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Drought Index Insurance and the Risk Behavior of Smallholder Maize Crop Farmers in the Northern Region of Ghana.

Master's thesis in Natural Resource Management, Specialising in Geography

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Abstract

Smallholder farmers in the Northern Region of Ghana are at risk in crop production because of uncertainties in the rainfall patterns and amounts caused by changes in the climate. This study revealed that, smallholder farmers recognize drought as their major risk in crop production. Therefore, they have adopted risk management strategies to cope with their production risks. Furthermore, the risk management strategies smallholders adopt are also influenced by their risk attitudes. From this study, smallholder farmers showed a risk averse attitude as they portrayed a safety-first behavior. Their aim is to keep their families away from starvation. Thus, risks in crop production and the risk attitudes of smallholder farmers account for their risk behaviors which informs their risk management strategies. Since the year 2011, smallholders in Northern Ghana have been introduced to a novel agricultural insurance scheme known as the drought index insurance, serving as an additional risk management strategy. Before this time, 2011, there was no such thing as agricultural insurance for farmers in the whole of Ghana. Hence, how the drought index insurance product is designed for smallholder farmers can ultimately determine its success in the long term as a relevant risk management strategy, amid other existing strategies which farmers have employed over the years. From the results of this qualitative research, drought index insurance is designed and administered by the Ghana Agricultural Insurance Pool (GAIP), Ghana's Premier Agro Insurer. The study revealed that, both customers and providers are encountering challenges. Nonetheless, while GAIP attempts to address challenges, it is also committed to making the insurance scheme for smallholder farmers economically sustainable in the long term.

Declaration

I Henry Selasi Kpodo do hereby declare that this thesis is my original research work conducted during the 2016/2017 academic year under the supervision of Haakon Lein at the department of Geography, Norwegian University of Science and Technology (NTNU), Trondheim.

Full acknowledgement has been given where other people's work has been used. This work has not been submitted either in part or whole to any other institution both here and elsewhere.

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.....
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May 2017

Dedication

This thesis is dedicated to Senam Theodore Anku. You are the strongest man I have met. To Mrs. Gifty Akpene Kpodo, my mum, this is for you. Thank you mama.

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To the one pillar my life revolves around, God, I say thank you for good health, sound mind and divine resources in accomplishing this work, I am eternally grateful.

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List of acronyms and abbreviations

ACET	Africa Center for Economic Transformation
ADB	Agricultural Development Bank
CEA	Community Extension Agents
DIRTS	Disseminating Innovative Resources and Technology to Smallholders
EUT	Expected Utility Theory
FAO	Food and Agriculture Organization
GAIP	Ghana Agricultural Insurance Pool
GDP	Gross Domestic Product
GIA	Ghana Insurers association
GIZ	Gesellschaft für Internationale Zusammenarbeit (German Society for International Cooperation – translated from German)
GMet	Ghana Meteorological Agency
GSS	Ghana Statistical Service
ICRM	Integrated Climate Risk Management
IIPACC	Innovative Insurance Products for the Adaptation to Climate Change
IPA	Innovations for Poverty Action
JSS/JHS	Junior Secondary School/ Junior High School
MOFA	Ministry of Food and Agriculture
MOFEP	Ministry of Finance and Economic Planning
MOU	Memorandum of understanding
NGO	Non Governmental Organization
NIC	National Insurance Commission
NOAA	The National Oceanic and Atmospheric Administration
OECD	Organization for Economic Co-operation and Development (OECD)
PNDC	Provisional National Defense Council
SARI	Savanna Agricultural Research Institute
SSS/SHS	Senior Secondary School / Senior High School
TMU	Technical management unit
UNCTAD	United Nations Conference on Trade and Development
USAID	U.S. Agency for International Development
WMO	World Meteorological Organization

1.

INTRODUCTION

1.1 Background of Study

Agriculture is one of the sectors that is facing many risks because of climate change. Climate change alters rainfall regimes and presents uncertainties to farmers' crop production, most especially to those that rely on rain-fed agriculture. According to Niang et al. (2014), there is a likelihood of diminishing yield potential of major crops in Africa due to the challenges the continent faces in adapting to the effects of climate change. However, not all regions in Africa may experience adverse effects of climate change on crop yields. Niang et al. (2014) note that maize production in East Africa could benefit from the high temperatures at high elevation locations. The most significant impacts of climate change on crop production will be felt by smallholder farmers whose socio-economic and demographic characteristics limit their capacity to adapt (Morton, 2007).

In Ghana, smallholder farmers are small scale or peasant farmers, where about 85 percent of them have farm land sizes less than 2 acres (Effah-Abedi, 2014), they employ family labor in crop production and their farm produce is mainly for family consumption. What do smallholder farmers consider as their major risks in crop production? Understanding what smallholders regard as their significant production risk provides an understanding of the risk management strategies they adopt. Furthermore, investigating the attitude of smallholder farmers toward risk is also important in understanding their risk management strategies, especially given their exposure to events such as drought (Binici, Koc, Zulauf, & Bayaner, 2003). According to Binici et al. (2003), the risk attitude of a farmer can be determined by specifying a household objective. Thus, will smallholder farmers take decisions that reduce their production risk to safeguard their families from starvation, even if these decisions translate into lower incomes, or will smallholder farmers act economically to earn higher income by taking more risks? This study employs the theory of the optimizing peasant and the risk aversion theory to help explain the risk attitudes of farmers. Existing literature on the risk attitudes of farmers has followed the trajectory that smallholder farmers are risk averse. Therefore, they are more likely to take decisions that underscore the 'safety-first' goal in contrast to acting economically.

If smallholder farmers are risk averse, then they may adopt strategies that will provide a buffer in the event of low crop yields caused by drought. Recently, one of such strategies for risk reduction is index insurance, now championed by several donor agencies and international organizations in developing countries. In Ghana, such agricultural insurance was nonexistent until 2011, when a pool of seventeen insurance companies formed an institution called the Ghana Agricultural Insurance Pool (GAIP). GAIP is Ghana's premier agro-insurer, with a core mandate of helping farmers cope with the economic stresses they face as a result of low crop yields emanating from the effects of climate change. GAIP provides two types of insurance products for farmers. There is a drought index insurance product for smallholder farmers who have land holdings between 1 to 49 acres. And there is a multi-peril insurance product for commercial farmers with farmland holdings of 50 acres and above.

Some scholars have questioned the motivation for providing an index based insurance product in developing countries. The argument is that, although the index insurance with its associated benefits provide economic security for smallholder farmers, it is also a product advanced by commercial actors in order to penetrate and expand emerging markets in developing countries as non-life insurance markets in industrialized countries are becoming saturated (Johnson, 2013). According to Isakson (2015a), this is about the commodification of agricultural risk that creates revenue streams for insurance providers. On account of these arguments, this study presents the design of the drought index insurance product for smallholder farmers, situating a discussion of the motivation for providing index insurance for smallholder farmers in a political economic context.

1.2 Problem Statement

According to M. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson (2007), globally and regionally climate change is one of mankind's greatest risks. Poor rural communities in developing countries involved in agriculture face the most risks because agricultural production and particularly grain food in these region's is very dependent on favorable climate. In Sub-Saharan Africa alone more than 95% of the farmed land is rain-fed (Wani, Rockström, & Oweis, 2009). This reiterates how critical a steady rainfall pattern is to agricultural production.

Ghana's agricultural sector is no exception because its heavily dependent rain-fed agriculture is susceptible to effects of climate change and variability (Asante & Amuakwa-Mensah, 2014). Smallholder farmers alone account for about 80% of agricultural production in the country (Wood, 2013) and in the northern region maize is their most widely cultivated crop. The maize crop is known to be highly sensitive to water scarcity, therefore any disturbance to the rainfall pattern will adversely affect crop yields. Thus, smallholder farmers in the northern region are in the constant glare of production risks in their farming activities. Worryingly, the northern region is in the Guinea Savanna Agro-ecological zone, with a unimodal rainfall pattern and regarded as a drought prone area.

As noted by Kemeze, Kuwornu, Miranda, and Anim-Somuah (undated, p. 2), "Smallholder farmers practicing rainfed agriculture in drought-prone areas are forced to adapt their production practices to reduce the adverse consequences of drought". Therefore, smallholder farmers employ a plethora of strategies that can reduce their risks in crop production. Lately, index insurance has been one of those strategies. However, it is necessary that the design of such insurance schemes is tailored to specific regions. Because insurance for agriculture in Ghana is relatively new, there is a need to understand how it works for smallholder farmers, and how it may influence the smallholder farmer's decisions to adopt it as a new strategy amid already existing risk management strategies.

1.3 Objectives

The core of the study is to explore how the drought index insurance product in the Northern region is designed and how it related to the needs of smallholder farmers. In doing so, there is a need to investigate what farmers perceive as their production risks and what are their risk attitudes. These will provide an understanding of the risk behaviors of farmers and the rationale behind the decisions they take, such as adopting index based crop insurance.

Specifically, the aims of the study are

- To identify smallholder farmer's production risk perceptions.
- To explore the risk attitudes of smallholder farmers

- Investigate the design of weather (drought) index insurance for smallholder maize crop farmers.

1.4 Research Questions

- What are the common types of risks in production that smallholder farmers face?
- What are the risk attitudes of smallholder farmers?
- What are the existing risk management strategies?
- How is the weather index insurance product designed for smallholder maize crop farmers?
- What challenges do providers and smallholder farmers face in the provision and adoption of the insurance product?
- How do providers intend to make the product sustainable for smallholder farmers?

1.5 Organization of Thesis

This thesis is structured into seven chapters outlined in Table 1

Table 1: Structure of thesis

Chapter	Title	Summary of Chapter
1	Introduction	Presents a background of the study, the objectives and research questions
2	Background	Provides basic background information on relevant themes of the study and a geographical description of the study area.
3	Concepts and Theories	Introduces the concepts and theories that have guided discussions in the study.
4	Methodology	Shows how the study was conducted and the justification for the chosen methodology
5	Results and Discussion	Discussion of the production risk perceptions of smallholder farmers and the risk attitudes of smallholder farmers

6		Description and discussion of the drought index insurance product in the Northern region of Ghana.
7	Summary, conclusions and recommendations	Presents the summary, conclusions and recommendations of the study

1.6 Motivation for the study

Upon following a few climate change discourses and conference proceedings, I came across the index insurance or parametric insurance subject. I have a genuine interest to study this topic and particularly to know if it existed in Ghana. As I reviewed documents on agricultural insurance in Ghana, I realized that, the subject index insurance had not been adequately researched. Little information was available in academic domain about how it worked. Based on my document review, there was a feasibility study conducted by Stutley (2012), and more recently a doctoral thesis presented by Mensah (2016). My interest in the topic and motivation to conduct the research increased because I am committed to contributing to available knowledge through my empirical research. There is potential for my study to provide relevant information for further studies and influence policy directives.

2.

BACKGROUND

2.0 Introduction

This chapter provides some general background information on salient themes in this study. The first part presents issues concerning climate change and its relationship with agriculture, climate change adaptation in Ghana and the use of insurance as an adaptation strategy. The first part continues to provide a political economic lens through which the motivation for providing insurance will be discussed. In addition to that, the chapter introduces smallholder farmers and maize crop farming in Ghana. The second part of this chapter introduces the physical, climatic, socio-economic and agricultural characteristics of the Northern region and particularly the Yendi district, mainly making use of the report from the 2010 Housing and Population Census in Ghana.

2.1 Climate change and agriculture

A primary determinant of agricultural productivity is climate (R. M. Adams, Hurd, Lenhart, & Leary, 1998) and agriculture is one of the most affected sectors by the ongoing climate change (De Salvo, Begalli, & Signorello, 2013). Climate change is “a long-term shift in weather conditions identified by changes in temperature, precipitation, winds, and other indicators” (Reddy, 2015, p. 4). Climate change, in terms of both climate mean and variability, poses a great threat to farmers through reduced yields, lower farm incomes, and reduced welfares (Jalloh, Nelson, Thomas, Zougmore, & Roy-Macauley, 2013).

M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson (2007) predicted that climate change will increase weather variability coupled with weather related extremes. Climate change affects different dimensions in agriculture inducing losses in productivity, profitability and employment (De Salvo et al., 2013). Additionally, it threatens sustainable resilience, impairs socio economic development and reinforces cycles of poverty around the globe, as observed by GIZ (2015). However, there is the issue of uneven spatial distribution of climate change impacts globally. This is as a result of differing exposures, vulnerabilities and coping capabilities (GIZ, 2015). Though contributed least to the accumulation of greenhouse gas emissions as compared to other regions in the world (Kula, Haines, & Fryatt, 2013), Sub-Saharan

countries including Ghana are among the most seriously affected (McCarthy, 2001). Nearly half of their economically active population (about 2.5 billion people) relies on agriculture for their livelihood in 2005 (Nelson et al., 2009).

Nonetheless, it is imperative to note that climate change impacts may not always be negative. Chen et al. (2011) in their study suggested that agricultural production in northeast China may benefit from the increasing temperatures which is a typical feature of climate change. That said, though some regions like northeast China may gain from the effects of climate change, it is evident and to a large extent that its impacts on agriculture threatens food security (Nelson et al., 2009).

Historical data for Ghana from the year 1961 to 2000 displays a continuous increase in temperature and a decrease in mean annual rainfall in all six agro-ecological zones namely the rain forest, deciduous forest, the transitional zone, coastal savanna, guinea savanna and the sudan savanna (Antwi-Agyei, Fraser, Dougill, Stringer, & Simelton, 2012). Climate change is evident in Ghana through rising temperatures, declining rainfall totals and increased variability, rising sea levels and high incidence of weather extremes and disasters (Dovie, 2011). The average annual temperature has increased 1°C in the last 30 years (Stutley, 2012).

2.2 Climate change adaptation strategy in Ghana

The world over, climate change has become an issue of global concern, with countries coming together to find solutions to this seemingly unending nightmare. Countries including Ghana are coming up with strategies and adaptation methods to curb the impacts of climate change. Per Ghana's National Climate Change Adaptation Strategy (NCCC, 2015), the country seeks to do the following;

- Ensure a consistent, comprehensive and a targeted approach to increasing climate resilience and decrease vulnerability of the populace.
- Increase awareness and sensitization of the general public, particularly policy makers, about the critical role of adaptation in national development efforts.
- Position Ghana to draw funding for meeting her national adaption needs.
- Strengthen international recognition to facilitate action.

- Facilitate the mainstreaming of climate change and disaster risk reduction into national development.

There's a lot of evidence in Ghana that shows increase in temperature in all the ecological zones, as well as a remarkable reduction in rainfall levels and a change in their patterns, that have become increasingly erratic. This is an issue of major concern to the national economy, as it is dependent on certain climate sensitive sectors such as agriculture, energy and forestry. A 20-year baseline climate observation conducted by Agyemang-Bonsu et al. (2008), forecasts that yields of maize, which is a major staple in Ghana and other crops will reduce by 7% by 2050.

The goal of Ghana's adaptation strategy development is to enhance Ghana's current and future development to climate change impacts, by strengthening its adaptive capacity, and building resilience of the society and ecosystems (NCCC, 2015). According to NCCC (2015) Strategies that are being employed particularly in the agricultural sector include

- Building and strengthening the capacity of local farmers to increase agricultural productivity and awareness of climate issues.
- Building and strengthening the capacity of extension officers in new farming technologies to enhance their support for farmers.
- Enhancing the living standards of vulnerable groups through acquisition of alternative livelihoods skills
- Protecting the environment through the promotion of agricultural biodiversity
- Promoting cultivation of crops and rearing of animals adapted to harsh climatic conditions
- Documenting existing indigenous knowledge and best practices
- Training trainers to promote post-harvest technologies to minimize losses of farm produce.

In response to Ghana's climate adaptation strategies, such as building and strengthening the capacity of local farmers to increase agricultural productivity and awareness of climate issues, measures that have been taken to see that these measures are put in place include the introduction of agricultural insurance. A project titled Innovative Insurance Products for the Adaptation to Climate Change (IIPACC) was initiated in 2009 by a collaboration between The German Development Corporation (GIZ) and the National Insurance Commission (NIC), to address the risk associated with climate change (Stutley, 2010). The aim of this initiative was to facilitate the

development and the introduction of the demand-oriented as well as economically sustainable agricultural insurance solution to protect among others, farmers and agro-processors, rural and financial institutions (Ghana Insurers Association, 2015). This should assist the beneficiaries in the event of crop failure caused by extreme weather conditions such as drought or excessive rainfall. A similar strategy has been employed in Malawi, where the economy and livelihoods are severely affected by rainfall risk, resulting in drought and food insecurity. Groundnut farmers can now receive loans that are insured against default with an index-based weather derivative (Hess & Syroka, 2005).

2.3 Insurance as Climate change adaptation

Farmers have made efforts that have been directed towards adapting to climate change. It is evident as some farmers adjust their planting dates to correspond with that of the onset of the rains (Roncoli, Ingram, & Kirshen, 2002). Others have changed the crops they grow in favor of crops that are drought tolerant (Naess, 2013). The location and adaptive capacity¹ of the countries in the sub-Saharan region has made it difficult to adapt to changes in climate though they contribute the least to greenhouse emissions in the world. The concept of adaptation in climate change in recent years has become an important policy priority in international negotiations (Huq et al., 2004), as much as issues of mitigation. Several authorities and researchers provide differing definitions about the concept, but they are all centered around enhancing the capacities of individuals to adverse effects of climate change. McCarthy (2001) explains adaptation as an “adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts”. It further suggests that the term refers to changes in processes, practices, or structures to moderate or offset potential damages, involving adjustments to minimize the vulnerability of communities, among others to climatic change and its variability (McCarthy, 2001). Stakhiv (1993) suggests adaptation connotes “any adjustment, whether passive, reactive or anticipatory, that is proposed as a means for ameliorating the anticipated adverse consequences associated with climate change” (Smit, Burton, Klein, & Street, 1999). This definition brings to light ex-ante and ex-post strategies of adaptation as it makes mention of reactive or anticipatory

¹According to the IPCC (2007), It is the ability of a system to adjust to climate change, its variability and extremes, cope with its consequences, moderate its potential damages and taking advantage of opportunities.

means. Ex-ante adaptation strategies are typically those that aim at smoothing income, where households adopt strategies to protect them against income shock before it actually occurs (Lekprichakul, 2009). Conversely, ex-post strategies come about as a response to the shocks sequel to the manifestations of climate change and its variability.

Insurance for climate change adaptation is therefore considered an ex-ante strategy. Jensen and Barrett (2016) claim that when shocks strike, households that anticipate and receive indemnity payments accordingly by taking insurance reduce their economic vulnerability. This potentially reduces their reliance on detrimental coping strategies such as skipping meals, selling off productive capital and withdrawing children from school (Hoddinott, 2006; Janzen & Carter, 2013).

2.4 The Political Economy of Insurance

Peasant or smallholder farmers are “always part of a larger economic system which in varying degrees establishes the conditions under which they survive as agricultural producers” (Ellis, 1993, p. 51). Ellis (1993), continues to state that farmers’ individual action and decision making is not in isolation of the dominant larger economic system within which they produce. This argument is the principal tenet of the Marxian political economic theory. The Marxian political economic theory is relevant for this paper, because of its consistency with contemporary capitalism that has found its way into agriculture, through what Isakson (2015a) regards as the commodification of agricultural risk. He argues that recent expansion of financial capitalism has included the modification of agricultural risk into tradable commodities. Hence, agricultural index insurance’ popularity is but a reflection of the broader process of financialization that started developing in the late 1970’s (Isakson, 2015a). More so, “index insurance for small holders is, as of yet, a relatively small part of the larger micro insurance sector, which occupies a significant position within the global (re)insurance industry’s growth strategy” (Johnson, 2013, p. 2671). It is therefore imperative to understand the political economy within which smallholder farmers operate, as well as index insurance policies that are made by this larger economic system which leads to a redistribution of rents, benefits and cost across different dominant social and economic groups (Mueller & Mueller, 2016).

