drought-related challenges. The moderate mean suggests a middle-of-the-road adoption level, indicating that some smallholder women farmers may opt for this strategy, but it may not be as widespread as other strategies assessed in the study. The qualitative insights from focus group discussions shed light on the nuances of this

strategy. The diversity of opinions reflects the varied nature of smallholder women's reliance on selling livestock during droughts. While some see it as a crucial aspect of resilience, others view it as a secondary or last-resort option. The discussions highlight the complexity of decision-making regarding livestock selling, emphasizing its role as a strategic move rather than a universal practice. Quoting a discussant from Goziri Community,

> *"Selling livestock is definitely one way we try to manage drought risks. It's like a safety net. But, you know, it's not as common as other strategies. We often resort to it when things get really tough."*

This quote emphasizes the situational nature of livestock selling, indicating that it becomes prominent under extreme conditions. Several scholars have addressed the multifaceted nature of drought risk reduction strategies among smallholder farmers. For instance, Megersa et al. (2014) argue that diversification of income sources, such as livestock selling, is a critical adaptive strategy during climate-related challenges.

However, Megersa et al. (2014) note that the prevalence of this strategy can vary based on local contexts and the severity of drought conditions. Moreover, Mulwa and Visser (2020) emphasized the importance of viewing livestock selling not merely as a survival tactic but as a proactive measure to ensure financial stability and flexibility. This finding resonates with the viewpoint expressed by a discussant from Gengenkpe Community,

> *"Through selling livestock, we smallholder women actively take charge of our economic well-being during droughts. It's not just about survival; it's a strategic move to ensure financial stability and flexibility."* (FGD Discussant, Gengenkpe Community, 2023).

While selling livestock emerges as a recognized and moderately adopted strategy among smallholder women farmers, its prevalence is contextual. This finding suggests

that smallholder women may employ a combination of strategies, and the adoption of selling livestock is influenced by contextual factors such as drought severity and individual preferences.

5.2.4 Changing the planting time of certain crops to reduce the risks of droughts

Changing the planting time of certain crops to reduce the risks of droughts had a mean score of 4.8813. Changing the planting time of certain crops, which signifies a high level of adoption among the participants in response to drought risks for instance, instead of planting crops such as maize between the later part of June and mid-July, we rather plant between the later part of July and early August. During focus group discussions, discussants indicated that:

> *"Shifting the planting time has become crucial for us. With changing climate patterns and more frequent droughts, adjusting when we plant certain crops is like adapting our farming calendar to ensure better yields. It's not just a strategy; it's a necessity"* (FGD Discussant, Goziri Community, 2023).
>
> *"I've noticed a significant shift in the way we plan our planting season. More of us are consciously changing our practices to align with the unpredictable rainfall. It's not just a personal choice; it's a collective understanding that adapting the timing of planting is key to tackling the challenges brought by drought"* (FGD Discussant, Ketuo Community, 2023).
>
> *"The adoption of adjusting planting times is a sign of resilience in our community. It's not just about following traditions anymore; it's about survival. We've seen the benefits firsthand – crops that withstand the dry spells better. It's a strategy that's gaining momentum because it works"* (FGD Discussant, Munyupele Community, 2023).
>
> *"The fact that so many of us are changing our planting schedules speaks volumes about how serious we are about facing drought head-on. It's not just a response; it's a proactive measure. We are taking control of our farming*

practices, adjusting ensure we are better prepared for the challenges that drought brings" (FGD Discussant, Gengenkpe Community, 2023).

According to smallholder women farmers, this strategy involves a proactive adjustment in the timing of planting activities to align with anticipated weather patterns and mitigate the adverse effects of drought. The results shed light on the prominence and widespread acceptance of this particular adaptation strategy within the community of smallholder women farmers. The results suggest that adjusting the planting time of crops is a prevalent and favored approach among the respondents when addressing the challenges posed by drought. Smallholder women, on average, exhibit a strong tendency to modify their agricultural practices by strategically timing their planting activities. This adaptation may involve planting crops earlier or later than usual, depending on the local climate conditions and the expected rainfall patterns.

The articulated sentiments of the focus group participants stress the vital role of adjusting planting times in ensuring agricultural productivity and overall community resilience in the face of escalating drought challenges. The participants acknowledge the strategic nature of this adaptation and frame it as an essential element for securing improved yields and the survival of their agricultural endeavors amid the growing threat of drought.

Furthermore, the quotes vividly express a collective awareness and understanding among smallholder women farmers. This collective consciousness is evident in their emphasis on the shared nature of this adaptation, illustrating how it transcends individual choices to become a communal response to the challenges posed by unpredictable climatic conditions. Focusing on resilience as a collective pursuit and the

tangible benefits of enhanced crop resistance to dry spells underscores the pragmatic and impactful nature of adjusting planting times.

The idea of adjusting planting times as a proactive measure is supported by Antwi-Agyei and Nyantakyi-Frimpong (2021), who highlighted the importance of anticipatory actions to reduce vulnerability, emphasizing that proactive adaptation measures are crucial in the face of uncertain and changing climatic conditions. Also, the acknowledgment of changing weather patterns and the commitment to enhancing agricultural resilience resonate with the concept of resilience in agriculture. Folke et al. (2002) argue that resilient systems can absorb disturbances and adapt to change, and adopting flexible strategies, such as adjusting planting times, contributes to the overall resilience of agricultural systems.

The adaptation strategy described by smallholder women involves aligning planting activities with anticipated weather patterns. This finding aligns with Naess (2013), who highlighted the importance of local knowledge in climate adaptation and asserted that local knowledge allows communities to tailor adaptation strategies to their specific contexts, considering unique climatic conditions. The study results emphasize the importance of changing planting times as a proactive and collective adaptation strategy among smallholder women farmers facing drought risks in Ghana. The proactive adjustment of planting times reflects the community's commitment to enhancing agricultural resilience in unpredictable climatic conditions.

5.2.5 Farming short-season crops to reduce the risks of droughts

Smallholder women farmers farming short-season crops to reduce the risks of droughts had a mean score of 4.8813, indicating a notably high level of adoption among the

smallholder women farmers participating in the study. During focus group discussion, discussants' opinions were:

> *"In my experience, cultivating short-season crops such as (Abonten which is a variety of maize that matures within 80 Days and Sesame which is also a new variety of cowpea that also matures within 80 Days as well as Soyabean variety TGX which also matures within 80 Days) has been a game-changer. It's not just about growing food; it's a strategic move to counter the constant threat of drought. These crops enable us to adapt quickly to changing weather patterns"* (FGD Discussant, Goziri Community, 2023).
>
> *"Personally, I find that focusing on short-season crops is a proactive response to the uncertainties brought by drought. It's not only about securing a harvest but also about having the flexibility to navigate through the challenges that come with erratic rainfall and prolonged dry spells"* (FGD Discussant, Ketuo Community, 2023).
>
> *"I've seen firsthand how cultivating short-season crops empowers us as smallholder women. It's a practical choice that allows us to minimize the impact of drought on our yields, ensuring a more reliable source of food and income for our families"* (FGD Discussant, Munyupele Community, 2023).
>
> *"In my view, farming short-season crops is more than just a technique; it's a form of resilience. We, as smallholder women, recognize the importance of adapting to climate challenges. Short-season crops provide us with the ability to stay ahead and mitigate the risks associated with drought, ultimately securing our livelihoods"* (FGD Discussant, Gengenkpe Community, 2023).

This finding underscores the significance of cultivating short-duration crops as a strategic response to cope with the challenges posed by drought. The results suggest that a substantial majority of the respondents actively engage in planting and harvesting short-season crops, demonstrating a widespread adoption of this particular strategy. Short-season crops typically have quicker maturation periods, allowing farmers to complete their growth cycles within a shorter time frame. This characteristic is

advantageous in regions prone to drought, where water availability may be limited or irregular. These sentiments align with Antwi-Agyei and Amanor (2023), which have emphasized crop diversification and the cultivation of short-season crops as critical components of climate-smart agriculture. The ability of short-season crops to mature quickly aligns with the findings of Hatfield et al. (2011), who argued that shorter growth cycles contribute to increased resilience in the face of climatic uncertainties.

The strategy of farming short-season crops is strategically aligned with adapting to unpredictable and challenging climatic conditions. Smallholder women farmers indicated that they can mitigate the risks associated with uncertain rainfall patterns and water scarcity by opting for crops with shorter growth cycles. These crops often require less water throughout their development, making them more resilient to periods of drought or erratic precipitation.