According to Isakson (2015a); Johnson (2013), Isakson (2015b) key development actors including the World Bank, the United Nations, the G20, donors, non-governmental organizations, prominent financial enterprises and major reinsurers, have all endorsed and advocated for index insurance as an instrument to safeguard small holder farmers from weather related risks, though Linnerooth-Bayer, Warner, Bals, Hoeppe, et al. (2009) argue it is still too premature to fully assess its effectiveness. These organizations often work in tandem with governments from the Global South, marketing and managing their products through microfinance institutions (Isakson, 2015b). While stating that index insurance assists small holder farmers to cope with weather risks, Isakson (2015a) contends that the potential of index insurance as a means to expand markets and create revenue streams has made credit providers, insurers and input suppliers strong proponents of this insurance.

Consequently, in addition to mitigating smallholder farmer's climate vulnerability, it may promote "the adverse incorporation of smallholders into agricultural value chains that occlude yet deepen their exploitation while weakening the ecological and social foundations of their security" (Isakson, 2015, p. 570). Johnson (2013), also argues that index insurance for smallholder farmers in the Global South is a strategy and tool used to penetrate emerging markets because non-life insurance markets in the industrialized countries are saturated. From 2007 to 2009, there has been a stagnation in premium growths of industrialized countries and this has necessitated their action to break into new markets for insurance capital (Johnson, 2013).

Regardless of the supposed benefits that the financial sector or major (re)insurance firms may accrue, there has been little or no evidence from (re)insurers that index insurance for agriculture has been a profitable venture (Johnson, 2013). In fact, the first agricultural index insurance scheme in India, provided by a major microfinance institution BASIX, discontinued sales at the end of the 2009-2010 season due to cumulative average losses as indemnity payments exceeded the premiums collected (Miranda & Farrin, 2012). Despite the success recorded by other pilot projects in developing countries, the long term profitability for (re)insurers remains a subject for discussion (Johnson, 2013).

It is crucial to identify the roles of different actors within this system. In addition to farmers, the state has also been identified as a critical actor that will play significant roles in instituting and providing a conducive environment for the success of index based insurance. Martin and Clapp (2015), argue that role of the state has important implications for the practices of contemporary financialization. The interventions of the state at the intersection of agriculture and finance, Martin and Clapp (2015) argue, has shaped the conditions that have made agriculture an investment ground for private financial actors. Isakson (2015) asserts that, among other things, infrastructural development in the form of providing a substantial network of weather stations by the state, is one of the ways promoters commit the state to their cause.

2.5 Smallholders and why they are important

Smallholders merit special attention because they are essential in many regards (Narayanan & Gulati, 2002). All over the world and especially in developing and poor nations, smallholder farmers are responsible for feeding billions, and several livelihoods depend on it (Narayanan & Gulati, 2002). Smallholder farming is regarded as the backbone of African agriculture and food security (John Dixon, Tanyeri-Abur, & Wattenbach, 2004). In Ghana for example, smallholdings constitute about 95% of farms and about 80% of agricultural production (Chamberlin, 2007). Because poverty is dominant in rural areas, smallholders are essential in the economical and agricultural development of these areas through securing livelihoods, food security and ultimately supporting the national GDP.

Attempting to define who a smallholder is may be challenging (Narayanan & Gulati, 2002). It differs across countries and agro-ecological zones (J Dixon, Taniguchi, Wattenbach, & TanyeriArbur, 2004). But usually, a number of indicators aid in characterizing which groups of people fall under that umbrella. Chamberlin (2007) notes that farm holding size, wealth, market orientation and the farmer's vulnerability to risk are among the themes that can be used to classify smallholder farmers. Hence, smallholders may refer to those farmers who have limited resource endorsements, relative to other farmers. In this regard, smallholders are classified to be somewhat land constrained (Chamberlin, 2008), usually producing on farms that are 5 hectares or less in size (Narayanan & Gulati, 2002). They have been known to engage household labor and produce from the farm serves as the principal source of income (Cornish, 1998). In addition, smallholder farmers

are seen to be risk prone farmers and they have relatively high degrees of vulnerability (Chamberlin, 2008). Basically, smallholders dominate most farming systems of developing countries and are responsible for majority of rural employment and most food production (J Dixon et al., 2004).

In Ghana, smallholder farmers represent an overwhelming majority of maize producers. Maize is grown by about 2.2 million households (81%) out of about 2.7 million households in the 2005 census (Stutley, 2012). The northern region possesses 14% of the total maize production in the country (third only after the Ashanti and Eastern regions) (Stutley, 2012). In fact, the Northern region accounts for 18%, the highest, of the total smallholder produce from maize, soya bean, cowpea, cocoyam, plantain, yam, cassava, sorghum, millet and rice all put together (Stutley, 2012).

Stutley (2012) notes that their importance to food security, rural livelihoods and the national GDP makes it increasingly imperative for adaptation strategies that are geared towards their access to agricultural credit. Innovation for Poverty Action (IPA), a non-profit research organization, among others have been involved with maize smallholder farmers in the Northern region of Ghana. Their activities among others, aims at fostering issues related to smallholder farmers' understanding, attitudes and access to agricultural finance (Innovation for Poverty Action, 2016).

2.6 Maize crop farming in Ghana

Agriculture in Ghana is the single largest contributor to the nation's gross domestic product (GSS, 2014). In addition to the high export earnings from the cash crops, many staple crops, particularly maize is essential in the daily meals of the whole country. Maize is a crop which grows across a broad range of agro ecological zones. Every part of the maize plant has economic value: the grain, leaves, stalk, tassel, and cob can all be used to produce a food and non-food products (Liverpool-Tasie, Omonona, Sanou, & Ogunleye, 2016). Maize is also an important component of poultry and livestock feed.

It can develop in areas that have a minimum rainfall of about 1016 mm per annum (FAO, 2005). In addition, it can safely be said to be the most cultivated crop and accounts for about 60% of the total grain produced and consumed in Ghana (Angelucci, 2012). The three northern regions generally regarded as the food basket of the country are responsible for the production of large

quantities of maize during their cropping seasons. Its production has been dominated by smallholder farmers (Stutley, 2012) who grow it as a monocrop or use the multi-cropping farming system with other crops like groundnut and millet.

Despite efforts made by The Ghana Grains Development (1979-1997), as well as the Food Crops Development Project (2000-2008), to improve maize yield, the average maize yield in Ghana remains one of the lowest in the world. Maize yields in Ghana average approximately 1.7 metric tons per hectare. However, yields of 6 metric tons per hectare and higher have been realized by farmers using improved seeds such as Dupont Pioneer hybrid maize (VOTO Mobile, 2015).

Indexmundi (2016) provides an overview of maize production for the whole country. Following from the numbers (Figure 1), maize crop production has been declining from the year 2010 to 2015. From the year 2010 the only increase in production occurred was realized from year 2011 to 2012. It is also evident that there are fluctuations in the figures from 2005, suggesting that there is some level of uncertainty in maize production.

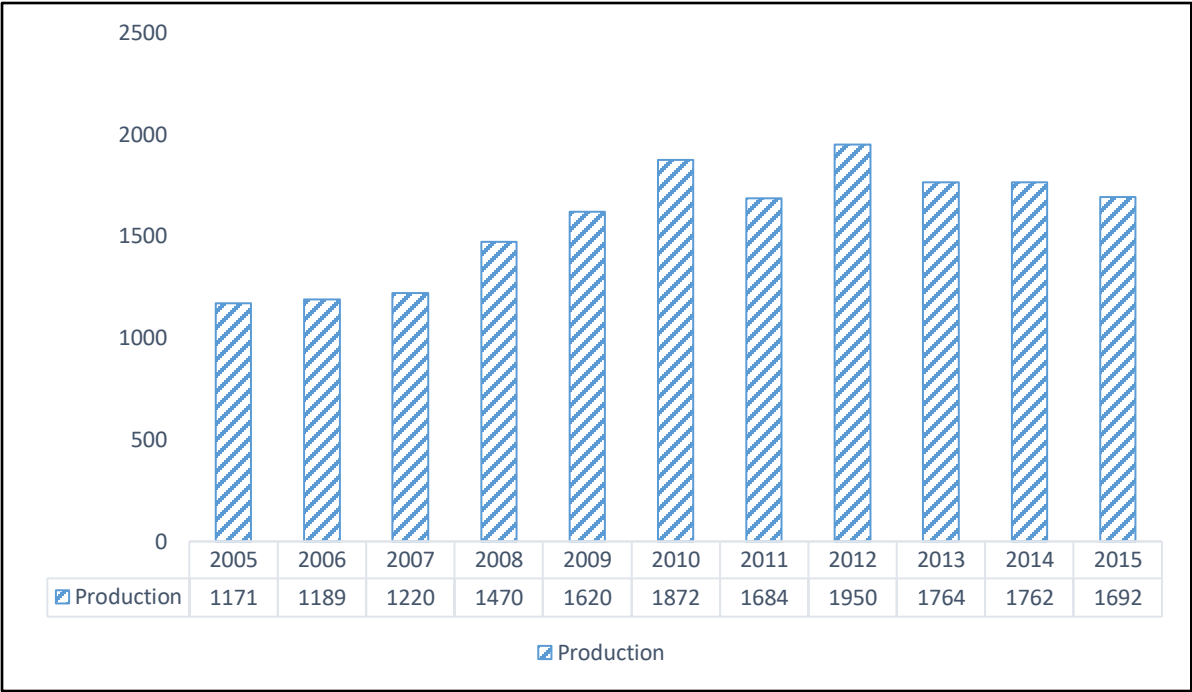


Figure 1: Graph of maize crop production (2005-2015) in Ghana

Production figures in 1000 metric tonnes (1000 MT)

Source: (Indexmundi, 2016)

It is also worth noting that though there has been a steady decline from the year 2012, production amounts from 2012 to 2015 are still higher than from the years 2005 to 2011. This is due to an increased use of modern varieties and fertilizer (Morris, Tripp, & Dankyi, 1999).

Of interest is the Northern region which lies in the Guinea savanna ecological zone and is susceptible to the vagaries of climate change, in terms of both rainfall means and variability. There is only one cropping season and any disturbance to the normal rainfall pattern will have serious impacts on farmers, most notably smallholder farmers who rely on their crop yield for their subsistence. Because the maize crop is sensitive to drought, the importance of a favorable climate, more crucially a steady rainfall pattern and amount cannot be overemphasized.

Box 1: Growth stages of Maize

Germination

The growth point and entire stem of the maize plant is about 25 to 40mm below the surface of the soil during germination. Seedlings emerge between six to ten days under warm and moist conditions. However, in dry conditions it may take 2 weeks or more. Moisture content, approximately 60% of soil capacity and temperature range of 20 and 30 Degrees Celsius is optimum for germination (Du Plessis, 2003). Furthermore, there is high demand for water in the process of pollination and fertilization. In a dry and hot weather during the flowering of maize, an additional stress is placed on the plant's resources and the silks may wither and burn off before the pollen reaches the ear. This leads to the lack of fertilization for all kernels as well as a great reduction of seed set.

Cob and kernel development

Cobs, husks and shanks are fully developed by 7days after silking. The plant now uses significant energy and nutrients to produce kernels on an ear. Primarily, the kernels are like small blisters containing a clear fluid; this is referred to as the kernel blister stage. As the kernels continue to fill, they get to the stage referred to as the 'milk stage'. This milk stage is when the fluid becomes thicker and whiter in color.

Maturity

Approximately 30 days after silking, the plant reaches physiological maturity. This stage is where a black layer is noticeable at the tip of each kernel, where cells die and hinder further starch accumulation into the kernel. The grain and husks begin losing moisture while healthy stalks remain green. Ultimately, the leaves will dry off and harvesting can commence when grain moisture is below 20%. The grain is dried down to 14% for delivery to storage or market.

Source: (VOTO Mobile, 2015)

2.7 The study area

The Northern region is one of the 10 regions that make up the nation of Ghana, and is located to the north of the country. It shares boundaries with the Upper East and the Upper West regions to the north, the Brong Ahafo and the Volta regions to the south, Togo to the east, and Ivory Coast

to the west (Ghana Statistical Service, 2013). The Northern region is Ghana's largest region in terms of land area (70,383 square kilometers), constituting about 30 percent of the country's land mass (Government of Ghana, 2017). The Black and White Volta, as well as the Nasia and Daka rivers drain the region. The Northern region has a unimodal rainfall pattern resulting in only one rainfall season, thereby making its climate relatively dry. The rainy season begins in May and ends in October with annual rainfall between 750 mm and 1050 mm. The dry season on the other hand, begins in November and runs through to between April and May, with peak temperatures of about 40°C during the day and 14°C at night, due to the harmattan winds. The main vegetation is grassland, interspersed with guinea savannah woodland, characterised by drought-resistant trees such as acacia, (*Acacia longifolia*), mango (*Mangifera*), baobab (*Adansonia digitata* Linn), shea nut (*Vitellaria paradoxa*), dawadawa, and neem (*Azadirachta indica*).

In the Northern region, almost all ethnic groups practice the patrilineal system of inheritance. The 2010 housing and population census data revealed that the total number of household heads in the Northern region is 318,119, made up of 270,488 male heads and 47,631 female heads. On the average, a household in the Northern region consists of about 7.7 persons, relatively higher than the national average of 4.4. The possible reasons for the large household sizes in the region are polygyny, high fertility and the common practice of nuclear and extended family members living together. About 240,238 households out of a national total 2,503,006 are involved in agricultural activities in the Northern region. This figure represents 9.6 percent of the national total. Most of these households are into crop farming, followed by livestock rearing, tree planting and fish farming.

In the year 2012, six (6) new districts were created in addition to the already existing twenty (20) districts, making a total of twenty-six (26) districts in the Northern region. Out of these districts, there is one Metropolitan area (Tamale) and two Municipal areas including Yendi (Ghana Statistical Service, 2014)

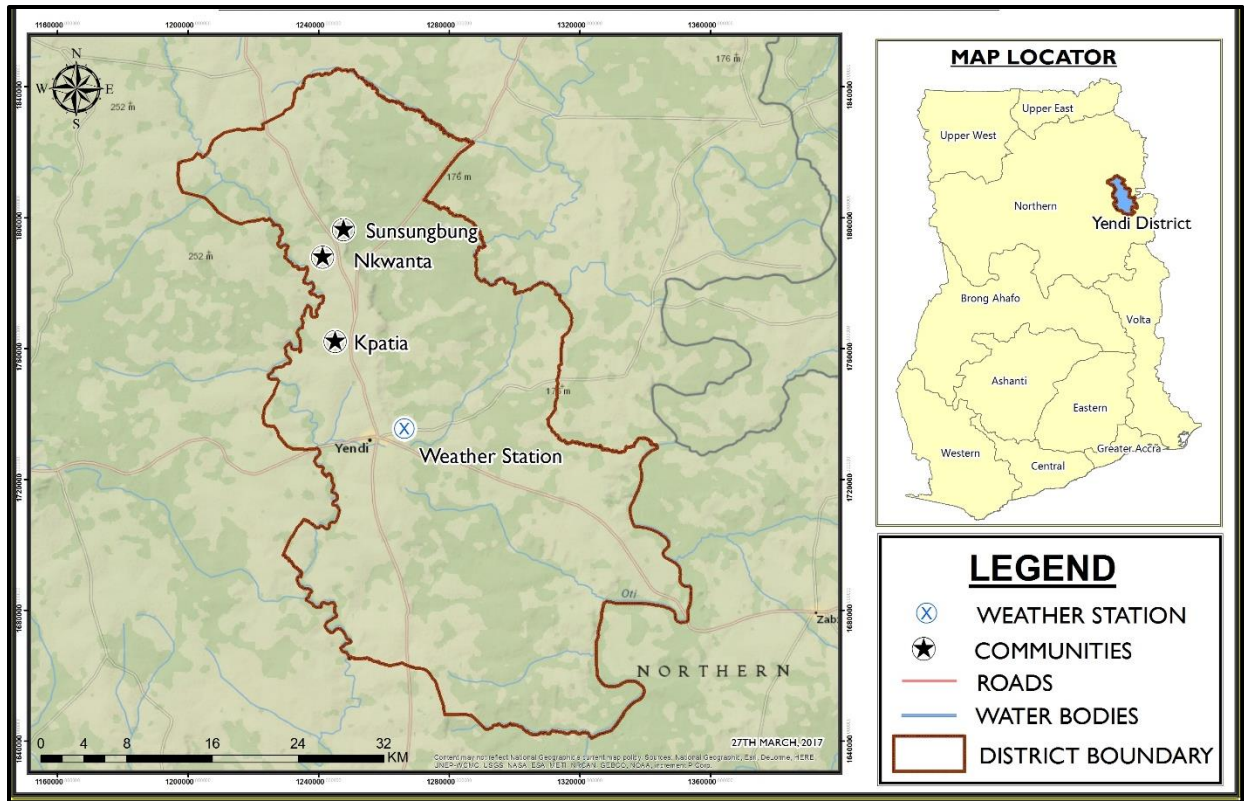


Figure 2: Yendi Municipal district showing selected communities

2.8 Yendi Municipality

The Yendi Municipal Assembly was established in 1998 by PNDC Law 207 Act 426 of 1993 (Yendi Municipal Assembly, 2013). It was then elevated to a municipality in 2007 by LI 1443. The Yendi Municipality is one of the two municipalities in the Northern region (GSS, 2013). The Municipal Assembly is made up of one urban council and five (5) Zonal Councils namely Yendi Urban Council, Kpabia Area Council, Jimle Area Council, Malzeri Area council, Gbungbaliga Area Council and Sang Area Council. The Municipal Assembly has 57 unit committees. The Yendi municipality is the capital of Dagbon Kingdom and the seat of the Yaa-Naa, who is the Over Lord of Dagbon (Yendi Municipal Assembly (MPCU), 2014). Yendi is also the second largest town in the Northern region, second to Tamale, the Northern regional capital (Adzawla, Fuseini, & Donkoh, 2013).

2.8.1 Physical and Climatic Features

The Yendi Municipality is in the eastern corridor of the Northern region of Ghana. It lies between latitude between 9°–35° North and 0°–30° West and 0°–15° East., with a land mass of 1,446.3sq. km. The Greenwich Meridian passes through a number of settlements in the Municipality. They include Yendi, Bago, Laatam, Lumpua, Gbetobu, Gbungbaliga and Nakpachei. Six (6) other district assemblies bound the municipality. These are Saboba to the east, Chereponi and Zabzugu to the south, Nanumba North to the north, Gushegu and Mion to the west.

There is a unimodal rainfall pattern that lasts from May to October, reaching its peak in August and September (Yendi Municipal Assembly, 2013). The rest of the year is dry. Matondi, Havnevik, and Beyene (2011) note that rainfall in the municipality is seasonal and unreliable, and this restricts food crop production to the short rainy season. The mean annual rainfall in the municipality is 1,125mm as compared to the 1,275mm of the region (GSS, 2013). In the Yendi municipality temperatures range between 21°C and 36°C. YOU have more details in rainfall- add figure?

2.8.2 Vegetation and Drainage

Yendi municipality just like in its mother region is tree savannah in areas that have not been affected by settlements and farming activities. The Municipality lies in the interior woodland savannah belt and has common grass vegetation with tress like sheanut, baobab, and acacia. The grasses grow in tussocks and some reach height of 3 meters or more. Extensive and rampant bush burning by anthropogenic agents, notably has affected the vegetation and consequently the micro climate within the municipality (Yendi Municipal Assembly, 2013). There are two principal drainage basins in the municipality. The Daka River enters the municipality through the Northeast and is joined by River Oti. These rivers flow throughout the year and can support irrigation farming especially in dry season.

2.8.3 Demography

The total population for Yendi Municipality is 117,780, making up approximately 4.8% of the population of the northern region. Various ethnic groups make up for the population of the municipality with the Dagomba ethnic group being the majority. The other ethnic groups include Konkomba, Akan, Ewe, Basare, Chokosi, Hausa and Moshie. To a considerable extent, the

population is rural, with about 62% living in the rural areas while 37.4% are in towns. According to Ghana Statistical Service (2014), the population growth rate is approximately 2.9% per annum.

Generally, Yendi has a youthful age structure with the population under 15 years constituting about 43 (42.9%) percent of the total population. The dependents in Yendi fall within the ages of 0-14 and 65 years and above. The dependency ratio in Yendi is 93.3, meaning approximately every working person in the Yendi Municipality takes care of one other person. According to the 2010 Population and housing census, the Municipality has more dependents in the rural areas (115.5) than in the urban areas (83.2).

2.8.4 Social Characteristics

On the average, the household size in the Yendi municipality is 4.5, lower than the regional average of 7.7. Household heads account for 12,717 of the household population in the Municipality (116,602). There are more male heads (84.5%) than female heads (15.5%). The Municipality has close to two thirds (63%) of its population aged 11 years and older being illiterate. Majority of the literate population are literate in English and Ghanaian language. However, there are no great disparities between the sexes with regards to literacy and age.

For the population currently in school, about half (49.3%) of them are in primary school with close to one fifth (17.5%) in JSS/JHS. Quite a sizeable proportion (30.0%) of the population currently in school, are in Kindergarten (6.7%) and Day Nursery (14.3%). About one in ten of the population currently in school, are in SSS/SHS, with less than two percent in the tertiary level. A similar trend can be observed for both males and females but with slightly more females in the basic schools than males. For those who have attended school in the past, majority of them (31.2%) have attended primary school followed by those who have attended SSS/SHS. Quite a sizeable proportion (7.1%) of those who have attended school in the past had tertiary level education.

2.8.5 Agriculture

The people of the Yendi municipality practice subsistence agriculture as their primary occupation. More than three quarters (80%) are directly involved in agriculture for their livelihoods. Out of the total land mass of 535,000 hectares, arable land constitutes 481,000 hectares (Yendi Municipal

Assembly (MPCU), 2014). Yet, only 15 percent of this arable land is under cultivation (Yendi Municipal Assembly 2011). The capability of the Municipality in agriculture is tremendous. The shea-nut is the main export product of the Municipality though it is largely grown in the wild. The dominant agricultural activities practiced are crop farming and livestock rearing. Out of 10,074 rural households, about 64% of are into crop farming, 35.46% are into livestock rearing, 0.16% are into tree planting and none of the households are into fish farming. Also, in urban communities, 72% out of the total households (3,359) are into crop farming, 27% are into livestock rearing, 0.48% are into tree planting and 0.03% are into fish farming. Deducing from these figures, crop farming is the principal agricultural activity in the Yendi municipal district.

2.8.6 Soil characteristics and crop suitability

In the Yendi municipality, there are predominantly sedimentary rocks of volatile sandstone, mudstones and shales (Yendi Municipal Assembly (MPCU), 2014). Out of this parent rock, the soils derived vary from laterites, ochrosols, sandy soils, alluvial soils and clay. Therefore, the organic content is low. The low organic content of the soil is further exacerbated by extensive bush burning. (Yendi Municipal Assembly (MPCU), 2014). This to a large extent is the reason for low crop yields per acre and its consequent food shortage during the dry season in the district (Yendi Municipal Assembly, 2013)

2.8.7 Economic Characteristics

Based on the 2010 Housing and Population Census, about 71% of the population aged 15 years and older are economically active. More than 95% of them are engaged in some economic activities such as agriculture, craftsmanship, angle mongering among others for income. About 65.4% of the economically active population in the municipality are into agriculture, forestry and fishing. Sales and service workers constitute the second largest number (14.8%) of the employed population in the municipality. Craft and related workers form about one tenth of the employed population. The remaining occupation categories form less than 10 percent of the employed population. Females dominate the service and sales sector with close to one quarter (23.0%) of females engaged in that sector as against 6.9% of their male counterparts. Females also dominate in the craft and related activities sector. Males tend to be more engaged in agriculture, forestry and

fishing, accounting for more than two thirds of the male employed population. Other income generating activities include smock weaving, agro-preparing (shea spread extraction), meat preparation, angle mongering and retail of general products. These income avenues are normally on a medium and little scale (Yendi Municipal Assembly 2011).

2.8.8 Schools, Banks and Markets

The municipality has 42 Early Childhood Centre's, 164 Primary Schools, 34 Junior High Schools, 4 Senior High Schools, One Vocational School and a health assistant training school (Yendi Municipal Assembly, 2013). These educational institutions are inadequate and there are plans towards the establishment of a nurses and teacher training colleges. Furthermore, there are four banking institutions in Yendi town. These are branches of the Ghana Commercial Bank Limited (GCB), the Agricultural Bank (ADB), Bonzali Rural Bank Limited and First National Bank (Yendi Municipal Assembly, 2013). In addition to these banks, there are other Savings and Loans institutions such as Opportunity International and Sinapi Aba. The municipality has twelve (12) markets located at Yendi, Bunbonayili, Sang, Kpabia, Ghani, Nakpachei, Adibo, Sambu, Sakpe, Gbungbaliga, Nadundo and Jimle.

2.8.9 Research communities

The communities involved in this study are Sunsongbon, Nkwanta and Kpatia. These are very small communities with less than a thousand people. Hence, the communities under this study are very small ones, where the occupants know themselves and relate with one another like an extended family. Two of the communities (Kpatia and Sunsongbon) have nucleated settlements, where houses are grouped closely together usually around the community head or chief's palace. The third community, Nkwanta, has a relatively more dispersed settlement pattern.

As peasant communities, the basic source of food for the household is from farm produce (Matondi et al., 2011). The males in the communities are largely into farming and they cultivate crops including maize, groundnut, yam and soya beans, guinea corn during the major season (Figure 3). The main cropping season begins in April, when farmers have experienced some amounts of rainfall which will allow them to plough their farm lands for cultivation. The cropping season usually ends in September but harvesting still goes on up till about December for some crops like

guinea corn and yam (Figure 3). November to March represents an off-season where no major planting is done. Farmers wait for the new rains in April to start cultivating again. Majority of the farm produce is for home consumption but surplus is sold in the local markets.

Based on field data, Figure 3 shows some major crops cultivated in the study communities. The horizontal lines on the graph represents the entire cultivation period for each of the 5 crops. At the beginning of each horizontal line there are broken dots that illustrate the time of planting. For instance, guinea corn has a green colored horizontal line and the illustration shows that planting is between the months of June and July. Similarly, at the end of each horizontal line there are broken dots which again illustrates the times of harvesting for each crop. So Soya beans for example is harvested between September and October. It is worthy to note that, the planting and harvesting times for each of these crops are subject to change based on when the rains come to allow ploughing and planting. As an example, maize planting usually starts in the month of April to May, however when the rains delay, farmers cannot plough their lands and as such cannot plant. When this happens, it pushes the planting time of maize to further. Consequently, the harvesting times are also pushed forward, given that farmers use the 120-day maize variety. Additionally, a farmer can plant one or more of these crops on his farm during the cropping season. Fact is, most of the smallholder farmers plant more than one crop during the season. The smallholder's farmlands range from 2 acres to as large as 40 acres (See appendix 10). Though they do not cultivate their entire available farm land, they cultivate as much crops as they can with family labor or rarely hired labor.

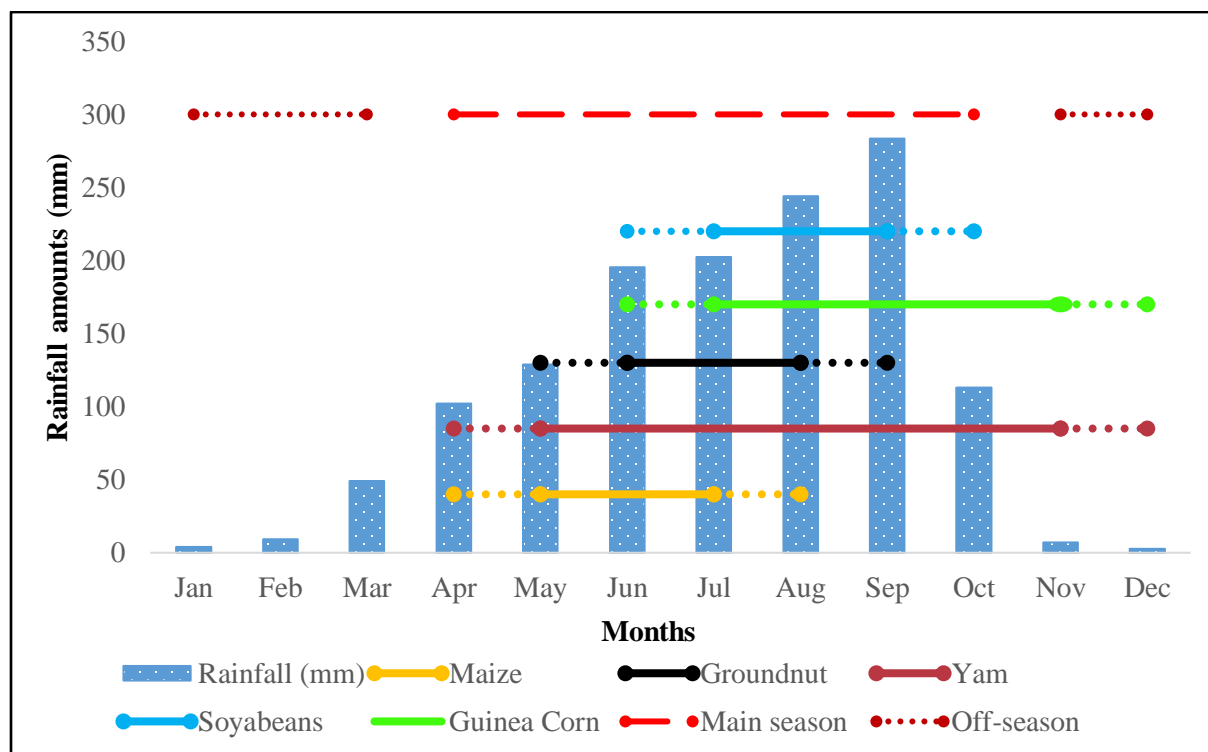


Figure 3: Graph of five major crops cultivated in study areas and average monthly rainfall

Source: Author, based on field data

Aside farming, the people engage in petty trading activities for more income. These include charcoal, firewood and shea nut selling. According to Matondi et al. (2011), the females dominate in these petty trading activities.

The variability in the rainfall pattern in these communities, just as in the district affects peasant food production. In addition to the risk management strategies that farmers in the communities have, some institutions have seen it expedient and have been given the mandate to introduce innovative adaptation strategies to cope with the rainfall variability. Particularly, the Savanna Agricultural Research Institute (SARI) and the Ministry of Food and Agriculture (MOFA) continue to work together to support farmers with good farming practices, among others. SARI, a scientific research institute has been exploring suitable crop seedlings that are drought tolerant for farmers in the interior savannah of Ghana. Currently, they employ a farmer system approach where they take their agricultural technologies to farmers and try to feed it into the farmer's system of

farming. In other words, SARI's farmer system approach aims at carving out a system with their technology that is most appropriate for the farmers. By doing this, they move away from on-station research, where they only presents farmers with the final technologies that may not be appropriate for them. MOFA then acts as the intermediary that takes these innovations to the farmers. SARI therefore does not deal with farmers directly when it involves adopting innovations. MOFA who local farmers popularly refer to as '*agric*', understand the jargons of SARI and they can break it down in simple terms for farmers to understand.

Other institutions have explored the viability of using financial instruments such as insurance to cope with the effects emanating from unreliable rainfall. A pool of insurance companies with support from the National Insurance Commission (NIC) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), provide this insurance under the Ghana Agricultural Insurance Pool. It is an insurance package that is linked to a weather peril such as drought. In the three communities under study, smallholder farmers can have access to a drought index insurance policy that uses rainfall as a proxy to measure the drought peril. Rainfall is measured by an independent institution, Ghana Meteorological Agency (GMet). From the map (Figure 2), GMet has a weather station in Yendi located almost in the center of the municipality. The closeness of the weather station to the communities under study is essential for the operations of GAIP in providing rainfall data that reflects the actual happenings on the farms.

3.

CONCEPTS AND THEORIES

3.0 Introduction

In this chapter, I will present key theories and concepts that will aid in analyzing empirical data collected from the field. The objectives of this study make it imperative to employ different theories and concepts that will help digest the diverse subject matters of this study. Considering this, the chapter firstly introduces the concept of agricultural risk, with particular attention to drought which is a production risk. I will present the different types of drought, paying more attention to meteorological drought. This is because meteorological drought is the basis for indemnity payments in the index insurance contract available in the Northern Region of Ghana. Then, two classical theories commonly employed in explaining peasant or smallholder farmer risk behavior is presented. In explaining these classical theories, I will introduce the risk management strategies that smallholder farmers employ in their risk management behavior. This chapter ends with an explanation of the concept and principles of index insurance, as well as the benefits, challenges and how index insurance can be sustained in the long term.

3.1 The Concept of Agricultural Risk

“Risk and uncertainty are inescapable in all walks of life” (Hardaker, Lien, Anderson, & Huirne, 2015). According to Drollette (2009), risk refers to the possibility of unfavorable outcomes due to uncertainties and imperfect knowledge. In agriculture, risk remains an inevitable feature and one cannot tell with certainty what amount of output will result from a given amount of inputs because of uncontrollable events, such as drought (Moschini & Hennessy, 2001). This output uncertainty is the risk that farmers must deal with in their crop production, most especially in these times of climate change and variability. Therefore, risk is an essential element in farming and the uncertainties inherent in production can have grave influences on farm income (Economic Research Service, 2016). Smallholder farmers in Africa must cope with risks on an everyday basis to secure their livelihoods (Meijer, Catacutan, Ajayi, Sileshi, & Nieuwenhuis, 2015). More so, agricultural risk serves as a significant deterrent for both agricultural and rural development (Hess & Hazell). Sources of agricultural risk include production or yield risk, price or market risk,

institutional risk and financial risk (Kahan, 2013). For this study, I concentrate on production risks and more specifically on drought. Production risks are risks associated with natural hazards and variations in weather events such as rainfall, insects, pests and diseases that affect yield or wipe out total production (The World Bank, 2005).

In the first place, drought and aridity are not the same (Mainguet, 1999; NOAA, 2008a). Aridity is a permanent feature of climate in regions where low precipitation is the norm, as in a desert (NOAA, 2008a). Drought has many meanings and the meanings vary depending on the specific interest of people (Palmer, 1965) such as meteorologists, agronomists, hydrologists and economists. It is therefore difficult to provide one concise definition. Nonetheless, a more generalized definition as a beginning point of departure is that drought is a “prolonged and abnormal moisture deficiency” (Palmer, 1965, p. 2). Drought can be classified into four main types. There is meteorological drought, agricultural drought, hydrological drought and socio-economic drought.

3.1.1 Types of drought

Firstly, *hydrological drought* is concerned with the impacts of precipitation shortfalls on both surface and subsurface water supply such as lakes, streams and groundwater (World Bank, 2006). However, the impacts of precipitation shortfalls on surface and subsurface water supply is not immediate because there is a considerable delay between deficits in precipitation and the point where these deficits become evident in the components of the hydrologic system (Sivakumar & Motha, 2008).

In continuation, *agricultural drought* can be described as deficiencies in soil moisture which affects crop yields (Wilhite, 2005). Thus, agricultural drought comes about because of meteorological drought and hydrological drought. Meaning that, deficiencies in precipitation translate into deficiency in soil moisture, which is critical factor in defining crop production potential (Wilhite, 2005). According to Heathcote (2005); World Bank (2006), the agricultural sector is the foremost to be affected by rainfall deficiencies because of its dependence on soil moisture. Deficient soil moisture at planting may hinder germination which contributes to low yield per hectare of land (World Bank, 2006).

Furthermore, *socio-economic drought* occurs “when water supply is unable to meet economic demand because of weather related factors” (Heathcote, 2005, p. 19). Similarly, socio-economic

drought illustrates a situation where demand for an economic good such as hydroelectric power, food grains, fish, exceeds supply because of shortfalls in water supply (World Bank, 2006). Therefore, Sivakumar and Motha (2008) notes that socio-economic drought associates the supply and demand of some economic goods and services with meteorological, hydrological and agricultural drought.

By and large, hydrological, agricultural and socioeconomic drought all originate from meteorological drought (Sivakumar & Motha, 2008). According to World Bank (2006, p. 80), meteorological drought refers to “identified periods of drought for the number of days when precipitation was less than predetermined thresholds”. Heathcote (2005) notes that, meteorological drought occurs because of persistent large scale disruptions in the global circulation pattern of the atmosphere which results in regional deficiencies of precipitation over a period. Thus, meteorological drought connotes deficiencies in precipitation in comparison to a specific region’s average rainfall amounts.

Meteorological drought has been employed in several agricultural index based insurance contracts all over the world. The agricultural index based contracts that use meteorological drought as the index, basically insure policyholders or farmers who are dependent on rain-fed agriculture, against rainfall deficits (Maestro Villarroya, 2016). Thus, indemnity payments to policyholders or farmers are triggered when there is a record or incidence of meteorological drought (Leblois & Quirion, 2013). However, contract designs for index insurance policies that use meteorological drought or rainfall deficiency as basis for compensation may vary from one region to the other. According to The World Bank (2014), there is no one-size-fits all design. Some rainfall index contracts are designed based on accumulated rainfall, other contracts are designed based on different phases of the crop growth during the cropping season (Giné, Menand, Townsend, & Vickery, 2010). The World Bank (2014) notes that index insurance contracts that measure rainfall deficiencies at different phases of the crop stage is prudent because crops have different water-deficit stress characteristics at different phases of their growth. In sum, index insurance contracts that are based on rainfall deficits or meteorological drought has the potential to absorb the risks that crop farmers who depend on rain-fed agriculture face.

3.2 Models of smallholder's behavior

A theory denotes a “distillation of reflections on practice into conceptual language so as to connect with past knowledge” (Pieterse, 2001). Furthermore, theories provide researchers with different “lenses” through which social issues can be looked at and they provide a framework within which to conduct analysis while focusing on different aspects of their data (Reeves, Albert, Kuper, & Hodges, 2008). There are two classical theories that seek to explain the attitudes of smallholder farmers towards risk and essentially, how peasant or smallholder farmers think and make decisions in agrarian settings. These are the theory of the optimizing peasant and the risk averse theory.

3.2.1 The theory of the optimizing peasant

This theory proposes that peasant farmers are efficient and are profit maximizers in a neo-classical context (Ellis, 1993). The theory dates all the way back to the work of T.W. Schultz and his book ‘Transforming Traditional Agriculture’ in 1964. He advanced the hypothesis that farm families or peasant households, though poor were efficient, and they are able to efficiently allocate factors of production in their traditional agricultural practices (American Agricultural Economics Association, 1992). The proposition brings to bear an essential normative term ‘efficient’ and it is imperative to clarify it. Generally, efficiency is output per unit of input. Additionally, it is the act of exploiting resources to maximize value. However, there is a need to distinguish between two types of economic efficiencies. There is technical efficiency and allocative efficiency (Ellis, 1993). Technical efficiency, according to Ellis (1993, p. 68) is “the maximum attainable level of output for a given level of production inputs, given the range of alternative technologies available to the farmer”. Allocative efficiency on the other hand is where production factors, such as land and labor, are used in proportions which maximize profits (Colman & Young, 1989). In sum, Economic efficiency = Technical Efficiency * Allocative Efficiency.