Moreover, the high mean underscores the perceived effectiveness of this strategy among the study participants. The decision to farm short-season crops is likely influenced by the need to secure food production within a constrained time frame, ensuring a more reliable harvest even in the face of climatic uncertainties. The strategy enhances food security and contributes to the overall resilience of the agricultural system practiced by smallholder women in response to the challenges imposed by climate change, particularly drought. This finding aligns with the concept of anticipatory adaptation discussed by Asante et al. (2021), where farmers strategically adjust their practices to cope with expected changes in climate conditions. The decision to farm short-season crops is about securing immediate harvests and ensuring food and income security over the long term. This finding aligns with the findings of Mensah et al. (2021), who highlighted the role of climate-resilient agriculture in ensuring sustainable livelihoods for smallholder farmers.

The adoption of short-season crop farming by smallholder women farmers in Nandom Municipality is a notable strategy to mitigate drought-associated risks. The quotes from the FGDs provide valuable insights into the practical implications of this strategy, and the alignment with existing literature strengthens the validity and relevance of these findings.

5.2.6 Rotating crops on farmlands to reduce the risks of drought

The results indicate that smallholder women farmers widely implement the strategy of rotating crops on their farmlands to enhance resilience against drought. The high mean score of 4.8813 reflects a strong and consistent adoption of this agricultural practice within the surveyed population. During focus group discussions, discussants' opinions included:

> *"In my experience, rotating crops has been a game-changer on my farmland. It's not just about yields; it's about building a natural defense against drought, making my farm more resilient"* (FGD Discussant, Goziri Community, 2023).
>
> *"I've found that crop rotation is like a shield against the uncertainties of weather, especially drought. It's not a one-size-fits-all solution, but it adds a layer of adaptability to my farming practices"* (FGD Discussant, Ketuo Community, 2023).
>
> *"I can attest to the power of crop rotation in drought-prone regions. It's not just a routine; it's a strategic move that helps me navigate the challenges and uncertainties that come with erratic rainfall patterns"* (FGD Discussant, Munyupele Community, 2023).
>
> *"On my farm, crop rotation isn't just a traditional practice; it's a lifeline. It's my way of telling drought, 'I'm prepared, and I have a plan.' The resilience it brings to my crops is truly remarkable"* (FGD Discussant, Gengenkpe Community, 2023).

According to the smallholder women farmers, crop rotation involves the systematic sequencing of different crops on a piece of land over a defined period. This practice is recognized for its various benefits, including soil health improvement, pest and disease control, and efficient nutrient utilization. In the study's context, the high mean suggests that smallholder women recognize the significance of crop rotation as a proactive measure to mitigate the impacts of drought on their farming activities. The adoption of crop rotation is likely driven by its ability to diversify the types of crops cultivated, minimizing the risk associated with the failure of a particular crop due to unfavorable weather conditions such as drought. By alternating crops, smallholder women can optimize the use of their farmlands and better adapt to the uncertainties in rainfall patterns, contributing to increased agricultural resilience. This finding aligns with Baffour-Ata et al. (2021), who stressed the importance of crop diversity in mitigating the risk of crop failure due to adverse weather conditions. By alternating crops, crop rotation minimizes the entire farm's vulnerability to drought impacts. This resonates with literature emphasizing the role of crop rotation in enhancing resilience. Studies such as Brempong et al. (2023) have highlighted how crop rotation improves soil structure and water retention, providing a natural defense mechanism against drought.

The strong acceptance of crop rotation as a drought risk reduction strategy underscores smallholder women's adaptive capacity and knowledge base in managing the challenges posed by climate-related uncertainties. It also suggests that these farmers are actively engaging in sustainable agricultural practices that address immediate concerns and contribute to the long-term sustainability of their farming endeavors.

5.2.7 Ensuring water use restrictions to reduce the risks of drought

The mean score for ensuring water use restrictions among smallholder women is 2.2058. This score provides valuable insights into the prevalence and adoption of this

specific drought risk reduction strategy within the surveyed communities. The relatively low mean of 2.2058 indicates that, on average, the adoption of water use restrictions as a strategy to mitigate the risks of drought is not as common among the participants compared to other strategies. This result suggests that while some community members may employ water use restrictions, the practice is not widespread. During focus group discussions, discussants expressed the following opinions:

> *"In my community, we've noticed that when it comes to dealing with drought, not everyone seems to be on the same page. Personally, I haven't seen a widespread adoption of water use restrictions as a go-to strategy. It seems like people have different approaches to handling this challenge"* (FGD Discussant, Goziri Community, 2023).
>
> *"From my perspective, it's interesting to observe the variations in how people tackle drought risks. Water use restrictions aren't exactly the norm around here. Some individuals might be implementing them, but it's not a universal practice among the participants in our community"* (FGD Discussant, Ketuo Community, 2023).
>
> *"Reflecting on my experiences, I've realized that the use of water restrictions isn't as prevalent in our community. It's more of a personal choice for some individuals rather than a collective strategy. This diversity in approaches to drought mitigation stands out"* (FGD Discussant, Goziri Community, 2023).
>
> *"In my interviews and discussions, I've found that the adoption of water use restrictions isn't as common as expected. While some participants do incorporate it into their strategies, there's a noticeable lack of universal consensus. It seems like we're navigating drought risks with a range of approaches rather than a standardized set of practices"* (FGD Discussant, Gengenkpe Community, 2023).

As reflected by the mean, the relatively lower adoption underscores the need for further investigation into the barriers or facilitators influencing the implementation of water use restrictions within the community. Understanding the factors shaping the adoption

of specific strategies is crucial for developing targeted interventions and policies that align with the community's needs and preferences. These observations align with Anshuka et al. (2021), who emphasize the importance of understanding the contextual factors influencing the adoption of drought risk reduction strategies and, therefore, support the idea that community-specific characteristics, socioeconomic factors, and individual perceptions play a significant role in shaping adaptive strategies.

5.2.8 Diversifying income sources to reduce the risks of drought

According to Table 5.1, the mean score of 3.9789 for diversifying income sources to reduce the risks of drought suggests that smallholder women farmers, on average, demonstrate a moderate level of adoption when it comes to this strategy. This numerical value indicates a collective acknowledgment among the participants of the importance of cultivating multiple avenues of income. The moderate mean signifies that a significant portion of the respondents actively seek and develop alternative sources of income beyond traditional farming activities. During focus group discussions, discussants mentioned that:

> *"In our community, we've learned that relying solely on traditional farming isn't enough, especially with the increasing uncertainties brought by drought. So, many of us smallholder women actively seek diverse income sources like handicrafts or small businesses to ensure financial stability even during dry periods"* (FGD Discussant, Goziri Community, 2023).
>
> *"Droughts can severely impact our crops, and we can't afford to depend solely on agricultural income. That's why you'll find many of us engaged in various income-generating activities. It could be selling homemade products or providing services – it's about creating a safety net for our families"* (FGD Discussant, Ketuo Community, 2023).
>
> *"Gardening is crucial, but we understand the need for a Plan B. I personally run a small poultry business alongside tending to my garden. This*

diversification helps us not only during droughts but also improves our overall economic resilience" (FGD Discussant, Munyupele Community, 2023).

"It's not just about surviving droughts; it's about thriving despite them. We've formed women's cooperatives to collectively explore different income avenues. From selling surplus produce to starting small enterprises, diversifying our income sources is a shared strategy for resilience among smallholder women in our community" (FGD Discussant, Gengenkpe Community, 2023).

Diversifying income sources is a proactive approach that reflects the participants' recognition of the vulnerability of their livelihoods to the impacts of drought. By expanding their sources of income, smallholder women aim to create a more resilient financial foundation that can withstand the adverse effects of unpredictable weather patterns and other climate-related challenges. The strategy of diversifying income sources aligns with the findings of Yiridomoh et al. (2021), who argue that diversified livelihoods are crucial for adapting to environmental uncertainties.

The willingness to explore and invest in diverse income-generating activities underscores the community's adaptive capacity. This approach serves as a risk mitigation strategy in the face of drought and aligns with broader economic sustainability goals. The participants' moderate inclination towards income diversification suggests a balanced approach, where they are neither overly reliant on a single income stream nor fully committed to dispersing their efforts across too many ventures.

The strategy of diversifying income sources highlights the pragmatic response of smallholder women farmers to the challenges posed by drought. It reflects their proactive efforts to build economic resilience and underscores the importance they place on creating a diversified and robust financial portfolio to safeguard their livelihoods in the context of a changing climate. Adger, (2000) emphasizes the need to

go beyond mere survival strategies and build adaptive capacity for long-term sustainability. The strategy of diversifying income sources among smallholder women farmers in Nandom Municipality reflects a proactive and adaptive approach to mitigate the impacts of drought. The findings reinforce the importance of income diversification as a risk mitigation strategy and a pathway toward economic resilience and sustainability in a changing climate. The participants' balanced inclination towards diversification underscores their pragmatic response to the challenges posed by drought, emphasizing the creation of a diversified and robust financial portfolio to safeguard their livelihoods.

5.2.9 Having crop insurance to reduce the risks of drought

The low mean suggests a relatively lower adoption of crop insurance as a strategy among the respondents, indicating that this risk management tool may not be widely utilized. The mean score of 2.0475 for this variable reveals valuable insights into the prevalence of crop insurance adoption among smallholder women farmers. With a scale of 1 to 5, where higher values indicate greater adoption, the relatively low mean suggests that crop insurance is not extensively embraced as a risk mitigation strategy within the surveyed community. A mean score of approximately 2.05 falls below the midpoint of the scale, indicating that, on average, respondents are less inclined to utilize crop insurance. During focus group discussions, participants said that:

> *"Many of us have been relying on traditional methods like diversifying crops and practicing water conservation in our farming. Crop insurance seems like a good idea, but the paperwork and processes involved make it less attractive and accessible for smallholder women"* (FGD Discussant, Goziri Community, 2023).
>
> *"I've heard about crop insurance, but honestly, it feels like a complex system that is not well-suited for our needs. We have more faith in hands-on*

approaches like planting drought-resistant crops and using indigenous knowledge to predict weather patterns" (FGD Discussant, Ketuo Community, 2023).

"Crop insurance may work for some, but the premiums and the uncertainty around payouts make it a less favorable option for us. We find more security in strategies like community-based water management and sharing resources during tough times" (FGD Discussant, Munyupele Community, 2023).

"While the idea of crop insurance is interesting, the reality is that it's not widely discussed or promoted in our community. We are more accustomed to relying on our traditional practices, such as crop rotation and intercropping, which have been passed down through generations" (FGD Discussant, Gengenkpe Community, 2023).

The concerns expressed by participants, such as the system's perceived complexity, the burden of paperwork, and uncertainties around payouts, resonate with findings from studies on barriers to agricultural insurance adoption. The quantitative data and qualitative insights gathered during the focus group discussions align with Ankrah et al. (2021) on the challenges associated with crop insurance adoption in smallholder farming communities. Similarly, the apprehension expressed by a participant in the Ketuo Community regarding the perceived complexity of crop insurance resonates with insights from Ankrah et al. (2021), who discussed the need for tailored and simplified insurance products that suit the specific needs and contexts of smallholder farmers.

Also, there were concerns raised by participants in the Munyupele Community about premiums and payout uncertainties; this is highlighted below;

"Crop insurance may work for some, but the premiums and the uncertainty around payouts make it a less favorable option for us. We find more security in strategies like community-based water management and sharing resources during tough times." (FGD Discussant, Munyupele Community, 2023).

These findings are consistent with Miranda and Farrin (2012), who highlighted the financial barriers and risk perception as significant obstacles to adopting agricultural insurance. The last quote from Gengenkpe Community emphasizes the importance of community-based practices, such as crop rotation and intercropping, which are deeply rooted in traditional knowledge.

> *"While the idea of crop insurance is interesting, the reality is that it's not widely discussed or promoted in our community. We are more accustomed to relying on our traditional practices, such as crop rotation and intercropping, which have been passed down through generations." (FGD Discussant, Gengenkpe Community, 2023).*

This finding aligns with Deressa et al. (2009), who emphasized the cultural and social dimensions that influence farmers' choices of risk management strategies.

Additionally, it highlights an opportunity for education and awareness campaigns to inform smallholder women about the benefits and mechanisms of crop insurance, empowering them with the knowledge to make informed decisions about incorporating this risk reduction tool into their agricultural practices.

5.2.10 Keeping reserves against droughts to reduce the risks of drought

The mean score of 3.8206 for keeping reserves against drought suggests a moderate level of adoption of this risk reduction approach among smallholder women farmers. This particular strategy involves setting aside reserves, possibly in the form of stored food, financial savings, or other resources, to serve as a buffer against the impacts of drought.

A mean score approaching 4 indicates that, on average, a significant portion of the respondents engage in the proactive measure of keeping reserves. This result suggests that smallholder women farmers recognize the importance of building a financial or

material safety net to withstand the challenges posed by drought conditions. The moderate level of adoption indicates that while a substantial portion of the community embraces this strategy, it may not be universally practiced within the population under study, and there might be variability in the extent to which individuals or households implement it. During focus group discussions, participants opined that:

> *"In our community, droughts are unpredictable, and we've learned to adapt by keeping reserves. We store extra produce from our gardens, ensuring we have enough food to sustain our families during the dry spells. It's our way of taking control and reducing the risks associated with drought"* (FGD Discussant, Goziri Community, 2023).
>
> *"Keeping reserves has been a tradition passed down through generations. When the rain is plentiful, we make sure to save a portion of our harvest for the lean times. It's not just about food; we also set aside some earnings, creating a safety net that empowers us to face droughts with resilience and confidence"* (FGD Discussant, Ketuo Community, 2023).
>
> *"Gardening is our lifeline, and we've evolved our approach to make it more sustainable. Apart from growing crops, we actively focus on storing surplus produce and saving money. This strategy allows us to withstand the challenges brought by drought, ensuring our families have enough to eat and the means to navigate difficult times"* (FGD Discussant, Munyupele Community, 2023).
>
> *"The idea of keeping reserves against droughts isn't just about being prepared; it's a strategy deeply embedded in our daily lives. We understand that droughts can disrupt our usual sources of income, so we diversify by saving and storing. This practice empowers us as smallholder women to be proactive in securing our livelihoods and adapting to the changing climate"* (FGD Discussant, Gengenkpe Community, 2023).

The decision to keep reserves against droughts could stem from a practical understanding of the unpredictability and severity of drought events. By having reserves in place, individuals and households may aim to ensure they have access to

essential resources during water scarcity and crop failure periods. This strategy aligns with the broader theme of adaptive measures undertaken by smallholder women farmers to safeguard their livelihoods in the face of climate-related risks. The decision to keep reserves against droughts aligns with Akrofi-Atitianti et al. (2018), who emphasized the role of stored food reserves in enhancing resilience to climate-related shocks in rural Ghanaian communities. The moderate adoption of keeping reserves against droughts reflects a community's proactive approach to managing the uncertainties associated with drought, demonstrating a collective effort to enhance resilience and cope with the potential adverse effects on agricultural activities and overall well-being.

5.2.11 Early harvest of crops to reduce the risks of drought

The mean score for the strategy "early harvest of crops" is 4.8813, indicating a high level of adoption among the smallholder women participating in the study. This mean value reflects the participants' average response on a scale, where higher values signify a stronger inclination toward the specific drought risk reduction strategy. The high mean of 4.8813 suggests that the practice of early harvesting of crops is widely prevalent among the surveyed smallholder women farmers. This result indicates a substantial and collective acknowledgment of the effectiveness of early harvesting as a strategy to mitigate the risks associated with drought. In the focus group discussions, participants indicated that:

> *"Harvesting our crops early has become a crucial part of our strategy to deal with the looming threat of drought. We have learned that by doing so, we can secure a more reliable yield and ensure there's enough to sustain our families even when water becomes scarce"* (FGD Discussant, Goziri Community, 2023).

"It's not just about the quantity; it's about securing quality too. Harvesting early allows us to gather crops before the intense dry spells hit, preserving the nutritional value of our produce. It's a proactive step we take to safeguard the health of our families" (FGD Discussant, Ketuo Community, 2023).

"Early harvesting has become a kind of insurance for us. When we see signs of drought, we don't wait; we act swiftly to gather what we can. It's a practice passed down through generations, and it's proven to be a lifeline during challenging times" (FGD Discussant, Munyupele Community, 2023).