The theory of the optimizing peasant is based on the assumption that the “overall satisfaction and aspiration of the human being can be measured or is a function of a single monetary variable” (Kanafani, undated, p. 7), which is profit. Secondly, the economic man or smallholder farmer is assumed to enjoy perfect knowledge of the market (Todaro & Smith, 2011) and is certain about the outcomes of his decisions.

Lipton (1968) argues that the individual's utility maximization will occur only under perfect competition. Each farmer must be able to predict, with reasonable confidence, the outcome of each array of production, consumption and sales decisions at his disposal (Lipton, 1968). Furthermore, Huang (1985) notes that, to Samuel Popkin in his book "The Rational Peasant", the peasant can best be described like a capitalist firm, where peasants act to maximize gains taking rational production decisions and balancing short and long term interests, just as capitalist firms do. Following from these propositions, to say a peasant is efficient assumes that he is optimizing in his behavior and therefore can be described as an 'economic man'.

There have been critiques against the assumptions that the theory of the optimizing peasant makes. Firstly, peasants cannot be considered to act rationally in terms of efficiency because "they lack sufficient information and live in a world of uncertainty" (Adams, 1986, p. 273), particularly in agricultural production. Again, "capitalist profit accounting cannot be applied to a peasant family farm on which there is little or no wage labor, where the family's own labor input cannot be readily disaggregated into unit labor cost" (Huang, 1985, p. 5). Ellis (1993, p. 80), also argues that the "pursuit of the averagely efficient peasant is elusive and not very meaningful", even though there is evidence of some economic calculations on the part of peasant farmers.

3.2.2 Risk-averse households and the Expected Utility Theory

Scott (1976) popularly argued that peasant farmers are risk averse and demonstrate risk aversion in their decision making (Moscardi & De Janvry, 1977). This risk averse behavior is borne out of necessity rather than choice because the farmers have to secure their household needs from their production, otherwise the family might face starvation (Scott, 1976; Umar, 2014). Todaro and Smith (2011) argue that in circumstances of uncertainties, the motivating force behind the decisions of a peasant is not maximization of income but the family's chances of survival. Accordingly, peasant farmers are not gamblers as there is a thin line between their family's survival and starvation.. Thus, a risk-averse household is more inclined to a smooth food consumption stream as opposed to a fluctuating one as noted by Umar (2014).

Smallholders choose safety and adopt risk management strategies that may produce low but certain returns (Umar, 2014). Risk management involves finding a combination of activities which reduces the effects of risks on the smallholders farm (Mishra & El-Osta, 2002) to secure his

livelihood. As stipulated by Tadesse, Shiferaw, and Erenstein (2015), risk management strategies that farmers can adopt exist at the household (micro-level), community or market (meso-level) and contributors from external sources such as government (macro-level).

At the household level, smallholder farmers have developed a range of methods for managing their risks (Hazell et al., 2010). Some of these strategies include crop diversification and off-farm income generating activities (Lekprichakul, 2009). Similarly, Scott (1976) argues that crop diversification might be evidence of risk aversion. Again, because of risk aversion, peasants whose incomes are near the subsistence level will favor subsistence crops over cash crops (Feeny, 1983).

At the community or market level, risk pooling and sharing strategies exist in the form of mutualization² and mutual help, normally informal or semiformal, but can be developed with more formal structures as they become larger and more established (World Bank, 2011). Smallholders may be willing to engage various types of social insurance in order to reduce and spread their risk (Feeny, 1983). For instance Scott (1976) as cited in (Feeny, 1983) noted that peasants in rural southeast Asia developed their own social-insurance mechanisms which was guided by the ethic of subsistence and reciprocity. The ethic of subsistence meant that, the right of the peasant to survive should be assured in the social- insurance scheme that he is part of. The ethic of reciprocity described a situation where the elites are required to return a flow of justice, protection and subsistence to peasants, just as peasants have shown respect and made payments to them (Feeny, 1983). The ethics of subsistence and reciprocity that Scott described, makes the issue of trust and reciprocity very important within the social insurance mechanism.

Macro level risks are concerned with efforts of the government and donor agencies aimed at managing production risks in farming. According to a World Bank (2005) report, governments must

- understand the country's rural risk profile
- quantify the impact of this risk on the economy and revenues
- design a rural risk management framework; and implement risk reduction and risk transfer strategies.

² A system where a group of people or businesses divide the costs associated with risk and financial losses.

These arguments by Scott have been criticized. Feeny (1983) argues that the assumption made by Scott that crop diversification is because of the risk averse behavior of farmers, is not entirely correct. This is because, a farmer may want to plant different types of crops because he has different lands and wants to maximize expected profits. Again, the peasant farmer may diversify just as an experiment (Feeny, 1983). Furthermore, the ethic of subsistence and reciprocity discussed by Scott illustrated that peasants have a collective rationality. But, problems associated with free-riders, adverse selection and moral hazards exist. Popkin (1979) argues that there must be careful consideration of the individual's rationality because it may not be the same as the collective rationality.

Ellis (1993) notes that risk can be treated as a probability of disaster, and insurance companies for instance approach risk with this perspective. Insurance providers assess the probability that a weather event such as drought may affect crop production and as such must be insured. Freeman and Kunreuther (1997), argues that identifying and assessing the probability of risk allows the insurer to set premiums. The insurance premium to be paid by the smallholder farmer, then becomes the income forgone to achieve certainty or a certain income (Ellis, 1993).

Therefore, there is an expected utility or satisfaction, which is family survival, that smallholder or peasant farmers are willing to pay for through premiums. The Expected Utility Theory (EUT) therefore, posits that the decision maker chooses between risky prospects by comparing their expected utility values (Mongin, 1997).

The Expected Utility theory (EUT) is one of several behavioral economic theories that seek to explain the behavior of individuals in the event of risk or uncertainty. It can be traced back to Daniel Bernoulli in the 18th Century, but formally developed by John von Neumann and Oscar Morgenstern in 1944 in their book 'Theory of Games and Economic Behavior' (Levin, 2006). It has been used as a framework for studying farmer decision making in various contexts, as observed by Ellis (1993); Meijer, Catacutan, Ajayi, Siloshi, and Nieuwenhuis (2015).

The smallholder farmers' decision making under the framework of the EUT can also be explained using the decision tree (Ellis, 1993). A simple decision tree adopted from (Ellis, 1993) can be used to elucidate farmers decision making with insurance adoption. The decision tree has four basic

components; Acts, States, Probabilities and Outcomes. The 'Acts' connotes a set of mutually exclusive alternative actions between which choices have to be made. The 'States' are those uncertain events or states of nature which influence the outcome of the decisions taken. Some 'State variables' are continuous (example, rainfall) but they can be assigned discrete representations such as good or bad, when using the decision tree. The 'Probabilities' are the degrees of belief of the occurrence of an event held by a decision maker. These are subjective probabilities. Finally, 'Outcomes' represent net payoffs made to a farmer because of his decision between two choices. In Figure 4 below, a smallholder farmer has a decision to choose between taking insurance and not taking insurance. He faces uncertain events, either good rainfall or bad rainfall in both cases and he has assigned probabilities to the uncertainty he faces based on his personal beliefs. The choice he makes finally informs what outcome he receives in terms of payouts at the end of the cropping season.

Using the example in (*Figure 4*), suppose a farmer is confronted with 2 decisions; If the farmer declines to take the insurance, there is a subjective probability of 0.6 in the event of good rainfall and he is assured of a \$2000 payout. Similarly, in the event of bad rainfall, there is a subjective probability of 0.4 with a loss of \$375. Mathematically, Expected Utility (EU) for the first 'action' will be $(0.6 * 2000) + (0.4 * -375) = \1050 . Doing the same calculation for the second 'action', EU will be \$900. The assumption is that since smallholder farmers are risk averse, they would opt to take insurance which will give them a net payout of \$300 dollars in the event of bad rainfall, as against not taking insurance and making a loss of \$375 in the same event of bad rainfall.

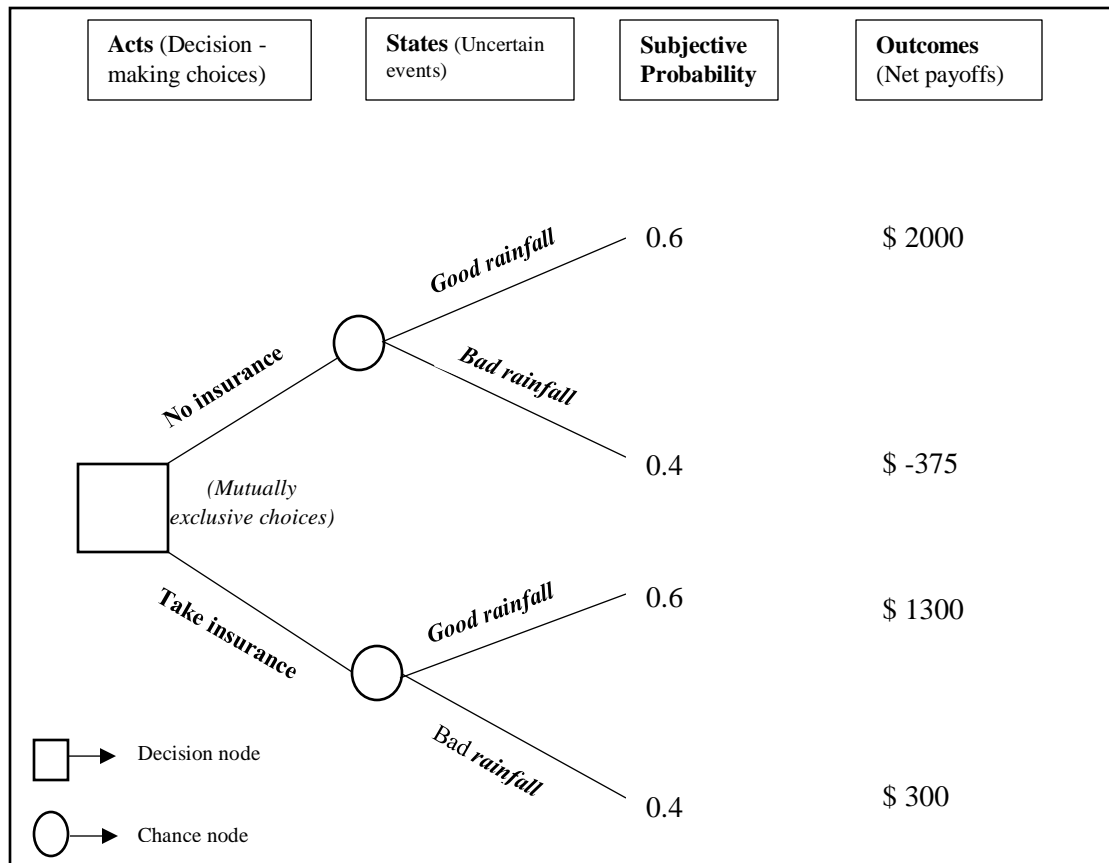


Figure 4: A decision tree analysis of choice under uncertainties

Source: Author, adopted from (Ellis, 1993).

In conclusion, Ellis (1993) notes some critical propositions about smallholder farmers. Firstly, smallholder risk aversion leads to spatial diversification of plots and mixed cropping, designed to increase family food security. Secondly, the risk aversion attitude of peasants inhibits the diffusion and adoption of innovations which could improve the output and incomes of farm households. Meaning that, peasants are skeptical about adopting an innovation because of imperfect knowledge of the innovation, high costs of the innovation or inadequate credit to adopt the innovation (Ellis, 1993).

In sum, both theories raise issues of profit maximization and utility maximization. Whiles (Lipton, 1968; Popkin, 1979) and other proponents of the profit maximizing peasant argue that peasants

take decisions in production with the exclusive aim of maximizing profits, Scott (1976) in contrast argues that peasants are utility maximizers. The utility that peasant households maximize represents the joint welfare of its members, which is avoiding starvation (Ellis, 1993).

3.3 Weather (Drought) index insurance in smallholder farmer settings

Weather uncertainty is the paramount cause of drought risk reduction strategies, such as weather insurance, and it is gaining significant attention as a risk transfer approach for smallholder farmers (Sirimanne et al., 2015).

Index insurance is a relatively new but innovative approach of insurance provision to farmers that makes indemnity payouts based on a predetermined index. Indemnity payments are made to cater for losses in farm investments because of weather events or climatic stress. The index is said to be easily quantifiable, objective, publicly verifiable and not manipulated by the insurer and the insured (Hess, Skees, Stoppa, Barnett, & Nash, 2005). A weather index measures a specific weather variable over a defined period of time at a particular weather station and a defined threshold that establishes the range of values over which indemnity payments will be made (Stoppa & Hess, 2003). The major characteristic of this innovation is that it is based on a proxy such as rainfall measured by an objective independent institution. (Skees, 2011). Therefore, there is no requirement for the services of insurance claims assessors, which increases cost of operation.

Weather index based insurance has been introduced in pilot forms in many countries (Barnett & Mahul, 2007) including Ghana, Malawi and India and some such have moved on into full deployment. It is regarded as having the potential as a major institutional innovation to revolutionize smallholder farmers access to formal insurance (Kloppinger-Todd & Sharma, 2010) and is potentially a much needed cost effective approach to resolving weather related disasters and reducing the vulnerability of smallholder farmers in developing countries (Carter, de Janvry, Sadoulet, & Sarris, 2014).

Traditional crop insurance has been used as a tool to manage risks and complement other risk management approaches against weather disasters, especially in developed countries (Bryla-Tressler, 2011). Traditional crop insurance has existed for some time and it relies on direct measurement of losses that farmers suffered on their farms. However, this form of insurance is

costly especially in locations with large numbers of smallholder farmers (Dick, Stoppa, Andersson, Coleman, & Rispoli, 2011). New products and innovations such as weather index insurance have evolved over time and can be used to transfer various weather-related risks (Barnett & Mahul, 2007). Fundamentally, weather index insurance pays indemnities based on an objective weather index such as rainfall, measured by an independent third party at a particular weather station and over a specified period of time (Collier, Skees, & Barnett, 2009). The period may be monthly or a planting season. Dick et al. (2011) notes that weather index insurance is most suitable for areas where there is a marked rainy season, there is no irrigation and there is a dominant single crop farmed. Thus, weather index insurance will be less useful in areas with complex conditions and micro climates (Dick et al., 2011). Weather index insurance can be applied at the micro, meso and macro levels. But for purposes of this study, I will concentrate on the micro level. At the micro level, the policy holder or the person who buys the insurance could be a farmer, a household or a small business (Dick et al., 2011). Farmers can buy this insurance as a stand-alone product or as part of a package, for instance a credit facility from a financial institution (M. G. M. Hilario, 2012). Furthermore, adequate and affordable reinsurance to protect against financial losses becomes necessary if many policy holders suffer losses from the weather peril (World Bank, 2011). It is critical that insurers have access to appropriate reinsurance coverage (Dick et al., 2011), be it through international reinsurers, national governments or international development organizations (World Bank, 2011). The reinsurance market can provide the insurer or insurance provider with reliable and easy access to financial resources to be able to pay out indemnities that exceed premiums paid by policyholders (Burke, de Janvry, & Quintero, 2010). Not only do reinsurers provide financial risk transfer capacity as their core mandate, but they can also provide technical support to the primary insurer (Dick et al., 2011).

According to Barnett and Mahul (2007) effective implementation of weather index insurance is dependent on governments, donors and international financial institutions. Among other things, establishing an appropriate legal and regulatory framework is essential for the proper regulation of insurance sales and the contract enforcement (Barnett & Mahul, 2007). Donor organizations and government entities provide training on weather index insurance for insurance suppliers and serve as an objective source of information for potential policyholders (Barnett & Mahul, 2007). The provision of subsidies can be part of a well-designed strategy to kick-start insurance by donors.

Nonetheless, Hazell et al. (2010) notes that subsidies should be applied cautiously because evidence suggests that few farmers will be willing to pay the full cost of unsubsidized insurance.

3.4 Principles of an index insurance contract

To discuss the design of weather index insurance in Ghana, I adopt a set of parameters proposed by Dick et al. (2011), which serves as a technical guide for designing a typical Weather Index Insurance contract;

1. A specific meteorological station is named as the reference station.

M. Hilario (2012), argue that there should be a weather station that will record daily amounts of rainfall received and this weather station should be within a 20km radius of farms that have been insured. Since rainfall is the indicator, the assumption is that all insured farms within that radius would record the same amount of rainfall as at the weather station (M. G. M. Hilario, 2012).

Essentially, The World Bank (2005) proposes that the underlying index (rainfall) measured by the weather station must meet the following criteria;

1. It must be observable and easily measured
2. It must be objective
3. It should be transparent
4. It should be independently verifiable
5. Must be reported in a timely manner and
6. Must be stable and sustainable over time. The weather station must have at least twenty (20) years historical data, lacking at most 3 percent of data (Dick et al., 2011).

2. A trigger weather measurement is set (e.g. cumulative, average, maximum or minimum millimetres [mm] of rainfall), at which the contract starts to pay out.

3. A limit of the measured parameter is set (e.g. cumulative rainfall), at which a maximum payment is made.

Skees (2008), notes that index insurance normally has a defined threshold and a limit that establishes the range of values over which indemnities can be paid. He noted that the threshold marks the point where there is a trigger for payment.

4. A lump sum or an incremental payment is made (e.g. a dollar amount per mm of rainfall above or below the trigger).

Skees (2008), explains that with the incremental form, indemnity payment will increase proportionately for each millimeter (mm) of rainfall below the threshold until it reaches the agreed limit where maximum indemnity payments will be made.

Skees (2008), illustrates with an example (Table 2) an incremental payment structure for an index insurance contract. The assumptions for the example are as follows;

- There will be a trigger for payments when the rainfall (*index*) is 100 mm or less. This is the threshold.
- The maximum indemnity payment will be made when the rainfall is at or below 50mm for the season. This value represents the limit.
- The liability purchased by the policyholder is USD 50,000.

Table 1: Payments due under different rainfall -level scenarios

Total Rainfall	Indemnity Payment due
110 mm	None. The threshold has not been reached
80 mm	USD 20,000
50 mm	USD 50,000
40 mm	USD 50,000. The limit of 50 mm has been exceeded, so maximum liability purchased will be paid.

Source: (Skees, 2008)

According to Skees (2008), the indemnity paid per mm of deficient rainfall is calculated by multiplying the payment rate by the amount of liability purchased (USD 50,000). The payment rate is calculated as the difference between the threshold value and the actual realized value of the

index (recorded by the meteorological agency), and divided by the threshold minus the limit. Thus, payment when rain is 80 mm (second case in Table 2) for instance, will be

= (threshold – actual realized value) / (threshold – limit) * Total liability purchased, (*where threshold is 100 mm*)

= (100 – 80) / (100 – 50) * USD 50,000

= 20 / 50 * USD 50,000

= 0.40 * USD 50,000

= USD 20,000

Hence, indemnity payment for the incremental payment structure depends on four factors, which are the threshold, actual value, limit and total liability (Zhang, 2008). According to Skees (2008), all policyholders who have similar contracts are entitled to the same payment rate regardless of the actual losses sustained on individual farms. The amount of indemnity payment received will also depend on the amount of liability purchased from the provider, which is the value of the insurance (Skees, 2008)

5. The period of insurance is stated in the contract and coincides with the crop growth period; it may be divided into phases (typically three), with each phase having its own trigger, increment and limit.

The period covered by the insurance may be the entire life cycle of the crop, or fractions of the crop life cycle (Dick et al., 2011). Additionally, the start of the coverage period of the insurance may either be fixed or dynamic (or flexible) (Mensah, 2016).