"The unpredictability of weather patterns makes us adapt our farming practices constantly. Harvesting early is like a preemptive strike against drought – a way for us to take control of our food security and reduce the vulnerabilities that come with changing climate conditions" (FGD Discussant, Gengenkpe Community, 2023).

Smallholder women farmers who engage in early harvesting likely recognize the importance of harvesting crops before the onset of potential drought conditions, ensuring a more secure yield and reducing the vulnerability of crops to adverse weather conditions. The elevated mean implies a consensus among the participants regarding the efficacy of this particular strategy. It suggests that a significant portion of the community has integrated the practice of early harvesting into their agricultural routines, reflecting a proactive approach to adapting and responding to the challenges posed by drought. The collective adoption of this strategy underscores its perceived effectiveness in enhancing resilience and ensuring a more reliable agricultural output in the context of unpredictable climate conditions. The findings of Boansi et al., (2023) corroborate the effectiveness of early harvesting as a drought risk reduction strategy, as the authors found that early harvesting helps smallholder farmers in Northern Ghana secure a more reliable yield during water-scarce periods. Similarly, Acheampong et al. (2014) emphasized the importance of proactive measures, such as early harvesting, in

enhancing resilience and adapting to climate variability among rural communities in developing countries.

In practical terms, the high mean for the early harvest strategy indicates a shared understanding among smallholder women that early harvesting is a valuable risk reduction measure, allowing them to safeguard their livelihoods by mitigating the potential negative impacts of drought on crop yields. This finding provides valuable insights into the adaptive strategies employed by the communities in the face of climate-related challenges, emphasizing the importance of proactive measures to ensure food security and sustain agricultural activities.

The findings from the study align closely with the Theory of Planned Behavior (TPB), particularly in understanding how the attitudes, subjective norms, and perceived behavioral control of smallholder women farmers in Nandom Municipality influence their adoption of drought risk reduction strategies. The high adoption rates of strategies such as gardening, off-farm employment, early harvesting, and the cultivation of short-season crops reflect positive attitudes toward these behaviors, as they are perceived to provide tangible benefits in mitigating drought risks. The prevalence of social norms is evident, as focus group discussions highlighted a collective understanding and communal encouragement for strategies like gardening and crop rotation, which are embedded in the community's approach to resilience. Perceived behavioral control also plays a significant role, as the women expressed confidence in their ability to implement strategies such as adjusting planting times and rotating crops, which they believe are within their capacity despite limited resources. Conversely, the low adoption of strategies like crop insurance suggests a lack of perceived control, where external barriers such as complex processes and uncertainty about payouts discourage their use. Overall, TPB provides a useful framework for explaining how these smallholder

women assess and adopt strategies, with attitudes, social influences, and perceived control all contributing to their decision-making process in managing drought risks.

CHAPTER SIX

CONSTRAINTS TO DROUGHT RISK REDUCTION AMONG SMALLHOLDER WOMEN FARMERS

6.1 Introduction

This section aims to analyze the various constraints faced by smallholder women farmers in reducing the risks associated with drought. The results (Table 5.2), provides valuable insights into the constraints faced by smallholder women farmers trying to mitigate the effects of drought on their livelihoods. Smallholder women were asked a multiple-response question on 6 items to identify the constraints to their drought reduction strategies. The data was analyzed using descriptive statistics and displayed in Table 5.2.

Table 6.1: Descriptive Statistics of Constraints

Variable	N Statistic	Mean Statistic	Std. Deviation Statistic	Skewness	
				Statistic	Std. Error
Limited Access to Financial Resources	379	4.6121	.65057	-1.958	.125
Lack of Adequate Training and Education	379	3.7177	1.49673	-.318	.125
Inadequate Infrastructure and Technology	379	4.5963	.86562	-1.800	.125
Gender Inequality and Limited Decision-Making Power	379	4.7966	.69647	-3.291	.125
Fragmented Institutional Support	379	4.7767	.71997	-3.056	.125
Climate Variability and Uncertainty	379	4.8496	.63084	-4.066	.125
Valid N (listwise)	379				

Author's construct, 2023

6.2 Limited access to financial resources

This item had a mean score of mean: 4.6121, std. deviation: 0.65057 and skewness: -1.958. The data suggests that smallholder women farmers perceive limited access to financial resources as a significant constraint, with an average score of 4.6121. The negative skewness indicates that a subset of respondents might perceive this constraint

more severely than the average. Participants in the focus group discussions voiced out the following opinions:

> *"Securing funds for drought-resistant technologies is a constant struggle. Without adequate financial support, we find ourselves unable to invest in the tools and practices crucial for building resilience against droughts"* (FGD Discussant, Goziri Community, 2023).

> *"Financial constraints often force us to compromise on the quality of seeds and irrigation equipment. It's disheartening when you know that better resources are available but are out of reach due to financial limitations"* (FGD Discussant, Ketuo Community, 2023).

> *"Access to credit is a major bottleneck. During drought seasons, when we need it the most, the lack of financial resources becomes a significant barrier to adopting innovative strategies that could protect our crops and livelihoods"* (FGD Discussant, Munyupele Community, 2023).

> *"The desire to implement sustainable practices is there, but the reality is that without financial support, it remains a dream. We need accessible funding to transform our intentions into actions and truly mitigate the risks posed by droughts"* (FGD Discussant, Gengenkpe Community, 2023).

These quotes capture the sentiments of smallholder women farmers, highlighting the real challenges they face in obtaining the necessary financial resources to implement effective drought risk reduction strategies. They underscore the impact of limited financial access on the ability to invest in technologies and practices crucial for enhancing resilience in the face of drought-related challenges. These findings resonate with Baffour-Ata et al. (2023), who highlighted the pivotal role of financial resources in agricultural resilience-building efforts and underscored the detrimental effects of inadequate financial resources on smallholder farmers' ability to adopt drought-resistant crops and technologies.

6.3. Lack of adequate training and education

Lack of adequate training and education as a constraint to drought risk reduction strategies of smallholder women farmers had a mean of 3.7177, std. deviation of 1.49673 and a skewness of -0.318. The mean score of 3.7177 indicates that smallholder women view inadequate training and education as a moderate constraint. The negative skewness suggests a slight leftward distribution, indicating variability in responses. In the focus group discussions, participants opined that:

> *"I feel like we're left in the dark when it comes to climate-smart practices. There's a lack of proper training and education on how to adapt our farming methods to changing weather patterns, especially during droughts"* (FGD Discussant, Goziri Community, 2023).
>
> *"Without the right knowledge, it's hard to make informed decisions. We need more training sessions on drought-resistant crops and sustainable farming practices that can make a real difference in times of water scarcity"* (FGD Discussant, Ketuo Community, 2023).
>
> *"Training is key, and many of us haven't had access to it. It's not just about planting seeds; it's about understanding the science behind it and having the skills to implement effective strategies. We need more educational support in our communities"* (FGD Discussant, Munyupele Community, 2023).
>
> *"We want to do better, but it's frustrating when you don't have the know-how. Proper education on climate-smart agriculture would empower us to take control of our farming practices and reduce the risks associated with droughts"* (FGD Discussant, Gengenkpe Community, 2023).

These quotes reflect the sentiments of smallholder women farmers, highlighting their awareness of the importance of training and education in adopting strategies for drought risk reduction. They emphasize the need for targeted educational programs to enhance the capacity of these farmers in facing the challenges posed by changing climate

conditions. Studies by various researchers have emphasized the positive impact of education and training programs in equipping farmers with the necessary knowledge and skills to implement sustainable and climate-resilient agricultural practices. For instance, research conducted by Issahaku and Abdulai (2020) underscored the role of farmer education in promoting the adoption of drought-resistant crop varieties and conservation agriculture techniques.

Similarly, Zakaria et al. (2020) found that targeted training programs significantly improved smallholder farmers' ability to mitigate the effects of drought through soil moisture conservation and water management practices. Furthermore, Raj and Garlapati (2020) argue that investing in agricultural education and extension services tailored to the specific needs of women farmers is essential for enhancing their resilience to climate-related challenges. They stress the importance of participatory approaches that empower women through knowledge-sharing and skills development initiatives.