Table 2: Summary of Contract and Payout Parameters for Index Insurance

Contract parameter	Options
Triggering Measurement for Weather Variable	Cumulative, Average, Minimum or Maximum.
Period Covered by index	Entire life cycle of crop or Fraction of crop Life cycle.
Number of Phases into which covered period is divided	Typically 1 to 3 phases
Start of Coverage period	Fixed and Dynamic or Flexible
Payout parameters	Options
Trigger	Threshold above or below the calculated value of the index (eg less than 2.5mm of rain, for 13 consecutive days).
Limit	The maximum payout is done if the calculated value of the index is equal to or below the agreed threshold.
Tick	Incremental payout value per unit deviation increase from the trigger.
Payout Structure	Incremental or Lump sum (Single value payout)

Source: (Mensah, 2016).

3.5 Benefits of Index insurance

Below are some benefits of weather index insurance for both farmers and insurance providers spelt out by Barnett et al (2007)

1. The insurance contract is straightforward and simplifies the sales process.
2. Indemnity payments are based solely on the realized value of the underlying index. As such, there is no need to estimate the actual yield loss experienced by the policyholder which increases cost for the insurer.
3. The potential for adverse selection is minimal. Again, there is little prospect for moral hazard since the policyholder or farmer cannot influence the measurement of the underlying index.
4. Operating costs are low relative to traditional insurance products due to the simplicity of sales and loss adjustment. However, start-up costs can be quite significant. Reliable

weather and agricultural production data and highly skilled agro-meteorological expertise are all critical for the successful design and pricing of weather index insurance products.

5. Since absolutely no farm-level risk assessment or loss adjustment is required, the insurance products can be sold and serviced by insurance companies that do not have extensive agricultural expertise.

3.6 Challenges of weather index insurance

3.6.1 Basis Risk

Barnett and Mahul (2007) posit that one major limitation of the weather index insurance is the exposure of policyholders to basis risk. They argued that basis risk refers to the imperfect correlation between the index and the losses experienced by the policyholder. In support of this argument, Collier et al. (2009) say basis risk is the most challenging problem of weather index insurance for both policyholders and providers, and it stems from the variability in the relationship between the value losses measured by the index and the value losses experienced on the farm. Simply put basis risk is the likelihood that indemnity payments are not consistent with actual losses (Zhang, 2008). There is a possibility of the policyholder to experience losses and yet not receive any insurance indemnity. In like manner, it is possible for the policyholder to receive an index insurance indemnity though he has not experienced any rainfall deficiencies.

Skees (2008) notes that the frequent manifestation of these situations will render the insurance scheme impracticable and may even damage livelihoods. He opines that, too much basis risk will deter farmer interest because farmers will feel that the index will not be representative of their loss experience and thus offers them little protection against the risk.

3.6.2 Weather stations

World Bank (2011) note that weather stations and infrastructure that are used for index insurance must be readily available. In the absence of these, the index insurance may not be reliable. Furthermore, weather stations or even satellite imagery can also be used to provide reliable indexes as the basis for payments (Skees, 2008) and significant investments that are made to increase the number of weather stations can help in reducing basis risk (Bryla & Syroka, 2007).

3.6.3 Education

Inadequate knowledge of insurers and farmers about how the index insurance contract works is a principal challenge. Therefore, there is a need for intensive education programs for both farmers and insurers. This is because weather index insurance is a new innovative concept and any rollout of the product requires in-depth education to help them understand the conditions and principles of the payout system (World Bank, 2011). Skees (2008) notes that potential policyholders may have no previous experience with insurance or similar products. Therefore, there is the need for education to convey the concepts of index insurance that will enable them assess its practicability as an effective risk management strategy (Skees, 2008). Potential policy holders need to be exposed to specific features of the index insurance including claims processes and to hold realistic expectations regarding payouts (Dick et al., 2011). Particularly, communicating the idea that the insurance payout is not triggered by losses that occur on individual farm plots, but rather by the measurement of the indexed weather variable is crucial (Dick et al., 2011). Likewise, local insurers and government regulators require education on index insurance (Skees, 2008). Insurers require substantial technical assistance in designing contracts plus extensive capacity building to enable them undertake the innovation on a sustainable basis (World Bank, 2011).

3.7 Sustaining weather index insurance

Weather index-based insurance has been carried out on several pilot programs in recent times (Balzer, 2010). Though in its nascent stages, it has proven to be a viable option for the rural poor to cover crop production risks emanating from unfavorable weather such as droughts (Balzer, 2010; Bryla & Syroka, 2007). In addition to reducing production risk for crop farmers, index insurance may facilitate access to credit and farm inputs (Balzer, 2010; Hazell et al., 2010; Skees, 2011). Hellmuth, Osgood, Hess, Moorhead, and Bhojwani (2009) also argue that if it is designed and introduced carefully, it can lead to sustainable development. The sequential benefits of index insurance reported in pilot regions makes it important to seek out possibilities for more large-scale implementation.

First of all, improving weather data and infrastructure has been identified as a necessity for sustainable index insurance scheme (Bryla & Syroka, 2007; Hazell et al., 2010). Since an index is required as a proxy for insurance contracts, weather data must be reliable, trustworthy and

consistent in collecting data daily while satisfying quality requirements prescribed by the World Meteorological Organization (WMO) (Hess et al., 2005). This is necessary to reduce the ever present challenge of basis risk associated with index insurance. Bryla and Syroka (2007) asserts that inadequate and unreliable weather data may not represent sufficiently a consumer's weather risk profile. Furthermore, it is needed for insurance providers to charge commensurate premiums (Bryla & Syroka, 2007).

The challenge however has been that, it is rather difficult to acquire meteorological data spanning 25-30 years in low income countries (Tadesse et al., 2015). They are either incomplete or missing, argued Tadesse et al. (2015). For instance, the three northern regions of Ghana with a total of 50 districts has only 18 weather stations covering the entire area (Oppong-Ansah, 2013). The number is inadequate if the goal of minimizing basis risk is to be achieved. This situation is making several donor and international organizations to support countries that are adopting weather index insurance, with automated weather stations. In 2012 / 2013 Ghana benefited from such initiatives when the German Agency for International Cooperation (GIZ) provided 36 automated weather stations to the Ghana Agricultural Insurance Pool (GAIP) (Oppong-Ansah, 2013). In addition, Feed the Future in 2011 installed 5 automated weather stations in 5 districts in the Northern and Upper West Regions of Ghana for GMet (Feed The Future, 2012)

Secondly, capacity building is another way through which index insurance can be sustained (Miranda & Farrin, 2012). Building the capacity of local people is fundamentally done through education, outreaches, technical assistance (Hellmuth, Osgood, Hess, Moorhead, Bhojwani, et al., 2009; Miranda & Farrin, 2012) and creating a sustainable cooperative working relationship among stakeholders (Miranda & Farrin, 2012); farmers, lenders, insurance providers. Client education strategies as Hazell et al. (2010) suggested, are necessary to introduce smallholders to available insurance products.

Skees and Collier (2008) recognize the role of governments as facilitator for long term insurance sustainability. Accordingly, Miranda and Farrin (2012) argue that even developed countries have sustained their agricultural insurance markets because of government interventions through subsidies. They argue these came in the form of premium payments for farmers, reimbursing administrative costs borne by private insurers and undertaking reinsurance agreements that are actuarially favorable to insurers. It presupposes that governments with limited financial resources

are unable to support agricultural insurance, making it unsustainable. Thus, governments with a weak financial standing may be unable to undertake effective capacity building strategies. Donor support in these instances will be required to assist and improve investments in capacity building (Skees & Collier, 2008) .

3.8 Conceptual Framework

The concepts and theories that have been discussed at the beginning of this chapter has been used to develop a conceptual framework which will guide this study and aid in addressing the objectives and research questions as outlined in chapter 1. The conceptual framework (Figure 5) shows the relationship that exists among key variables in this study.

Firstly, climate change makes agriculture a risky business. One significant agricultural risk is production risk. Smallholder farmer's battle with weather related events among others such as pest and diseases. However, what farmers perceive as their production risk is subjective. Therefore, knowing the production risk perceptions of farmers is essential to understanding the risk management strategies that they adopt (Bishu, 2014). In areas such as Yendi municipality which is drought-prone, drought is a major risk that crop farmers have to deal with in their production. However, drought can be classified into four main types. All these types of drought as explained in *Section 3.1.1* are related but originate from meteorological drought. Meteorological drought provides the basis for index insurance contracts.

On the other hand, the risk attitudes of smallholders also influence the kind of decisions they adopt in managing their risks. Risk attitudes deals with a farmer's interpretation of risk and how much he likes (risk seeking) or dislikes (risk averse) risks (Bishu, 2014). Smallholder farmers have been noted to be risk averse, because of this attitude, they engage a host of activities that either prevents, mitigates or copes with the risks that they face in production. Smallholder farmers employ risk management activities available at the household, community and macro levels. Particularly at the community or market level, smallholder farmers can engage insurance to reduce their economic vulnerability when shocks come because of adverse weather. A novel type of insurance which relies on an index such as rainfall deficits can be employed by smallholders against the drought weather peril.

All the variables in this conceptual framework show a linear relationship between one variable to the other. However, I reckon that there are influencing factors. For instance, farmer's production risk perceptions because of its subjective nature is influenced by their beliefs, culture, and knowledge among others. However, this study did not pay attention to such factors when analyzing and discussing the empirical data. In the end of this study, this conceptual model will be assessed by using empirical data to show its relevance and appropriateness for this study.

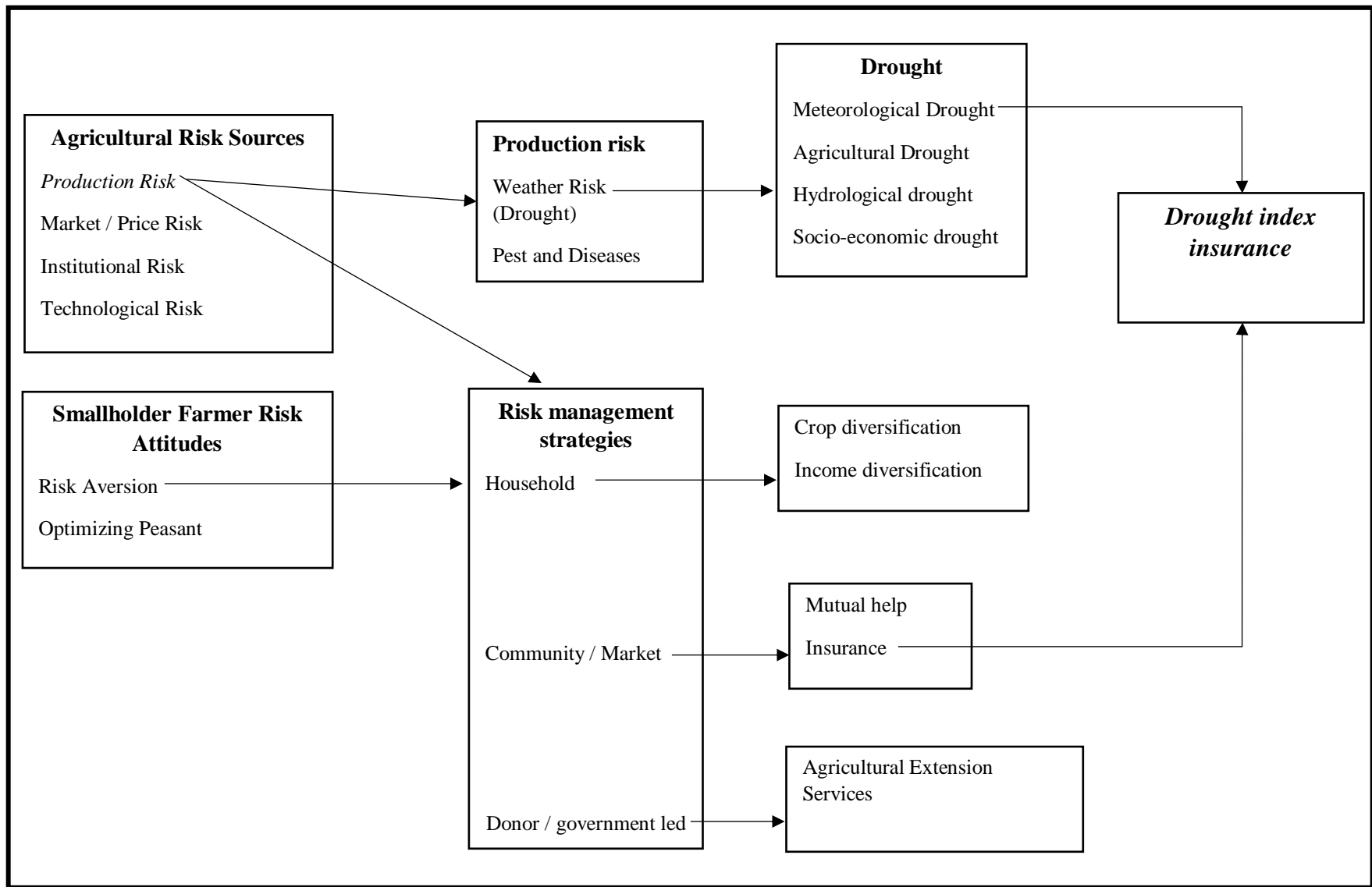


Figure 5: Conceptual Framework for this study

4.

METHODOLOGY AND RESEARCH PROCESS

4.0 Introduction

In this chapter, I present the methodology used in conducting this study. I provide information about how research communities and informants were selected, what kind of data was gathered, how the data was analyzed and the challenges that were encountered on the field.

According to Kothari (2004), research methodology is a process of systematically solving a research problem. Within it, we study the various steps adopted by a researcher in studying his research problem along with the rationale behind them (Kothari, 2004). Selecting a methodological approach is dependent on what the research seeks to achieve, or the objective of the research. This study is meant to be descriptive and explorative and employs a qualitative research approach. The study aims at exploring smallholder farmer's risk perceptions and attitudes and a concept, index insurance, which is new to smallholder farmers in Ghana. As new a concept as this is in Ghana, it is imperative that its design and structure is explored.

4.1 Justification for methodology

Qualitative methods were adopted for this study because of its ability to provide information about the human side of a phenomenon under study. It emphasizes on the beliefs, opinions, behaviors, emotions and experiences of people in a research issue. The whole idea of qualitative research is to gain a rich understanding of a phenomenon commonly using 'why' and 'how' in asking questions.

There is a significant level of spontaneity in qualitative research, which reveals its flexible nature (Mack, Woodson, MacQueen, Guest, & Namey, 2005). It allows the researcher to ask open-ended questions, while giving the opportunity to study participants to respond elaborately and in great detail. During the interaction between researcher and study participant, there is probing for deeper insight and researchers can respond immediately to answers of participants by asking for clarification based on previous responses. One major advantage that qualitative research has is that open-ended questions can provide researchers with both solicited and unsolicited facts that are relevant to the study. Researchers always have some understanding of the study from past

literature. Nonetheless, it is common that researchers do not anticipate some of the responses and explanations that participants provide, and are often taken by surprise by some responses of participants. This is what qualitative methodology offers, deep and diverse understanding of subject matter, rich and explanatory in nature (Mack et al., 2005).

The advantages of qualitative methods make it appropriate to be employed for this purpose, in spite of several criticisms been leveled against this methodological approach. Among the criticisms of qualitative methods, it has been argued that the relatively small numbers of participants make it less likely to be taken seriously by policy makers. Secondly, because of the large amounts of data that qualitative methodology produces, it is time-consuming to analyze and therefore more expensive.

4.2 Sampling Sites and Informants

“Even if it were possible, it is not necessary to collect data from everyone in a community in order to get valid findings” (Mack et al., 2005, p. 5). In qualitative research, sampling informants are connected to the decision about which persons should be interviewed and which groups they should come from (Flick, 2009). This presupposes that there must be a deliberate attempt to select informants with direct reference to the research questions being asked (Bryman, 2015). Thus, qualitative sampling essentially revolves around the notion of purposive sampling (Bryman, 2015).

The objectives for this study heavily rested on the concept of weather (drought) index insurance. Therefore, it was essential to employ a sampling technique that would select informants who are aware of the existence of an index insurance product in their community. For that reason, I employed a purposive sampling approach, together with snowball sampling technique. According to Bryman (2015), Snowball sampling is a technique whereby the researcher initially samples a small group of people relevant to the objectives of the research , and these participants suggest other participants who have had an experience relevant to the research.

4.2.1 Site and Informant Sampling process

When I arrived in the Yendi Municipality, I visited the municipal office of the Ministry of Food and Agriculture (MOFA) to explain the objectives of my study and ask for a name of any

community where index insurance had been implemented. I went to MOFA because they have direct contact with farmers and can provide names of communities that were involved in the insurance scheme. An official at the MOFA office gave me the contact of one farmer from Sunsongbon whose son was a sales agent for IPA. I proceeded to this community and started my interviews after asking for permission from the chief of the community. When I completed my interviews with smallholder farmers in this community, I asked the sales agent to provide me with the name of another community that also had knowledge of the insurance product. He then took me to Nkwanta, about a kilometer away from Sunsongbon. The sales agent in Nkwanta also referred me to Kpatia, which was the third community I studied. Thus, there was a chain of referrals from one community to the other, by the help of the sales agents. However, my sites were supposed to be within a 20-km radius of a Ghana Meteorological (GMet) weather station (*Table 3*). This was an additional criterion I used even as the sales agents referred me to new communities. With the help of the sales agent, I visited the first smallholder farmer who had taken insurance. I continued to interview all other farmers by referrals from that farmer and the sales agent. I repeated this process in the three other communities that I visited.

Table 3: Distance between communities and weather station

Name of Community	Distance to weather station
Sunsungbon	18 km
Nkwanta	15.5 km
Kpatia	8.4 km

Source: Author, based on field data.

4.3 Data Collection

Collecting data begins after a research problem and design have been defined (Kothari, 2004). This study collected relevant data about the subject matter of the study from primary and secondary sources. Primary data are those which are collected for the first time and therefore are original. It is generated by the researcher, hence self-constructed (Cloke et al., 2004). A typical advantage of

collecting one’s data as observed by Hox and Boeije (2005) is that the “data collection strategy can be tailored to the research question, which ensures that the study is coherent and that the information collected indeed helps to resolve the problem”. Secondary data, on the other hand, are those that have already been collected by other people (Kothari, 2004). They include existing literature, agency reports, among others. Cloke et al. (2004) refer to secondary data as pre-constructed material.

4.4 Primary Data and Informant Characteristics

Primary data was collected through one-on-one interviews, focus group discussions, observations and photographs. There was a total of 36 primary informants (*Table 5*) and 7 key informants. Out of the 36 primary informants, there was one female over the age of 45 years in Nkwanta, who had not taken insurance. I collected this data between the dates 25th June 2016 and 4th August 2016 in the Yendi Municipal Area. One on one interviews were conducted by using a semi-structured interview guide.

Table 5: Primary Informants by age group and insurance adoption status

Communities	Taken Insurance		Not Taken Insurance		Total
	<i>Less than 45 years</i>	<i>45 years or more</i>	<i>Less than 45 years</i>	<i>45 years or more</i>	
Sungbon	2	5	2	2	11
Nkwanta	6	1	2	3	12
Kpatia	5	4	2	2	13
Total	14	10	5	7	36

4.4.1 Interviews

Bryman (2015) argue that the most widely used method of data collection in qualitative research. It is fundamentally a conversation between a researcher and a respondent to gain understanding of the underlying reasons and motivations for people’s attitudes, preferences or behavior (Bryman,

2015). It has the advantage of allowing in-depth questions and follow-ups, as well as assessing the tone of voice, facial expression and other characteristics of the respondent.