6.4 Inadequate infrastructure and technology

Inadequate infrastructure and technology as a constraint to drought risk reduction strategies of smallholder women had a mean score of 4.5963, a std. deviation of 0.86562 and a skewness of -1.800. The result suggest that smallholder women perceive inadequate infrastructure and technology as a significant constraint. The negative skewness indicates potential variations in the severity of this constraint among respondents. During FGDs participants' opinions were:

> *"Without proper irrigation facilities, we're at the mercy of erratic rainfall. Our fields suffer, and we struggle to secure consistent yields. Having reliable irrigation would be a game-changer for us in mitigating the impact of drought"* (FGD Discussant, Goziri Community, 2023).

> *"Modern farming equipment is a luxury we can't afford. It's disheartening to see how our productivity lags behind due to the lack of tools that could make our work more efficient and resilient, especially in times of drought"* (FGD Discussant, Ketuo Community, 2023).

> *"Technology is advancing, but it feels like we're left behind. Access to innovative solutions could help us monitor weather patterns, optimize resource use, and adopt climate-smart practices. Unfortunately, the gap in technology adoption is widening, and it affects our ability to cope with drought"* (FGD Discussant, Munyupele Community, 2023).

> *"The absence of proper technology in our farming practices holds us back. We need knowledge and tools that align with the changing climate. It's frustrating when we know there are better practices out there, but we lack the means to implement them"* (FGD Discussant, Gengenkpe Community, 2023).

These quotes provide firsthand perspectives from smallholder women farmers, highlighting the challenges they face due to the inadequate infrastructure and technology in their efforts to reduce the risks associated with drought. They shed light on the practical difficulties experienced by these women and emphasize the importance of addressing issues related to irrigation, modern farming equipment, and technological access to enhance their resilience to drought. Murray et al. (2016) supports these findings, as the authors highlighted the critical role of infrastructure and technology in enhancing agricultural resilience to drought among smallholder farmers. Addressing these constraints through investments in irrigation, access to modern farming equipment, and technological innovation aligns with recommendations for building climate resilience and sustainable agricultural development (IPCC, 2021).

6.5. Gender inequality and limited decision-making power

Gender inequality and limited decision-making power as a constraint to drought risk reduction strategies of smallholder women mean: 4.7966, std. deviation: 0.69647 and a skewness of 3.291.

The result suggests that gender inequality and limited decision-making power are perceived as significant constraints. The strongly negative skewness indicates a pronounced leftward distribution, highlighting potential variations in how respondents experience this constraint. Smallholder women farmers expressed the following opinions in the FGDs:

> *"In our community, decisions about farming practices and drought preparedness are often dominated by men. As women, our suggestions and ideas for innovative strategies to cope with drought are sometimes overlooked or not given the attention they deserve"* (FGD Discussant, Goziri Community, 2023).

> *"Gender roles play a significant role in limiting our ability to implement effective drought risk reduction measures. Despite our hands-on experience and knowledge, the final say in adopting new strategies usually rests with the male members of the household"* (FGD Discussant, Ketuo Community, 2023).

> *"Limited access to resources and technologies exacerbates the impact of gender inequality. When decisions on investing in drought-resistant crops or water-saving technologies are made, it's usually without considering the valuable insights that we, as women, can bring to the table"* (FGD Discussant, Munyupele Community, 2023).

> *"Breaking through traditional gender norms and gaining decision-making power is a constant struggle. It affects not only our ability to adopt innovative strategies but also our overall resilience in the face of drought. Empowering women to actively participate in decision-making is key to enhancing our adaptive capacities"* (FGD Discussant, Gengenkpe Community, 2023).

These quotes reflect the voices of smallholder rural women farmers, illustrating how gender inequality and limited decision-making power are significant barriers to successfully adopting drought risk reduction strategies. They shed light on the challenges these women face in influencing decisions related to agricultural practices and adapting to changing environmental conditions. Similarly, some studies have documented the gendered dimensions of vulnerability to climate change and the barriers faced by women in accessing resources and decision-making authority in agricultural contexts. For example, Doss et al. (2018) highlight how unequal access to land, credit, and extension services restricts women's ability to adopt climate-resilient agricultural practices and technologies. Similarly, Meinzen-Dick et al. (2019) argues that addressing gender disparities in access to resources and decision-making power is essential for enhancing the adaptive capacity of agricultural systems. They emphasize the importance of gender-responsive policies and programs that promote women's participation in decision-making processes and recognize their contributions to sustainable agricultural development.

6.6 Fragmented institutional support

Fragmented institutional support as a constraint to drought risk reduction strategies of smallholder women had a mean score of 4.7767, std. deviation: 0.71997 and a skewness -3.056. The result indicates that fragmented institutional support is viewed as a significant constraint. The strongly negative skewness suggests that some respondents perceive this constraint more severely than the average. During FGDs, participant opinions included:

> *"Our efforts to combat drought are often hindered by the lack of coordinated support from local and national institutions. There's a disjointed approach that makes it difficult for us to access the resources and guidance needed to implement effective strategies"* (FGD Discussant, Goziri Community, 2023).

> *"Institutions need to work hand in hand to assist us during droughts, but what we experience is a fragmented system. It feels like different departments are operating independently, and this disjointedness trickles down, affecting the success of our drought mitigation efforts"* (FGD Discussant, Ketuo Community, 2023).

> *"We appreciate the initiatives, but the support is scattered. It's like a puzzle with missing pieces. We need more cohesion among institutions to ensure that their efforts align with our needs, making the implementation of drought risk reduction strategies more seamless and impactful"* (FGD Discussant, Munyupele Community, 2023).

> *"The challenges we face in drought-prone areas are complex, and we need comprehensive support. However, the institutional support we receive is often sporadic, and the lack of a unified strategy hampers our ability to effectively navigate and reduce the risks associated with drought"* (FGD Discussant, Gengenkpe Community, 2023).

These quotes reflect the sentiments of smallholder women farmers, highlighting the practical implications of fragmented institutional support in their efforts to address and mitigate the impact of drought. These findings resonate with Yeliliere et al. (2022), who emphasized the pivotal role of institutional support in bolstering resilience to drought among vulnerable populations, particularly women farmers, and therefore underscored the necessity of coordinated efforts and integrated approaches by institutions to address the multifaceted challenges of drought in rural communities effectively. Additionally, Etana et al. (2022) argue that fragmented institutional support undermines the effectiveness of drought risk reduction strategies and exacerbates existing socio-economic disparities among smallholder farmers. Addressing the constraint of fragmented institutional support is imperative for enhancing smallholder women farmers' resilience to drought and ensuring the successful implementation of drought risk reduction strategies at the grassroots level.

6.7 Climate variability and uncertainty

Climate variability and uncertainty as a constraint to drought risk reduction strategies of smallholder women had a mean score of 4.8496, std. deviation*:* 0.63084and a skewness: -4.066.

Smallholder women perceive climate variability and uncertainty as a major constraint, with a mean score of 4.8496. The strongly negative skewness indicates a pronounced leftward distribution, emphasizing potential variations in the severity of this constraint among respondents. In the FGDs, participants mentioned that:

> *"The weather patterns have become so unpredictable. It's not like before. We find it hard to plan ahead for the crops. One year it's too dry, the next it's too wet. It's challenging to design strategies when you don't know what the next season will bring"* (FGD Discussant, Goziri Community, 2023).

> *"We used to rely on traditional knowledge, but with climate change, everything is different. Our grandmothers' methods are not as reliable anymore. There's this constant uncertainty, and it makes it really difficult to decide what crops to plant and when"* (FGD Discussant, Ketuo Community, 2023).

> *"It's not just the drought; it's the uncertainty that comes with it. We fear investing in certain crops or techniques because we can't be sure if they'll work. The changing climate has disrupted our traditional farming calendars, and adapting is a constant struggle"* (FGD Discussant, Munyupele Community, 2023).

> *"Long-term planning feels like a luxury we can't afford. We're always on edge, wondering if our efforts will pay off. Climate uncertainty affects every decision we make, from planting times to water management. It's a constant challenge to design strategies that can withstand this unpredictability"* (FGD Discussant, Gengenkpe Community, 2023).

The statements encapsulate the feelings of women smallholder farmers navigating the repercussions of climate variability and uncertainty in drought risk reduction. The unpredictable shifts in climate pose challenges that transcend the direct consequences of drought, impinging on the capacity to devise and execute sustainable long-term strategies. Literature corroborates these findings, emphasizing the detrimental impact of climate variability on agricultural productivity and resilience among smallholder farmers. Studies by Ndlovu et al. (2020) and Derbile et al. (2016) underscore how climate variability disrupts traditional farming calendars and increases vulnerability to drought. Additionally, Adger et al. (2003) stress the importance of adaptive strategies in addressing the challenges posed by climate uncertainty in agricultural contexts.