For the study, farmer household heads, either male or female, were interviewed one-on-one. The operational definition of a household head used during this study is, a male or female member of the household recognized as such by other household members, and is responsible for the economic and social welfare of its members (Ghana Statistical Service, 2014). The household connotes “a person or a group of persons, who live together in the same house or compound and shared the same house-keeping arrangements” (Ghana Statistical Service, 2014). Household members are not necessarily related by blood or marriage and can consist of a man, his wife, children and other relatives.

It was imperative that households who had taken the index insurance were selected for interviews as well as households who had not taken the insurance. Though the study was not meant to be strictly comparative in nature, it was necessary to interview farmers from both sides to understand their opinions and reasons for the attitudes they portray towards index insurance and the risks they face during crop production.

In addition to the farmer household heads, I interviewed 7 key informants. These were people in organizations that were directly or indirectly involved with the provision of index insurance in the region. The insurance is provided by a pool of insurance companies under the Ghana Agricultural Insurance Pool (GAIP) and GAIP officials were in the best position to respond to pertinent issues regarding the development and design of the index insurance. As such, I decided and was fortunate enough to interview two officials from GAIP on-on-one in English Language. The first person was the marketing officer for GAIP in the Northern region. This interview was done in their northern regional office in Tamale, Ghana. The second person was the country underwriter for GAIP. The interview was conducted at the Head Office of GAIP in Accra, Ghana. The second interview with the underwriter was conducted after I had returned from the study sites in the Northern region. By this time, I had interacted with several other officials who had increased my understanding of how the index insurance product worked. Therefore, I used this to my advantage to ask further questions. First, to confirm what other officials on the field had said to me, and secondly to clear any misunderstandings and misinformation that had emanated from interviews with other officials. It is worthy to note that, the underwriter of GAIP confirmed in many regards what the marketing

officer and other officials had already made known, and provided more detailed information that the marketing officer in the Northern region was not permitted under codes of conduct to disclose. This situation improved the credibility of the data I had gathered from GAIP. Furthermore, the marketing officer for GAIP in the Northern region continued to provide me with more information, even after returning to Norway through telephone calls and text messages. A typical example is, on the field in Ghana, I was informed that smallholder farmers had to pay 10 percent of their production cost as insurance premium. But the marketing officer notified me through a text message that, the insurance premium had been reduced to 5 percent in 2017.

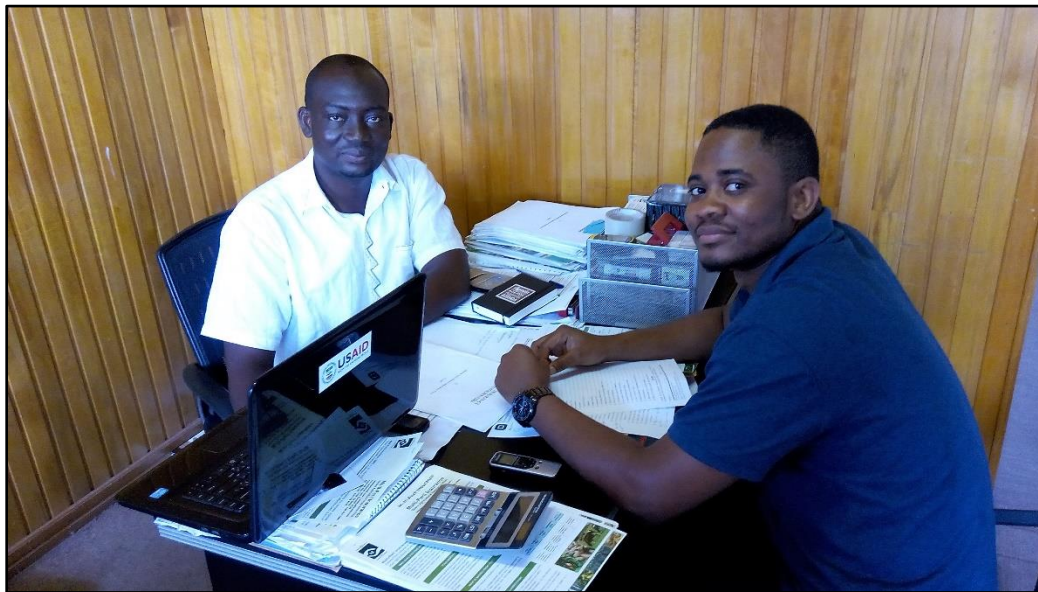


Figure 6: Interview session with the marketing officer of GAIP in the Northern Region

In addition, I interviewed an official from Innovations for Poverty Action (IPA). IPA is a research based non-governmental organization. In the Northern region, they have been involved in agricultural research and have partnered GAIP to disseminate index insurance to smallholder farmers. According to the underwriter for GAIP, IPA is currently the only institution that actively sells insurance for GAIP. Because IPA also had direct contact with the farmers through their sales agents, I deemed it fit to interview an official from there. Furthermore, the crops officer for the Ministry of Food and Agriculture (MOFA) in the Northern region, the head of the climate change adaptation unit of the Savanna Agricultural Research Institute (SARI), an official from USAID

ADVANCE Ghana, and an official from the Deutsche Gesellschaft für Internationale Zusammenarbeit (German Society for International Cooperation – translated from German) (GIZ), were interviewed. Also, I came in contact with some of the sales representatives of IPA in the communities. They provided me with some valuable information in their capacity as community sales agents and farmers.

Before leaving Norway to Ghana, I had booked an appointment with the official at GIZ (Team Leader - Integrated Climate Risk Management (ICRM)), at the GIZ head office in Accra for the 25th of July 2016. Appointment with the underwriter of GAIP was also scheduled for the 22nd of July 2016, while in Ghana. Favorably, all other interviews with key officials did not require specific interview dates and times. The interviews lasted between 35 minutes to 90 minutes. All the interviews were recorded with a Philips audio recorder for later transcription. Because key informants were in different institutions and primarily concerned with different issues, it required tailored interview guides to extract relevant information. (See Appendices). It would be inappropriate to use the same interview guide for GAIP and SARI, because GAIP is the insurance provider and SARI is concerned with developing sustainable crop production systems for farmers. They have separate mandates and realistically, GAIP will have more information about the design and development of the index insurance product. The interview guides were semi-structured so I had the flexibility to interact with officials and farmers and probe further based on their responses while staying within the confines of the interview guide. I started every interview with a brief of myself and the reasons for doing this research. Respondents were assured of confidentiality and they had the option to withdraw at any point in time from the interview. Each interview was recorded with permission, except the interview with the official from GIZ. For the smallholder farmers, the period of the study was during their crop planting season, so some interviews were conducted in the evening.

4.4.2 Focus Group Discussion

A focus group discussion is a technique to collect data which involves gathering a small group of participants, often moderated, to discuss a specific topic of interest (Wong, 2008). Crang and Cook (2007) point out that focus group discussions rely on frank and fluent discussions. The group can comprise of 6-12 people. There is constant interaction between the study participants and the

moderator, as well as among participants. Bryman (2015) notes that, it is important that the moderator is not too intrusive and the approach of the discussion should not be structured. Though the moderator is supposed to guide the discussion on a particular topic, there should be enough allowance for participants to digress which may reveal some completely new information that will be of interest to the researcher (Bryman, 2015). The researcher does not necessarily have to be the moderator (Crang & Cook, 2007).

I conducted two focus group discussions in Sunsongbon and Nkwanta, leaving out Kpatia. I left out Kpatia because the information gathered from the previous 4 discussions were repetitive and had reached a point of saturation. In Sunsongbon, I gathered a group of 7 farmers who were below the age of 45 years and another group of 6 participants 45 years and above. As noted by Wong (2008) the group members may be homogenous or heterogenous along certain dimensions and the choice is mostly influenced by the purpose of the research. The group comprised of a mix of farmers who had or had not taken insurance. Some of these smallholder farmers were initially interviewed one-on-one. I made these groupings based on age, to explore the impact of different age groupings on their perceptions of the agricultural insurance. My initial assumption was that, young farmers (below age 45) would have a positive perception of insurance during the group discussion, as opposed to older farmers (45 years and above). The discussions in Sunsongbon took place at the entrance of the chief's palace. Similarly, in Nkwanta I repeated the process and there were 6 farmers who were household heads below age 45 and 6 smallholder farmers above 45 years. Most of the smallholder farmers were male. There was only one female who was part of the focus group discussion in Nkwanta. One of the research assistant moderated the sessions in my presence. During the discussions, I recorded, observed and made notes of their reactions, facial expressions among others. Some participants were reserved while others were actively commenting and engaging colleague farmers in friendly arguments.

The main topic for discussion was the perceptions that farmers had about weather index insurance, which they commonly call 'Faarigu' in Dagbani language. I provided the moderator with a discussion guide to direct the discussions but not to limit it to it. The moderator asked them questions in relation to the cost of the insurance, claims process and payments and their motivation for taking or not taking the insurance. These questions were intended to stir up deep conversations and probably reveal other information that was not acquired during the one-on-one interviews.

Other issues that came up for discussion was their views on the pattern of rainfall over the past 10 years. Discussions lasted between 30 and 60 minutes in these communities.

Focus group discussions possess great potential but face some challenges. Some of which are, the researcher has less control over proceedings in comparison with the one-on-one interviews. Again, huge amounts of data are produced and therefore it may be difficult to organize and analyze. Thirdly, when two or more participants speak at the same time, it becomes difficult to separate and transcribe appropriately (Bryla & Syroka, 2007). However, during the focus group discussions, I made sure all cross talks were recorded and the exact time was recorded by it to reduce the uncertainty when transcribing.

4.4.3 Non-Participant Observation

According to Flick (2009), aside the benefits that come with speaking and listening used in interviews, observing is another methodologically systematized skill used in qualitative research. Observations integrates the seeing, hearing, feeling and smelling senses in its technique. There are basically two forms of observation; participant and non-participant observation. This study employed non-participant observation. Non-participant observation is a method of collecting data where the researcher watches the subject in his or her usual environment without altering that environment (Hox & Boeije, 2005). During non-participant observations, researchers try to disassociate themselves from interactions. This is done to avoid participant bias, or to prevent participants from changing their behavior because they realize someone is recording their actions. Non-participant observation can also be conducted by video recording.

In the field, I observed events using the non-participant observation approach. This was meant to complement data received from my focus group discussions. It was used to reveal non-verbal gestures which help to assess the reliability of answers provided by the respondent. In Nkwanta and Sunsongbon where I conducted focus group discussions, I stayed aside to observe and record participant's facial expressions, and gestures while discussing the topical issues. During the one-on-one interviews, too, I managed to observe some gestures from smallholder farmers as they responded to questions. I also visited the farms of the smallholder farmers to observe their planting practices and see at first-hand how they diversify their crops on the field. Doing all these things helped me to reconcile some of the responses that I received during the interviews,

Regardless of the benefits of observations, it is flawed by the assertion that there may not be verbal explanation or understanding of the reasons why people behave the way they do, especially when observations are used as the only methodological technique for the study. Nonetheless, in instances where it is used to complement focus group discussions and interviews, like in this study, then there is a basis for some understanding and careful interpretation.

4.4.4 Research Assistants

All the interviews with key officials were conducted in English language. However, interviews with farmers were conducted in their language. Majority of them spoke the Dagbani language, and a few of them spoke Konkomba language. Because I do not understand these languages, I used two research assistants. Both research assistants spoke the Dagbani and Konkomba languages and they also live in the Northern region. Before I started the research, I trained the research assistants by explaining the objectives of my research to them. I combed through all the questions with them and explained my expectations to them. I trained them one by one at different times and on different days. The rationale for doing this was to make sure that, they gave me the same responses when I asked them to explain certain key words. For instance, I asked them to explain a key word, drought, in the local language and I recorded it. Then, in the process of training the second person, I expected to hear the same explanation of the same key word. It required 3 days to do this training but, it was necessary for data reliability purposes. The assistants have undergraduate tertiary education, so making them understand the basic objectives of the research was smooth. More so, because they come from and reside in the Northern region, they had basic knowledge of the farming practices and the risks that smallholder farmers face.

In each of the three communities, IPA had sales agents who could speak the local language and the English language. I initially had an interaction with each agent and explained the objectives of the study to them also. I used the process I used for my research assistants and they were able to explain key words appropriately to me, just as the two research assistants did. Because I was fortunate enough to have this human resource available, I used them as interpreters as I conducted my interviews. My research assistants were with me during the process and assisted me in probing for more answers when they deemed it necessary. This process I must say was time consuming but reliability of data could not be comprised.

4.4.5 Community Entry

Before I collected the primary data from smallholder farmers, I had to go to the community head or the chief to ask for permission to conduct the research. I met the chief of Sunsungbon and explained the research objectives to him, before I started my interviews with farmers. The chief expressed interest in the topic because he had also taken the index insurance. The chief did not speak English, so he summoned a teacher from the community to act as an interpreter for him. So, I spoke English to the interpreter and he translated it into Dagbani for the chief. Because I had my research assistants with me, they could clarify miscommunications when the interpreter wrongly explained to the chief. Moving on to Kpatia and Nkwanta communities, I did not have to meet the community heads. However, I still informed my contacts in these communities about my coming. My contacts were agents of IPA who had been referred to me by similar agents in Sunsungbon.

4.5 Secondary Data

Scientific journals, articles, conference documents, institutional reports and books served as good sources of secondary data. Also, I collected rainfall data from GMet for the Yendi Municipality for the period 1980 to 2015. This data was collected to provide evidence for the variability in rainfall pattern, as was indicated by some officials. The concept of index insurance has been embraced in some developing economies. In some countries, it is in the pilot and experimental stages, and in other countries it is fully implemented. In Ghana, however index insurance served as the first insurance scheme for farmers and not much academic work has been done on this in Ghana. The works of Stutley (2010) and Mensah (2016) have contributed immensely to providing some academic material on index insurance in Ghana. Most of the literature available on index insurance were studies and experiences from other African and particularly Asian countries. However, there is numerous existing literature on risk perceptions and behaviors of smallholder farmers in developing countries.

Using secondary data is beneficial in the sense that, it can deliver relevant information which can aid comprehension of the current research and at the same time complement primary data (Mikkelsen, 1995). Nonetheless, one weakness of it is that, secondary data may have been produced from a distinct geographical or cultural setting and thus may not be easily applicable for other research works which may have different contexts.

4.6 Data Analysis

After putting all data collected together, it is ready to be sorted and analyzed. This research work primarily was intended to be explorative in nature. Hence, I broadly categorized the content of the data into themes in connection with my research questions and objectives. I employed the content analysis approach to qualitative analysis. Content analysis is a method which classifies written or oral materials into identified categories of similar meanings (Cho & Lee, 2014). According to Hsieh and Shannon (2005) the categories represent respondent's inferred or specific communication. In line with the assertion of Hsieh and Shannon (2005), I strived to present the comments and opinions of smallholder farmers and key informants by quoting them and inferring meanings from their response.

To perform content analysis, there are two approaches; the deductive and inductive approaches. In the deductive approach, the researcher has preconceived themes and categories derived from prior research from which his data will be tested. On the other hand, the inductive approach begins with the creation of categories or themes, drawn from the field data (Elo & Kyngäs, 2008). The inductive approach is suitable when there is limited knowledge about phenomenon under study. I employed the inductive approach to create themes which enabled me to answer my objectives and research questions. In the process of collecting the data, I had already recognized some themes emerging. Therefore, generating more themes after I had put all the information together, was straightforward. Furthermore, I used the Microsoft Excel spreadsheet program to analyze average monthly rainfall data (1980-2013) from GMet.

4.7 Validity and Reliability

According to Bryman (2015), validity of a research process describes the integrity of the conclusions that are generated from it. Validity is based on determining whether the findings of a research are accurate from the viewpoint of the researcher, participant and readers of the study (Creswell, 2013). Qualitative research has been open to several criticisms due to the subjective nature of data collection and analysis. Therefore, it is imperative to adopt approaches that increase the credibility and validity of the findings of the research.

Creswell (2013) proposed a few strategies that are most frequently used to assess the accuracy of the findings. The first strategy I adopted was data triangulation. According to Bryman (2015, p. 392), “triangulation entails using more than one method or source of data in the study of social phenomenon”. Data triangulation basically describes an approach where findings from a qualitative study is strengthened by showing that several sources information converge at the same theme, or at least, do not oppose each other (Decrop, 1999). On this basis, I used semi-structured interviews, focus group discussions and non-participant observations to complement each other. Though some of the individual interviewees were part of the focus group discussions, their responses did not influence the comments of other participants in the group. All the participants were observed to have strong opinions of the subjects discussed.

Similarly, there were different interview questions for key informants who were connected to the insurance scheme. Intentionally, some of the questions were the same for different informants coming from different institutions. For instance, I repeated some questions about how claims are paid to the farmers after the cropping season, for the key informants from GAIP (both regional and head office) and IPA. The rationale behind this was to cross-check if the information all these three key respondents were given me were the same. As expected, they were consistent with each other and this improves the validity of the findings. More so, on my return from the field, I consistently reverted to one the key informant in the Northern regional GAIP office with semi-polished findings to be sure I was presenting the exact and true findings. According to Creswell (2013) the researcher can take back parts of the ‘polished’ or ‘semi-polished’ products, such as major findings to check for accuracy. Furthermore, some of the interviews with key informants were well spaced apart. This allowed me to have a deeper understanding of the concepts from previous interviews and develop appropriate follow up questions for the next key informant to clear misunderstandings.

In connection to validity, reliability of the data comes in to play. Reliability indicates that a particular approach will yield consistent results in different researches (Creswell, 2013). Thus, the approach if repeated within the same period of time by other researched will have similar results. To ensure reliability or dependability of my findings, I employed two research assistants who could speak and write the local language of the primary respondents to serve as interpreters, because I do not speak their language. In addition to these research assistants, sales agents of the insurance providers were literate in both English and the local language, and therefore reaffirmed the

meanings of farmer's comments. The sales agents and the research assistants served as checks for one another and mostly agreed on the meanings of what the farmers intended to communicate in the local language. Again, I strived to avoid leading questions in my interview guide, so that the opinions and responses from the farmers were pure and not influenced by the researchers view point.

Nonetheless, to achieve similar findings of farmer's perceptions, further research must consider the socio-economic and geographical settings of the study area. Areas that do not have the similar settings may result in different results. Though weakness exist in this approach, findings are trustworthy because site and respondent selection, data collection methods and analysis have been approached with appropriate research skills and knowledge.

4.8 Ethics

According to Bryman (2015), the researcher has to pay attention to ethical issues because it relates directly to the integrity of the research. As much as the objectives of the research have to be met, the researcher must do well to respect and observe the rights of the research participants (Orb, Eisenhauer, & Wynaden, 2001).

I set appointments with key informants prior to the interviews through email messages and by phone calls. At the start of the interviews, I introduced myself and provided information about my study. I then asked for their consent to record them. All of them except one key informant in GIZ, agreed to be recorded. I also asked for permission from smallholder farmers to record them and take pictures of them during the interviews. All audios and photos recorded were without duress and informants were at liberty to withdraw from the interview, at any time. The responses of the interviewees, were stored securely to ensure privacy. Some key informants have requested for a copy of the finished work and I intend to deliver it to them in confidence. I obtained permission from individuals whose photos appear in this thesis.

4.9 Challenges and limitations

Collecting data in the field always presents some challenges. On the field, it was difficult for me to get the first community that had knowledge of index insurance. This was because, officials had

to seek permission to release the names of communities that were involved, and this process was long. Initially I was supposed to perform this study in the Tamale metropolis. When I tested my interview guide on one farmer in Tamale, he revealed that I was not going to find much information. I then had to move to another district, Saboba, still in the Northern region based on the advice of this farmer, but there was not much luck there either. From Saboba, I was directed to Yendi and there I found some communities which met the criteria I had set for site selection. This was a major setback during data collection because I spent about a week on the road looking for the appropriate communities. Hence, I was behind on my working schedule. However, it did not affect the quality of the data gathered.