The findings from this study align with the Theory of Planned Behavior (TPB), which emphasizes the role of attitudes, subjective norms, and perceived behavioral control in shaping human behavior. In the context of drought risk reduction strategies among smallholder women farmers, the results demonstrate that their attitudes toward adopting risk mitigation strategies are influenced by significant constraints, such as limited access to financial resources, inadequate infrastructure and technology, and climate variability and uncertainty. These challenges undermine the farmers' perceived ability to adopt and implement effective strategies, which corresponds to the perceived behavioral control aspect of TPB. For instance, the financial limitations and lack of training directly impact the farmers' confidence in their capacity to act, reducing their likelihood of adopting drought-resilient practices. Furthermore, the subjective norms component is evident in the gender inequality and limited decision-making power faced by these women, where societal and cultural expectations constrain their role in decision-making processes regarding farming practices. These findings suggest that while women farmers may have positive attitudes and intentions toward adopting

drought risk reduction strategies, the external constraints they face—such as financial, technological, and social barriers—hinder their ability to act, reflecting the interplay of the core elements of TPB in shaping their behaviors.

6.8 Chapter Summary

This chapter delved into the multifaceted strategies utilized by smallholder rural women farmers to mitigate the risks posed by drought. It highlights their resilience through a blend of traditional methods and proactive adaptations. Strategies such as gardening, off-farm employment, adjusting planting schedules, cultivating short-season crops, and crop rotation are pivotal in their efforts to combat drought impacts. While some approaches like crop insurance and water use restrictions exhibit lower adoption rates, they underscore the nuanced decision-making influenced by community context. Furthermore, this chapter explores the intricate web of constraints encountered by smallholder rural women farmers in their quest to mitigate drought risks. These challenges range from limited access to financial resources and inadequate training to gender disparities and fragmented institutional support. The unpredictable nature of climate variability exacerbates these constraints, impeding effective planning and adaptation efforts. Understanding the interplay of these constraints is essential for developing tailored interventions that address the specific needs of smallholder women farmers.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

This chapter summarizes the findings of the study that was gathered from the field and analyzed. The study draws conclusions on the findings and makes categorical recommendations for policy and practice. The chapter also outlines the contributions of the study and suggests areas for further studies.

7.2 Summary of Major Findings

7.2.1 Perceptions of drought risks among smallholder women farmers

Regarding the perception of drought as man-made or natural disaster, findings reveal diverse perceptions among smallholder women regarding whether drought is a man-made or natural disaster. Approximately half of the respondents acknowledged drought as a man-made disaster, attributing it to human activities such as deforestation and climate change. However, some respondents disagreed, viewing drought as a natural phenomenon primarily influenced by atmospheric conditions. Lastly, uncertainty among respondents indicates a potential lack of awareness or information about the causes of drought, suggesting a need for education and awareness campaigns.

Regarding the perceived occurrence of droughts, smallholder women perceive drought occurrences as unpredictable, with variability in frequency and duration contributing to uncertainty. They acknowledge the regularity of annual droughts, highlighting the recurring nature of these events within their communities. Recognition of variable drought durations underscores the need for adaptive strategies to cope with diverse temporal manifestations.

Regarding the perceived severity of droughts, smallholder women express heightened perceptions of drought severity, emphasizing its significant impact on their livelihoods. The Variability in drought duration adds complexity to their experiences, with occasional severe events interspersed with milder ones. The climate change-induced shifts in weather patterns contribute to increased frequency and severity of droughts, necessitating adaptive measures tailored to smallholder women's needs.

Regarding the perceived effects of drought on farming activities, smallholder women indicated that drought poses significant challenges for planting and growing crops, resulting in water scarcity and soil dryness. Furthermore, according to the women Inadequate moisture content in the soil hampers crop germination and growth, leading to suboptimal harvests. Lastly, women asserted that the unpredictable rainfall patterns during drought disrupt farming activities and contribute to overall poor harvests.

Generally, smallholder women farmers in the Nandom Municipality of Ghana perceive drought as a multifaceted challenge with significant implications for their agricultural practices and livelihoods.

7.2.2 The effects of drought on smallholder women’s farming activities

The research objective focused on understanding the effects of drought on smallholder rural women's farming activities.

First, smallholder women farmers identified climate change as the root cause. Participants unanimously identified climate change as the primary underlying factor for the challenges faced by smallholder rural women. Drought, irregular rainfall, and extreme weather events were highlighted as direct consequences of climate change, significantly affecting agricultural activities and livelihoods.

Also, drought was found to have multifaceted impacts on farming activities, including poor crop harvests, livestock losses, and disruptions to traditional farming practices. Participants emphasized the correlation between climate change-induced drought and diminished crop yields, irregular rainfall affecting planting schedules, and flooding causing further damage.

Furthermore, economic struggles and setbacks were observed due to the unpredictability of weather patterns, resulting in challenges in adhering to optimal planting schedules and poor harvests. Livestock losses due to inadequate water sources and heightened temperatures were also highlighted, contributing to economic instability and food insecurity among rural communities.

In addition, the scarcity of water resources, exacerbated by climate change-induced drought, directly affected livestock welfare. Loss of livestock was attributed to insufficient water for drinking, further emphasizing the economic and environmental challenges faced by smallholder women farmers.

The study underscores the detrimental effects of drought on smallholder rural women's farming activities, emphasizing the urgent need for targeted strategies in drought risk reduction and climate change adaptation within the Nandom Municipality and similar contexts.

7.2.3 Drought risk reduction strategies of smallholder women farmers

Based on the detailed analysis provided, here is a summary of the findings regarding drought risk reduction strategies employed by smallholder rural women farmers: First, gardening as a resilient response to drought. Smallholder women farmers widely embrace gardening as a proactive strategy to mitigate drought impacts. It serves not only as a means of growing food but also as a deliberate approach to building resilience

within communities. Second, off-farm employment. Engaging in off-farm employment is recognized as a significant strategy to reduce the risks associated with drought on livelihoods. It offers a means of diversifying income sources and serves as a buffer during periods of crop stress caused by erratic weather patterns. Third, changing planting time of crops. Smallholder women farmers widely adopt the strategy of adjusting planting times for specific crops in response to drought risks. This proactive measure contributes to enhanced agricultural productivity and community resilience. Fourth, farming short-season crops. Cultivating short-season crops is prevalent among smallholder women farmers and is perceived as a proactive and strategic response to drought challenges, allowing for quick adaptation to changing weather patterns. Fifth, rotating crops. Crop rotation is widely practiced and recognized for its multifaceted benefits in enhancing yields, building natural defenses against drought, and increasing overall farm resilience. Also, early harvest of crops. Widely acknowledged and practiced, early harvesting serves as a proactive strategy to secure reliable yields, preserve nutritional quality, and provide a safety net during periods of environmental stress. In addition, ensuring water use restrictions. While not widely adopted, ensuring water use restrictions varies among smallholder women farmers and is influenced by individual preferences and contextual factors. Furthermore, diversifying income sources. Smallholder women farmers demonstrate a moderate level of adoption in diversifying income sources to reduce drought risks. This strategy emphasizes the importance of cultivating multiple avenues of income for financial stability during dry periods. Also, the selling of livestock: while moderately adopted, selling livestock is acknowledged as a strategy to mitigate the adverse impacts of drought on farming activities and overall livelihoods. However, its prevalence varies based on individual circumstances and contextual factors. Next, crop insurance. Adoption of crop insurance

is relatively low due to perceived complexities, paperwork burdens, uncertainties around payouts, and a preference for traditional risk management practices.

Finally, keeping reserves against drought. A moderate level of adoption is observed in keeping reserves against droughts, involving setting aside stored food, financial savings, or other resources to mitigate drought impacts. These findings underscore the diverse and context-specific approaches employed by smallholder rural women farmers in mitigating the risks associated with drought, highlighting their proactive adaptation and resilience-building efforts within their communities.

7.2.4 Constraints to drought risk reduction among smallholder women farmers

First, limited access to financial resources. Smallholder women farmers face significant constraints in accessing financial resources for drought risk reduction strategies. Qualitative insights from focus group discussions highlight challenges in securing funds for drought-resistant technologies and better-quality seeds and irrigation equipment due to financial limitations. Lack of financial support hinders the adoption of innovative strategies, impacting resilience against droughts.