Secondly, some officials were not in the position to provide some sensitive information that could have added more to this project. Some confidentiality clauses had to be adhered to. However, I still appreciate the invaluable information that they provided.

Smallholder farmers in some cases deviated from the subject matter to discuss other issues or problems they were facing. I had to strategically bring them back to the subject matter of the study. I had to be careful doing this so that farmers do not think I am insensitive to their problems and only want information from them. When farmers have such conceptions, it could sway their responses or even their willingness to continue with interview.

5.

SMALLHOLDER FARMER'S PRODUCTION RISK PERCEPTIONS, RISK ATTITUDES TOWARDS RISK MANAGEMENT STRATEGIES

5.0 Introduction

This chapter begins with a discussion of the production risk perceptions of smallholder farmers in Sunsungbon, Kpatia, and Nkwanta. Then, it continues with a discussion of the risk attitudes of smallholder farmers. Smallholder's production risk perceptions and their risk attitudes are used to explain their decision to adopt risk management strategies including drought index insurance. In doing this, I present some comments from the smallholder farmers in the three (3) communities studied. Their comments indicated that farmers' decision to take insurance is informed by a safety-first mentality, as they seek to safeguard their families from starving.

5.1 Farmers production risk perceptions

Farmers were questioned on what they regarded as the risks they face in their crop production. This was meant to explore what farmers perceived as their most significant risks. According to Sulewski and Kłoczko-Gajewska (2014), risk perception is essential for choosing an effective risk-coping strategy, because a farmer who is unaware of the risks he faces is unable to manage them effectively. In addition to pests and diseases, there was almost a common response, pointing out that uncertainties in the rainfall pattern and drought are the most critical risks that maize crop farmers are confronted with in the study sites.

Drought in the local Dagbani language is known as '*Sanzali*'. "*Drought is when there is very low rainfall*" [Male farmer in Sunsungbon]. From the explication of farmers, there is an understanding that drought denotes a situation where there is a deficiency in rainfall amounts which affects their crop yields. According to Palmer (1965), drought can mean different things to different people depending on their interest. However, to a farmer, drought is simply a shortage of moisture for his crops. From this point of departure, the responses of smallholder farmers without knowledge of the possible types of drought described in academic work (*see chapter 2*), are describing or illustrating agricultural and meteorological drought. Agricultural drought is the shortage of water

for crop growth (Mortimore, 1989), while meteorological drought involves precipitation deficiencies in terms of amounts, intensity and timing (NOAA, 2008b). Agricultural drought, however, links various characteristics of meteorological drought to impacts on agriculture (Wilhite, 2000). Below is a focus group discussion in Sunsongbon, where smallholder farmers discussed their crop planting times, and rainfall patterns and how it affects their crop yields.

[Farmer 1]. These times the rains come very late so our planting times too are late

[Cross Talk]. Every year it changes

[Farmer 2]. Last year by now I was harvesting but now they are not even mature.

[Cross Talk]. My own is still germinating. Mine has begun to grow leaves. My maize is like yours.

[Farmer 3]. The way it rains these days, we don't even plant all the intended crops else, they will die.

[Farmer 2]. We were babies when our fathers were farming. We grew up and learned the farming and even witnessed how they used to harvest very well. Comparing that to our time, ours is just so small. In fact, it is not there at all. We can plant and be here for up to 3 months without rainfall. And now our children even know there is no rainfall.

[Farmer 1]. Three years ago we had two times of harvest. The rains came well so we planted twice a year. But now we have to buy food in the market to supplement. What we planted and harvested in 2014 is not what we planted and harvested in 2015.

[Cross talk]. It is all about the rainfall

“there is a proverb that, if you buy a hoe and there is no blade, you cannot use it on the farm. This means that the water represents the blade of the hoe. Without the water farming is not possible”. [Farmer 4]

The Yendi municipality lies in the guinea savanna agro-ecological zone of Ghana, characterized by high intra-season rainfall variability. It therefore comes as little surprise that farmers consider rainfall shortages and variability as the primary source of risk for their crop production. As much as they have observed changes in the rainfall amounts over the past ten years, their comments also revealed their worry with the timing and irregularity of the rains. This is coherent with responses from the crops officer at MOFA [Officer 2]: “*When you need the rains, you do not get it and when you do not need it, it is coming too much.*” This comment also brings up the argument of the intensity of the rains. Farmers however

had little to say about the menace of the intensity of rains. Their main concern was with drought.

Maize is a crop that is very susceptible to drought. SARI continues to develop short and medium variety of crops for smallholder farmers, which take 75, 80 or 115 days from till harvesting, instead of the typical 120-day duration for the local or traditional varieties. The expectation is that smallholder farmers will resort to cultivating these short variety crops to reduce their risk exposure to drought. According to Nyantakyi-Frimpong (2013), about 85 percent of households in Northern Ghana still use local varieties of maize. The assumption of the maize farmer is that these local varieties taste better, do not require fertilizer inputs and are easier to store, as compared to the short varieties. If smallholder farmers have not accepted the new varieties of crops that are being developed because of their personal preferences as Nyantakyi-Frimpong (2013) noted, it increases the need for other strategies to tackle the effects of drought on maize crop yields.

5.2 Risk attitudes of smallholder farmers

The attitude that smallholder farmers portray towards agricultural insurance is influenced by their household goals. What satisfaction are smallholder farmers interested in maximizing? Are farmers willing to take risks with this satisfaction in mind? Deducing from the responses of the smallholder farmers during the study, their goal is to be able to provide food for their families and avoid starvation. Simple. Yes, there were indications from some of the responses that farmers also desired an alternative satisfaction or utility; that is making some profit from the sales of their produce in the local markets. . Despite the desire to make profit, the smallholder farmer's primary goal is not to maximize the utility from this alternative. In the sections below, the risk attitudes of smallholder farmers is illustrated through the various risk management strategies that they engage.

5.3 Risk management strategies

5.3.1 Micro-level (Farm household) risk management strategies

At the micro-level, smallholder farmers exposed to drought over time have adopted local strategies to cope with this peril. The most obvious strategy from the research was that farmers have resorted

to cultivating diverse crops to give themselves a buffer against the drought risk. In all three communities studied, farmers noted that in addition to maize, they farmed other crops such as millet, soya-beans, guinea corn, groundnut and cassava. It is worth mentioning that all the farmers were involved in maize cultivation (See Appendix 9). Crop diversification by smallholder farmers is observed as a farm-level adaptation strategy to climate variability (Bradshaw, Dolan, & Smit, 2004). Furthermore, Ellis (1998, p. 2) notes that diversification has been described as “one associated with the desperate struggle for survival”. The smallholder farmers pointed out that they have been doing this for a long time and it has helped them whenever one crop does not do well in that cropping season. One smallholder farmer in Nkwanta [Farmer 4] commented “*if you want to get something to eat at the end of the season, then you have to do more crops. If we rely on only maize, the rains may not come well and we will not have anything to feed ourselves and our families. I take care of 11 people. We will suffer if I do not do this*”. All the farmers in the communities I interviewed diversify their crops. From their responses, the least number of crops that a smallholder cultivated was three (See Appendix 9).

The decision to diversify crops is observed as evidence of a risk aversion behavior of the peasant or smallholder farmer by moral economists (Feeny, 1983). Diversifying their crops over the cropping season is designed to increase family food security. Consistent with the remarks of the farmer in Nkwanta [Farmer 4], the primary goal of crop diversification is to provide daily meals for the family. This opposes the arguments of Feeny (1983) where he argues that the crop diversification behavior is not necessarily because the farmer is risk averse, but because the farmer wants to maximize his expected profits. Feeny’s argument matches the viewpoints of rational peasant theorists. In the words of this farmer [Farmer 4], which is coherent with many other farmers views, there is little indication that they are interested in the profits they can make. Smallholder farmers are seen to be making a trade-off between livelihood security and economic efficiency (Ellis, 1993).

In addition to crop diversification, the responses from the smallholder farmers revealed that they are diversifying their income sources as well. They are engaging off-farm sources of income. According to one of the farmers in Sunsongbon [Farmer 6], “*I leave my community and go to another community to go and work to come and feed my family.*” Other farmers’ responses revealed that they are into rearing guinea fowls. Although it appears that there is some level of

dependence on off-farm income to sustain these smallholder farming households, many of the farmers asset that farming is their major source of livelihood and they are still highly dependent on produce from their farms.



Figure 7: Photo of smallholder farm with mix of maize crops and yam

5.3.2 Meso-level (community) risk management strategies

At the meso-level, the study revealed that smallholder farmers helped each other with seedlings if a colleague farmer does not have enough to start farming with in a cropping season. A 45-year-old farmer [Farmer 3] in Kpatia commented that

“...last year I did not have enough yield and I had to go to my brother to give me some seedlings to farm this year. I hope that this year it will be better. If he also needs some another time, I can also help him. He will not force me to give it back to him, but maybe if I get a lot of yields, I can give him a bag of maize”.

Another farmer also commented that *“when there is poor harvest, I contact some people to borrow maize, 4 or 5 bags then the next season, I pay back”* [Farmer 10 from Sunsongbon]

As at now some of us farm on credit. We go and collect seeds from colleague farmers and come and farm. [Farmer 9 from Nkwanta]

Farmers helping each other is not a formally instituted community practice, which all smallholder farmers have to adhere to. The farmers have this understanding among themselves and informally assist one another. There appears to be strong community ties and informal networks through which farmers support each other. How farmers help each other can be described as an informal village welfare scheme. Though the farmers behave and make decisions in their self-interests, there is a sense of community and collective support. Not everyone is forced to contribute to assist the needy. Furthermore, some of the smallholder farmers are part of farmer associations. These associations provide a host of services to the smallholder farmers. Below are views of some farmers from all three (3) communities.

In Kpatia, there is one called 'SAVANNA'. They taught me how to plant. I used to scatter my seeds, but they taught me to plant in lines. In this association, I pay dues by giving them bowls of seeds". There is another one called 'Asim Betarim'. They help us on the farm and give us seedlings from NGO's. [55-year-old farmer in Kpatia].

In Sunsongbon we have SAVANNA. The association buys my produce. I get more profit from them than when I sell in the market [49-year-old farmer in Sunsongbon].

In Nkwanta there is one called "Titurtub", which means good farm practices. They provide us with organic manure.I do not pay dues. [35-year-old farmer in Nkwanta].

From the comments of these farmers, the associations support farmers with seedlings, provide them with organic manure, and teach them good farming practices such as planting in lines. It appears that the associations do not require farmers to pay dues in the form of cash. The farmers who are part of the Savanna farming association for instance, revealed that they sometimes give the association a part of their produce, while others do not give anything at all. It is unclear what the association uses this produce for. I did not have the opportunity to engage any official of the associations, so it is rather difficult to conclude on what the produce is used for. My guess is that, these collections from the farmers are used to support other farmers who are part of the association and who did not get enough yield. However, a 46-year old farmer in Sunsongbon [Farmer 1] noted that *"They keep some of the money they are supposed to give to me after buying my produce in the bank. They said I should keep it there as savings for me"*. It indicates that the associations

encourage farmers to save as well. From my observation, the facial expression of this farmer appeared as though he was not in favor of the association keeping a portion of his money.

Another meso-level risk management strategy that is available for smallholders in the study areas is insurance. In the Yendi municipality, smallholder farmers can pay for a drought index insurance in return for compensations when they experience drought. Most of the farmers I interviewed had bought the insurance. A typical comment that run through all the responses of the farmers was that the insurance is good. A 35-year-old farmer in Kpatia [Farmer 12] stated that, “*when they paid me, I used the money to some debts I had, so it is good for me*”. However, the design of the insurance scheme is explained in chapter six of this thesis.

5.3.3 Macro-level Risk management strategies

Furthermore, institutions of government particularly the Ministry of Food and Agriculture (MoFA) and the Savanna Agricultural Research Institute (SARI), have been involved in providing farmers with appropriate technology to manage their production risks. SARI conducts research and provide drought resistant seedlings, while MOFA is tasked with the mandate of disseminating these technologies to farmers. “*About three years ago, I got some seedlings from ‘agric’ [MOFA]. They told me it is a short variety maize seedling. So I tried it. It is not bad*”, said a 30-year-old farmer in Nkwanta. As proposed by World Bank (2005), the government of Ghana, through MOFA and SARI have identified and designed a rural risk management strategy by the services that they provide to farmers, to assist them manage their production risks.

Also, a non-governmental research organization, Innovation for Poverty Action (IPA), selects community extension agents (CEA) in these communities to provide farmers with support or extension services. The IPA community extension agent for Kpatia [Agent 1] explains the process by which IPA selects them. He noted that;

They give us application forms to fill and apply for the job as a community extension agent (CEA). They tested us on farming practices. So they ask us certain questions. For example, what is a crop? What is rain? What is drought? What is fertilizer? If you can explain these things in both English and local language (Dagbani), then they will select you to be the community extension agent. We even write translation from English to Dagbani.

An implementation associate with IPA [Officer 5] explained what the community extension agents do for the farmers in the communities. In his words,

“we offer extension messages to community members right at their door step. We have an Android platform program called survey CTO. How it works is, we have community extension agents who visit randomly selected farmers and speak with them at the end of every week throughout the rainy season. So the community extension agent will ask the farmer some questions and he will record the answers on the android platform. Now based on the responses the farmer gives, the system will recommend an extension video that the farmer should watch.....The extension videos include how a farmer should plough, how he can apply first fertilizer etc. The videos are given in the local language”.

According to the key informant [officer 5], the advantage of this extension service is that, relevant messages are given to the farmers at the time they need it. The surveyCTO program is a questionnaire and it is very simple to administer. All the CEA has to do is to read the questions and input responses. The community extension service provided by IPA is a part of an ongoing project of the organization. The project is called Disseminating Innovative Resources and Technology to Smallholders (DIRTS). The project has a timeline from 2014-2017. However, [officer 5] cannot assure that the program will be discontinued, as proposed in the initial project timeline. This means that, if by the end of 2017 the DIRTS project is discontinued, farmers no longer have access to these extension messages which helps them to make better farming decisions. The danger that comes with donor projects is that, their aid or assistance is only for a period and when the project is discontinued farmers will have to fall back on their local knowledge to farm.

Table 4: Summary of risk management strategies in the research communities

	Farm-households (Micro-Level)	Community/Market (Meso-Level)	Government/Donor (Macro-Level)
Ex-ante strategies	Crop diversification	Farming Associations (For example teaching farmers how to plant in rows)	Agricultural Research (SARI and MOFA providing new technologies to farmers)
	On-farm Adopting advanced cropping technologies (growing in lines, drought resistant maize seedlings short season variety maize seedlings)		Community extension services provided IPA
	Off-farm Income diversification (For instance rearing fowls)	Drought Index Insurance	
Ex post strategies (Coping mechanisms)	Income diversification (For example, working in other communities for income after cropping season)	Mutual Aid	

Source: Author, based on field data

5.4 Summary

The production risk perception and risk attitudes of farmers are essential themes in understanding smallholder farmers behavior in crop production. While production risk perception is concerned with the smallholder farmer's interpretation of the chance or probability to be exposed to risk, risk attitudes is concerned with how much a smallholder farmer likes or dislikes risks. A combination of these two informs the risk management strategies of farmers. From the study, smallholder farmers revealed a risk averse attitude. They also acknowledged that drought represented a significant risk in their crop farming. Thus, they have engaged strategies at different levels including crop diversification, income diversification and adopting insurance to mitigate and cope with the risks.

6.

DROUGHT INDEX INSURANCE

6.0 Introduction

In this chapter, I will provide and discuss empirical findings from interviews with farmers and key informants concerning drought index insurance and its design. To begin, I provide comments of key informants regarding rainfall decreases and variability that have necessitated the provision of the innovative weather index insurance for farmers. As I present the findings, I situate the discussion of the motivation for providing index insurance in a political economic context. I continue to describe the Ghana Agricultural Insurance Pool (GAIP) and explain how the weather (drought) index insurance in Ghana, specifically in the Northern region is designed. In the process of discussing the design of the index insurance, I answer questions such as: How are insurance premiums calculated? Who sells the insurance? How it is sold and the period for sales? How are indemnity claims made? How long does it take for farmers to receive indemnity payments?

Importantly, I will discuss the challenges that GAIP as a major stakeholder and smallholder farmers face. The chapter will conclude with a discussion of how GAIP plans to sustain weather index insurance after donor support has ended.

6.1 Motivation for index insurance

The Savanna Agricultural Research Institute (SARI) is the agency tasked with the mandate of conducting agricultural research for the interior savanna of Ghana. In an interview with the head of the climate change adaptation unit of SARI [Officer 1], he noted that “*the biggest bite we get from climate change is the dry spell*”. However, he pointed out that the dry spell is not a result of rainfall decrease causing droughts. In his words,

“If you ask any farmer now, the farmer will tell you that we now have less rain. But empirical data points to the contrary. When you do a trend analysis, you realize that rainfall has not changed much, it has not even changed for some locations. In fact, for some locations it is even increasing, but the problem now is there is increased variability intra-season. If you were here [in July] 5-6 years ago, you would have seen the whole place will be green, maize crops will be already tasseling, but as at

now people are still ploughing. The time the rain takes to start now is highly variable so it is creating a lot of challenges”.

The northern regional crops officer of the Ministry of Food and Agriculture (MOFA), [Officer 2] shares similar view on variability of rainfall. He claims

“the rainfall pattern has generally changed for the worst. The difference in amount is negligible. When you need the rains, you do not get it and when do not need it, it is coming too much. It is now making farmers move towards medium varieties of maize. For example, we used to have 125 days’ maize crop variety, now they are moving to 115, 80, 75 days’ maize varieties”.

As noted by the marketing officer for GAIP in the Northern Region [Officer 3], “... *we thought that if we come up with some insurance that can at least cushion farmers, help them mitigate the risk as a result of climate change, it will be good*”. Furthermore, the underwriter for GAIP [Officer 4] also stated that, the organization pursues insurance for maize crop farmers because maize is sensitive to drought and GAIP provides the insurance as a product that compensates in case there is low yield due to drought.

These statements suggest that the purpose of the innovation is to help farmers. But the arguments put across by some scholars (Isakson, 2015a; Johnson, 2013) suggest that, though index insurance is significant in reducing the economic vulnerability of smallholder farmers, it is a profit venture for the providers as well. In the interview with [Officer 4], she noted again that insurance for agriculture in Ghana is risky and the insurance companies involved have come together to share the liabilities and the profits.

I argue that different actors may be contributing to the creation of new markets for index insurance. For instance, NGO’s in the Northern region want to help farmers, so they introduce and encourage smallholders to adopt index insurance. The NGOS’ intentions may be clear. Meanwhile, they may not be aware that they are helping farmers to become new subjects for the commodification of agricultural risk.

According to Stutley (2010), insurance companies were willing to support the innovation provided the commercial viability of the insurance product can be demonstrated and that they will have reinsurance protection. The objective of the index insurance is to help farmers cope with climate stress, but there are also commercial motives for insurance companies who are part of the pool. None of the insurance companies involved have exhibited interests to run the

insurance by themselves. It indicates that agricultural index insurance in Ghana has still not yet become a profitable venture just as Johnson (2013) argues. Hence, the insurance companies will prefer to stay in the pool to share the risks. GAIP has had to depend on donor support for some of their operations and there is an indication that donors are still committed to seeing the developmental objective of this innovation for farmers been fulfilled.

6.2 Ghana Agricultural Insurance Pool (GAIP)

Before GAIP, there was no crop insurance for farmers in the whole of Ghana. GAIP was established in the year 2011 after a pilot project funded by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and supported by the National Insurance Commission (NIC) in some selected communities in the north of Ghana. The project was aimed at assessing the feasibility of insurance for crop farmers, noted [Officer 3]. After this pilot project, GIZ recommended that agricultural insurance could be commercialized in the country based on the project findings in the northern region. Consequently, GAIP from the year 2011, commenced commercial sales and they develop policies for both smallholder and commercial farmers. Since then GAIP has made some payments most notably in the year 2013 and 2015. [Officer 3] asserted that in *“over 162 communities, payouts were made to farmers in 2013 who suffered from drought”*.