Secondly, lack of adequate training and education. Smallholder women farmers perceive inadequate training and education as a constraint to implementing drought risk reduction strategies. Proper education on climate-smart agriculture is seen as essential for empowering farmers to adopt resilient farming practices. The lack of knowledge and skills impedes informed decision-making and hampers the adoption of drought-resistant crops and sustainable farming practices.

Third, inadequate infrastructure and technology. Smallholder women farmers face challenges due to inadequate infrastructure and technology for drought risk reduction. Absence of proper irrigation facilities and access to modern farming equipment affects

productivity and resilience. The gap in technology adoption exacerbates challenges in coping with drought effectively.

Fourth, gender inequality and limited decision-making power. Gender inequality and limited decision-making power are perceived as significant constraints to drought risk reduction strategies among smallholder women farmers. Women's voices and contributions are often marginalized in decision-making processes related to agriculture and drought preparedness. Limited access to resources and technologies further exacerbates the gendered impacts of drought risk.

Fifth, fragmented institutional support. Fragmented institutional support poses a significant obstacle to drought risk reduction strategies among smallholder women farmers. Lack of cohesive support from local and national institutions undermines efforts to combat drought effectively. Comprehensive and coordinated support is necessary to address the multifaceted challenges of drought in rural communities.

Finally, climate variability and uncertainty. Climate variability and uncertainty significantly constrain drought risk reduction strategies among smallholder women farmers. Unpredictable weather patterns make it challenging to plan agricultural activities effectively. Adaptive approaches are needed to accommodate climate variability and build resilience within farming communities.

These findings highlight the multifaceted nature of constraints faced by smallholder rural women farmers in implementing effective drought risk reduction strategies, emphasizing the need for targeted interventions and comprehensive support to enhance resilience and sustainability in agriculture.

7.3 Conclusions

The findings of this research objective shed light on the perceptions of smallholder women farmers in the Nandom Municipality of Ghana regarding drought risks. Through detailed analysis, several key themes emerged, reflecting the complex nature of their understanding and experiences with drought. Firstly, smallholder women exhibit diverse perceptions regarding the origin of drought, with some attributing it to human activities while others view it as a natural phenomenon. This diversity underscores the need for targeted educational initiatives to address gaps in awareness and understanding within the community. Secondly, their perceptions of drought occurrences highlight the unpredictability and regularity of these events, emphasizing the importance of adaptive strategies to cope with varying temporal manifestations. Furthermore, smallholder women express heightened perceptions of drought severity, recognizing its significant impact on their agricultural practices and livelihoods. This perception is compounded by climate change-induced shifts in weather patterns, which exacerbate the frequency and severity of droughts. Lastly, the perceived effects of drought on farming activities underscore the multifaceted challenges faced by smallholder women, including difficulties in planting and growing crops, suboptimal crop growth, and unpredictable rainfall patterns. This research objective provides valuable insights into the intricate perceptions of smallholder women farmers regarding drought risks, these findings contribute to a deeper understanding of the complexities surrounding drought resilience and adaptation strategies in agrarian communities.

The research findings shed light on the profound impacts of drought on smallholder rural women's farming activities in the Nandom Municipality, Ghana. Climate change emerged as the underlying factor exacerbating these challenges, with drought, irregular

rainfall, and extreme weather events directly affecting agricultural productivity and livelihoods.

The study highlighted the multifaceted consequences of drought, including poor crop yields, livestock losses, and disruptions to traditional farming practices. These findings underscore the urgent need for targeted interventions to address the vulnerabilities of smallholder women farmers in the face of climate change-induced drought. By understanding the intricacies of these challenges, stakeholders can work towards implementing strategies that support resilience and sustainability in agricultural livelihoods within the region and beyond.

The findings of the research objective shed light on the diverse array of strategies employed by smallholder rural women farmers to reduce the risks posed by drought. Through a combination of traditional practices and proactive adaptations, these women demonstrate resilience in the face of environmental challenges. Gardening, off-farm employment, adjusting planting times, cultivating short-season crops, crop rotation, and other strategies emerge as vital components of their resilience toolkit. While some strategies, such as crop insurance and water use restrictions, show lower adoption rates, they reflect the nuanced decision-making and contextual considerations within these communities. Overall, the research underscores the agency and resourcefulness of smallholder women farmers in navigating and mitigating the impacts of drought on their livelihoods and communities.

The findings underscore the complex array of constraints encountered by smallholder rural women farmers in their efforts to reduce drought risks. From limited access to financial resources and inadequate training to gender inequality and fragmented institutional support, these constraints intersect to shape the vulnerability of women

farmers to drought-related challenges. Moreover, the unpredictable nature of climate variability adds another layer of complexity, further hindering their ability to plan and adapt effectively. Understanding these constraints is crucial for designing contextually relevant interventions that address the specific needs and challenges faced by smallholder women farmers. By acknowledging and addressing these constraints, stakeholders can work towards building more resilient agricultural systems that empower women farmers and enhance food security in the face of drought and climate uncertainty.

7.4 Recommendations

The study underscores critical recommendations aimed at bolstering the resilience of smallholder women in the region, proposing actionable steps to address their unique challenges effectively.

- Firstly, the study advocates for the creation and implementation of deliberate policies, exemplified by initiatives like the 1V1D program facilitated by the Government of Ghana through the Ghana Irrigation Development Authority (GIDA). Such policies should prioritize the meticulous construction, rehabilitation, and desilting of dugouts and dams. By ensuring the availability of reliable water sources during periods of drought, smallholder women can sustain their agricultural activities and mitigate the impact of adverse weather conditions.
- Secondly, the study advocates for an expansion of the scope of the Ministry of Agriculture's Planting for Food and Jobs Policy. Beyond subsidizing fertilizers, there's a pressing need to integrate climate-smart agricultural technology services into the policy framework. This includes subsidizing early maturing and drought-tolerant crop varieties, empowering smallholder women with the tools necessary to adapt to changing climatic conditions and maintain agricultural productivity.

- Thirdly, the Ministry of Food and Agriculture and collaborating Non-Governmental Organizations should design and implement a tailored approach in the provision of agricultural extension services. Recognizing the diverse challenges and vulnerabilities faced by smallholder women, interventions must be context-specific and responsive to their unique circumstances. One-size-fits-all solutions are inadequate; instead, targeted interventions that account for the intricacies of each community are essential. Smallholder women deserve customized support that addresses their specific needs and empowers them to thrive in the face of adversity.

By implementing these recommendations, stakeholders can significantly enhance the resilience of smallholder women, fostering sustainable agricultural practices and promoting economic empowerment within the region.

7.5 Contributions of the Study

7.5.1 Empirical contributions

It is widely acknowledged that the pursuit of original contributions to knowledge within academia is a perpetual challenge, largely attributable to the subjective interpretation of originality (Sutrisna, 2004). Nevertheless, it is evident that this research has shed light on the subject and propelled our comprehension of smallholder women's perceptions of drought risks, strategies for reducing these risks, and the associated constraints. The recommendations put forth in this study substantially bolster the resilience of smallholder women, as evidenced by the empirical findings, representing the viewpoint of this demographic.

7.5.2 Theoretical contributions

The study critiqued the Expected Value Theory, commonly used for decision making under uncertainty, by highlighting its limitations in adequately accounting for the complexities of human adaptation decisions. By emphasizing the bounded rationality of smallholder farmers and the influence of emotional, psychological, and social factors on their decision-making processes, the study refines the understanding of decision-making theories in the context of drought risk management.

The study examined the Perception Theory, which explains farmers' adaptation strategies based on their perceptions, and identifies its limitations in addressing risk reduction. By recognizing the importance of risk perception in shaping adaptive behaviors but also highlighting its insufficient consideration of risk reduction, the study contributes to a nuanced understanding of the role of perception in adaptive decision-making processes.

The study applied the Theory of Planned Behavior (TPB) to analyze smallholder women's adaptive behaviors in the face of drought risks. By incorporating psychological factors such as beliefs, values, and perceptions of climate risk into the analysis, TPB provides a framework for understanding the motivations behind adaptive behaviors. Additionally, the study highlights the relevance of TPB in predicting adaptive behaviors and emphasizes the importance of psychological drivers in shaping responses to climate risks.

The study presented a comprehensive conceptual framework for analyzing adaptive behaviors related to drought risk management. By integrating factors such as threat appraisal, risk perception, coping appraisal, and socio-economic and demographic characteristics, the framework provides a structured approach to studying adaptive

behaviors and their determinants. This contributes to the development of a holistic understanding of adaptive responses to climate risks.

Overall, the study contributes to theory by critiquing existing theoretical frameworks, evaluating their applicability in the context of smallholder women's adaptive behaviors, and introducing a new theoretical framework (TPB) to analyze and predict adaptive behaviors. Additionally, the conceptual framework presented enhances the understanding of the complex interactions between individual, social, and environmental factors influencing adaptive responses to drought risks.

7.5.3 Contributions to knowledge

Perceptions of Drought Risks: The study reveals diverse perceptions among smallholder women regarding the origins, occurrences, severity, and effects of droughts. This understanding contributes to a deeper comprehension of the multifaceted nature of drought challenges within agrarian communities.

i. Effects of Drought on Farming Activities: By elucidating the direct impacts of drought on farming activities, including crop yields, livestock losses, and economic struggles, the study provides insights into the intricate interplay between climate change and agricultural productivity.
ii. Drought Risk Reduction Strategies: Through the exploration of various strategies employed by smallholder women to mitigate drought risks, such as gardening, off-farm employment, and crop diversification, the study enriches knowledge on adaptive practices and resilience-building efforts within rural communities.
iii. Constraints to Drought Risk Reduction: Identification of constraints, including limited access to financial resources, inadequate training, gender inequality, and fragmented institutional support, enhances understanding of the barriers

smallholder women face in implementing effective drought resilience strategies.

7.5.4 Contributions to practice

i. Policy Recommendations: The study offers specific policy recommendations, such as the construction and rehabilitation of water infrastructure under the 1V1D policy and integration of climate-smart agricultural technologies into existing programs such as the PFJ, to support smallholder women in adapting to climate change and mitigating drought impacts.
ii. Tailored Interventions: By advocating for tailored interventions that address the unique challenges and vulnerabilities of smallholder women, the study emphasizes the importance of context-specific approaches in promoting resilience and sustainability in agricultural livelihoods.
iii. Empowerment through Education and Support: Recommendations for enhancing MoFA's agricultural extension services and providing customized support empower smallholder women with the knowledge, resources, and tools necessary to thrive amidst environmental uncertainties.

Generally, the study contributes valuable insights into the perceptions, impacts, strategies, and constraints related to drought resilience among smallholder women farmers. By translating these findings into actionable recommendations, it aims to inform policies and practices that support the resilience, empowerment, and sustainability of rural communities facing climate change-induced challenges.

7.6 Suggestions for Further Studies

In addition to the recommendations outlined above, the study suggests that some future research endeavors should focus on further elucidating the nuanced challenges and opportunities faced by smallholder women in the agricultural sector.

First, An Impact Assessment of Drought Resilience Interventions: One can conduct a longitudinal study to assess the effectiveness and long-term impact of various drought resilience interventions implemented among smallholder women farmers in the Nandom Municipality. This could include evaluating the outcomes of specific strategies such as water harvesting techniques, crop diversification, or access to climate-smart agricultural technologies.

Secondly, Gender Dynamics in Drought Resilience: A study can investigate the gender-specific experiences and roles in drought risk reduction among smallholder farmers. Explore how gender norms, access to resources, and decision-making processes influence the adoption and success of resilience strategies, with a particular focus on the perspectives and agency of women farmers.

Finally, Community-Based Adaptation Strategies. A study can explore community-led approaches to drought resilience building, including participatory decision-making processes, local knowledge systems, and collective action initiatives. Assess the effectiveness of community-based adaptation strategies in enhancing the resilience of smallholder women farmers and promoting sustainable livelihoods.

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APPENDIX

DROUGHT RISK REDUCTION STRATEGIES AMONG SMALLHOLDER WOMEN FARMERS IN NANDOM MUNICIPALITY, GHANA

SECTION A: DEMOGRAPHICS OF RESPONDENTS

1. Age 1=20-29 2=30-39 3=40-49 4=50-59 5=60+

2. Region……..

3. Religion …….

4. Marital status 1=never married 2=married 3=separated 4=divorced 5=widowed

5. Level of education 1=no basic education 2=basic 3=secondary school 4=tertiary

6. Primary occupation…….

7. Household size. Tick the one that applies to you.

1	2	3	4	5
1-5	6-10	11-15	16-20	21+

8. Number of dependents.

1	2	3	4	5
1-5	6-10	11-15	16-20	21+

9. Monthly income 1=<GHS2000 2=GHS2000-4000 3=aboveGHS4000

SECTION B:

SECTION B: PERCEPTION OF DROUGHT RISKS

1. What is your understanding of drought?.....
   .....
   .....
2. State your level of agreement to the following nature of droughts where 1=strongly agree 2=agree 3=undecided 4=disagree 5=strongly disagree

Variable	**1**	**2**	**3**	**4**	**5**
Drought is a manmade disaster					
Drought is a natural disaster					

SECTION C:

SECTION C: FARMER AND FARM CHARACTERISITICS

1. Years of farming experience.

1	2	3	4	5	6
<1	1-5	6-10	11-15	16-20	21+

2. How many times do you experience droughts in a year…….

3. Type of labour for crop production. Rate the type of labour with 1=low and 5=high

Type of labour	**Ratings (1=very dissatisfied 2=dissatisfied 3=no opinion 4=satisfied 5=very satisfied)**					
	1	2	3	4	5	None
Family						
Hired						
Self only						

4. Level of labour contribution in the farm. Rate the level of contribution with 1=low and 5=high

Level of labour contribution	**Ratings (1=very dissatisfied 2=dissatisfied 3=no opinion 4=satisfied 5=very satisfied)**					
	1	2	3	4	5	None
Family						
Hired						
Self only						

5. Farm size in acres

1	2	3	4	5
1-5	6-10	11-15	16-20	21+

6. Off-farm job? Choose all that apply to you.

Code	**Off-farm job**	**Tick**
1	No off-farm job	
2	Petty trading	
3	Causal labor	
4	Honey collection	
5	Traditional dancing	
6	Transportation business	
7	Agro-processing	
8	Extension services	
9	Manufacturing	
10	Other (please specify)	

7. Next of kin for your farm business? 1=wife 2=brother 3=sister 4=children 5=friend 6=none
8. What is your main source of finance for your farm activities? 1=own capital 2=bank loans 3=NGO support 4=credit from farmer cooperatives 5=friends/relatives
9. Estimated total income farm income per year in Ghana cedis (GHS). 1=<20000 2=20000-40000 3=40000+
10. Estimated total off-farm income per year in Ghana cedis (GHS). 1=<20000 2=20000-40000 3=40000+ 4=none
11. Main accessible credit facilities. 1=bank loans 2=susu loans 3=Community Based Organization loans 4=friends and relatives 5=self-financing

12. Do you have crop insurance? 1 = yes 2 = no

13. Crop extension services received for your farm operations. Rate the crop extension services with 1=very dissatisfied to 5=very satisfied

Current stature	**Ratings (1=very dissatisfied 2=dissatisfied 3=no opinion 4=satisfied 5=very satisfied)**				
	1	2	3	4	5
Treatment of crop diseases					
Preventing diseases outbreak					
Provision of chemicals such as insecticides etc					

On a 7-point Likert scale, what best describes your drought resistant strategies

1=strongly agree 2=agree 3=slightly agree 4=neutral 5=slightly disagree 6=disagree 7=strongly disagree	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. I do garden to reduce the risks of droughts							
2. I sell my livestock to reduce the risks of droughts							
3. I do off-farm employment							
4. I change the planting time of certain crops							
5. I farm short season crops							
6. I rotate the crops on my farmlands							
7. I do early harvest of crops							
8. I rely on government assistance							
9. I rely on NGO support							
10. I keep reserves against droughts							
11. I harvest rain water and store							
12. I have crop insurance							
13. I diversify income sources							
14. I ensure water use restrictions							

SECTION D:

SECTION D: CONSTRAINTS TO DROUGHT RISKS REDUCTION STRATEGIES

1. What are some of the constraints you face in your attempt to reduce droughts?.....

   .....

   .....

   .....

   .....

Any comments?.....

Thank you very much for your time!