Additionally, GAIP has an agricultural insurance product for all the players in the agricultural value chain including financial institutions and input suppliers who can purchase insurance to protect their investments. Financial institutions play critical roles because they can buy the insurance from GAIP to cover the loans that they give to smallholder farmers. In this case, if a smallholder farmer defaults from paying back the loan facility, the bank does not lose much. GAIP provides this product a way of protecting the banks interest so that they do not shy away from advancing loans to smallholders who are often credit constrained. Currently in the northern region, GAIP partners with UT Bank, Bonzali Rural Bank, Zabzugu Rural Bank, Borimanga Rural Bank, Opportunity International and Sinapi-Aba savings and loans.

Another important player in the value chain are nucleus farmers. These are farmers who relatively have more resource (land and capital) endowment than smallholder farmers. Nucleus farmers

support smallholder farmers in various ways. They provide them with agricultural credit facilities (loans), they provide them with farmland, and they sometimes buy insurance for the smallholders. Finally, NGO's such as Innovation for Poverty Action (IPA), also buy the insurance for farmers. Therefore, banks, nucleus farmers and NGO's can serve as intermediaries through which smallholder farmers can get insurance for their crops or the loans they secure for their crop production.

As noted by a key informant [Officer 3], GAIP is a public-private partnership with support from all the insurance companies in Ghana through their mother association, the Ghana Insurers Association (GIA). There are seventeen (17) insurance companies involved. The initial business plan, as noted by the underwriter for GAIP [Officer 4], was for the providers to stay as a pool until 2017. However, there have been new discussions to extend the agreement to remain as a pool to 2022. UNCTAD (1994) noted that a pool approach is advisable particularly in the initial stages of agricultural insurance development and in small markets, and there is little need for each insurance company to go through the process of product development on their own. According to UNCTAD (1994) companies with small capital base and limited infrastructure may not be able to administer agricultural insurance, making it worthwhile to join other companies that are interested. When the insurance companies involved are comfortable enough to individually sell agricultural insurance to farmers, GAIP according to an informant [officer 4] will take charge of designing and researching into new products, leaving sales of the product for the insurance companies.

The Ministry of Finance and Economic Planning (MOFEP) and Ministry of Food and Agriculture (MOFA) also play critical supporting roles. They are the two agencies that represent the government in this pool. In addition, certain international NGO's support the activities of GAIP in various ways. Some provide technical assistance and support. USAID acts as major donors through their projects USAID ADVANCE and USAID FinGAP. An informant [Officer 7] pointed out that the USAID projects supported GAIP by giving grants, empowering GAIP to establish presence in the three Northern regions, in addition to providing logistics such as GPS and weather stations.

6.3 Drought index insurance

There are two types of agricultural insurance provided by GAIP for farmers in the Northern Region of Ghana. There is a multi-peril insurance policy for commercial farmers and a drought index insurance policy for smallholder farmers. The multi-peril insurance policy was developed for commercial farmers with land sizes of 50 acres and above, to cover them from all types of agricultural risk including fire, pests and diseases, drought or floods. Whereas the drought index insurance policy was developed specifically for smallholder farmers with farmland size between 1 acre and 49 acres, and who cultivate maize, millet, soya and sorghum. The drought index is the only policy for smallholder farmers because of the nature of their farms. Smallholder's farms are wide apart and scattered, and it is very difficult to go and monitor their individual farms. As noted by the marketing officer of GAIP in the Northern Region [Officer 3], it is easier to do a drought index policy for smallholders because they do not necessarily need to be present on their farms to ascertain rainfall deficiencies. This assertion was in line with Johnson (2013) when he noted that the dispersed locations and limited production volumes of smallholders repelled traditional agricultural insurance providers. In traditional agricultural insurance, providers had to visit individual farms of farmers to assess the losses and then determine indemnity payouts.

Sales of the index insurance in the Northern region have grown steadily from 2014, though it encountered some challenges in the beginning years. In 2012 and 2013 as shown in Figure 8 **Error! Reference source not found.**, the banks that were involved in the previous year's sales dropped out. This meant that the farmers they bought the insurance for were also without cover. Per the comments of a key informant [officer 4], this accounted for the low numbers of insured farmers in 2012 and 2013. According to one informant [officer 4], the banks dropped out because of the problem of basis risk and high premium rates. However, in 2015 fourteen (14) rural banks joined the pool. GAIP has partnered with the Africa Center for Economic Transformation (ACET), who is paying the premiums for the banks. The intention is that once the bank benefits from the insurance, they (the bank) would see why they should pay the premium in subsequent years. ACET is undertaking this as part of a research to ascertain how financial institutions can be actively involved in the provision of index insurance for farmers.

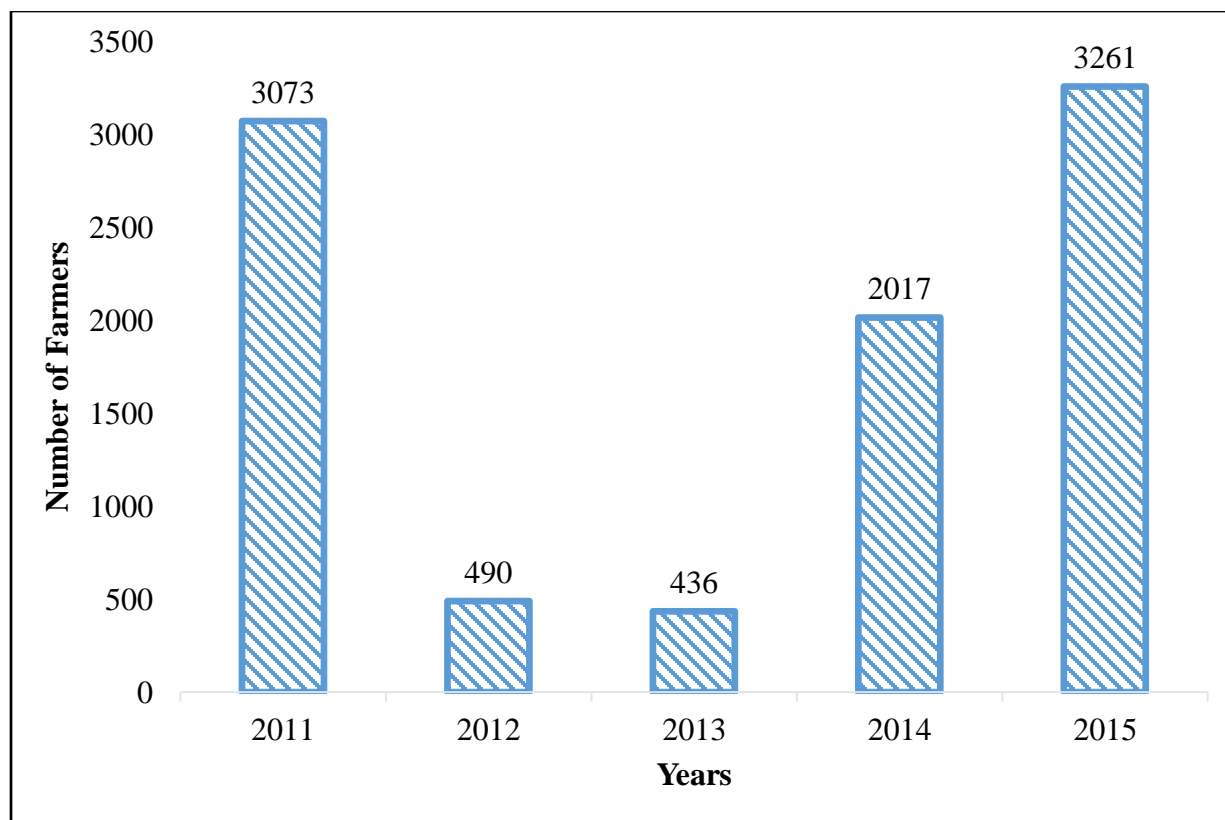


Figure 8: Graph of number of farmers who were insured from 2011-2015 in Ghana

Source: Author, based on field data

Sales for the drought index insurance in Yendi began in 2011. GAIP sold the insurance through Bonzali rural bank. The bank bought the insurance for the farmers as part of a credit facility (loans) available to smallholder farmers. Index insurance in the Yendi Municipality can either be sold solo or as part of a package, just as Hilario (2012) argued.

For a smallholder farmer to access the drought index policy, he is basically required to provide his name, his location, the size of his farm, type of crop and variety of crop. The variety, for instance, is required for GAIP to know how long the crop will stay on the farm for purposes of calculating dry days and rainfall amounts that will trigger payouts. Though some farmers are not able to adequately provide the variety of maize crop they are using because of illiteracy, they are still able to inform GAIP how long the maize will last till harvesting and GAIP confirms this information their sales agents.

One officer [Officer 3] explained that, GAIP receives forecasts of rainfall from GMet and that also guides them in their work. With the forecasts, GAIP is able to inform farmers about how the season may look like in terms of rainfall amounts and it will be important for them to get insured.

6.3.1 Who sells the Insurance and what is the sales period?

GAIP as an institution has agents who do marketing and sales for them. Also, some institutions sell GAIP's insurance to the farmers they work with. Among others, Innovation for Poverty Action (IPA), a non-governmental research organization in the North sells the insurance to farmers in their research communities. They hold local drama programs in the evenings in the communities and use that as a platform to increase farmer's knowledge about the insurance. They use projectors and screens and play videos of the index insurance in the local language of the people to watch and ask questions.

IPA has agents in the communities who respond to further questions from the farmer's sequel to the drama they have watched and other information they have received. These agents are called community-based marketers. They are trained to educate and sell insurance to smallholder farmers in their communities. However, IPA is paid some commission for selling for GAIP. The commissions paid by GAIP goes to support the community-based marketers that IPA engages in the communities to sell insurance for them, noted Officer 3.

Sales for the drought index insurance should typically end in May. Nonetheless, at the time of this research during July 2016, some farmers had not even ploughed their lands, and so GAIP were still selling insurance. From May 2016 till July 2016, some areas in the Northern region had not received adequate rainfall to allow farmers to plough their lands. An informant [Officer 3] claimed that some farmers pointed out that they were not very sure of the season, and will only buy insurance when they are sure that they will farm. These events force GAIP to shift their end of sales deadlines, to accommodate the changing seasons. GAIP gives certificates of purchase (Figure 9) to smallholder farmers who have bought the insurance for a particular cropping season. The certificate shows information such as the name, number of acres' the insurance has been purchased for, among others.

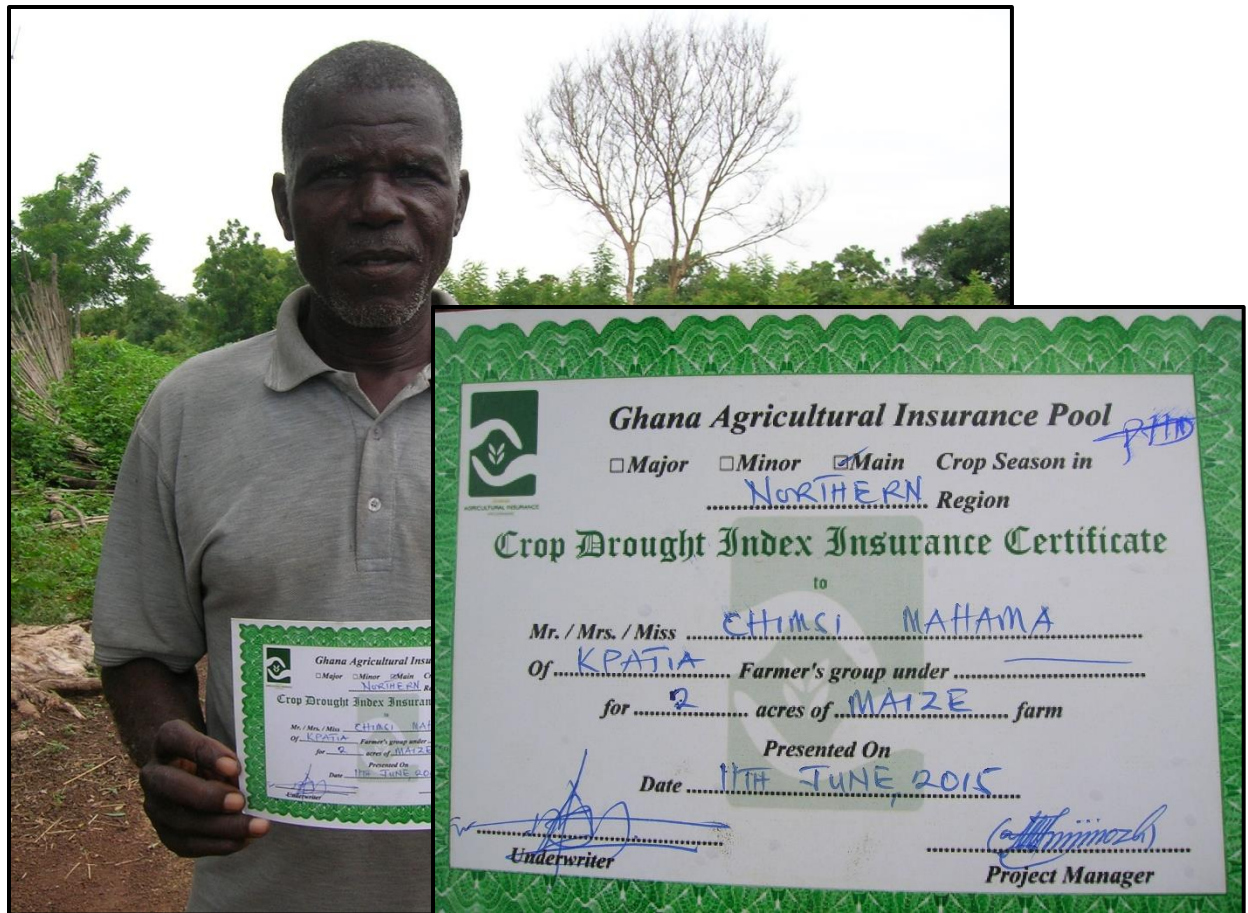


Figure 9: A smallholder farmer with his drought index insurance certificate

6.3.2 Weather Data

Before the start of the cropping season, smallholder farmers are required to contact the local agents of GAIP or agents of other partner institutions such as Innovation for Poverty Action (IPA), that sell insurance for GAIP. At the time of policy purchase, officers from GAIP go to the farm to collect GPS coordinates on individual farms for rainfall data. The GPS coordinates are then passed on to the Ghana Meteorological Agency (GMet) and The National Oceanic and Atmospheric Administration (NOAA) for rainfall data. The index (rainfall) can be monitored by a weather station, satellites or even a combination of both (Johnson, 2013). GAIP uses rainfall data from GMet for areas where there are weather stations and rainfall data from NOAA in areas where there is no weather station. GMet and NOAA act as independent institutions and the rainfall data they

provide is the proxy by which GAIP makes analysis for rainfall shortages and further indemnity payments.

6.3.2.1 Ghana Meteorological Agency

Each GMet weather station covers all insured smallholder farms (A, B, C) that are within a 20-km radius, as shown in (Figure 10) of the weather station. In the Yendi Municipality, GMet has a synoptic weather station that collects daily rainfall data of all the insured farmers.

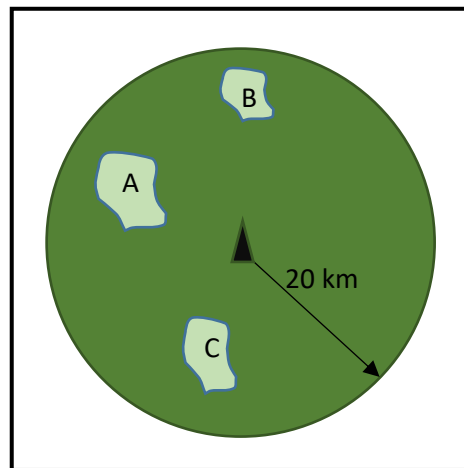


Figure 10: Smallholder farmer communities within 20km radius of weather station

Source: Author, based on field data

GMet provides daily rainfall data to GAIP every two weeks via E-mail from the start of the cropping window provided by GAIP. According to an informant [Officer 3], GMet also has this data available for farmers, but due to illiteracy, most smallholder farmers are not able to comprehend the information or even access it. Nonetheless, smallholder farmers who form groups and want this report can have the data printed out in hard copy for their perusal. The procedure that GMet uses to provide information to GAIP and the smallholder farmers meets the criteria of transparency, objectivity, timely reporting, and independent verifiability, which The World Bank (2005) proposed. The synoptic weather station objectively measures rainfall data and is transparent. Mensah (2016) notes that GAIP chooses weather stations that have at least 30 years' historical data and has missing data of up to 5%. This figure (5%) is a slight deviation from what

Dick et al. (2011) recommended that there should be 20 years' historical data and at least 3% missing data.

Currently, GAIP has a memorandum of understanding (MOU) with GMet running for five (5) years since 2013. Initially, there was a 2-year contract from 2011 to 2013, and it was renewed. At the start of the program in 2011, GAIP supported GMet with 46 automated weather stations, and the provision of these weather stations, per the comments of an informant [Officer 4], was a kind of pre-payment for the daily data GAIP would receive from GMet for the next 5 years. Discussions about paying for GMet's services will commence when this period is over. Thus, GAIP currently does not pay GMet for weather data.

6.3.2.2 National Oceanic and Atmospheric Administration (NOAA)

NOAA also uses the satellite system to provide daily rainfall data to GAIP. NOAA groups the farming communities into pixels. Each pixel covers a 10-km square area (Figure 11). Therefore, farms (A, B, C, D) in the same pixel are assumed to have similar rainfall patterns and amounts. To that end, if there is rainfall shortage in any of the pixels, all insured smallholder farmers in communities located in that pixel are eligible for payments.

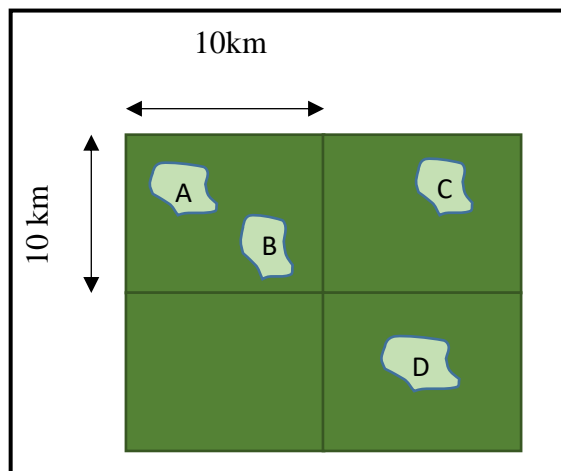


Figure 11: Smallholder farmer communities in 10*10 km pixels used by NOAA

Source: Author, based on field data

According to the principles expounded by Dick et al. (2011), one critical component of an index insurance scheme is a reference weather station. Based on the findings of this study, GAIP does not only use a GMet weather station but also employs a satellite system to measure rainfall for compensation calculations.

6.3.3 Start of Coverage Period

Policies for the planting window or period are in two forms. An implementation associate with Innovation for Poverty Action (IPA) [Officer 5] explained that “*there is the flexible planting window policy and the static planting window policy*”. The static window policy has a defined date range within which planting should begin regardless of the rainfall incidences. For the flexible window policy, its commencement is triggered by certain rainfall conditions. An informant [Officer 5] comments that GAIP waits to experience certain rainfall conditions before a policy is started for a farmer. Normally the planting period for smallholder farmers is from 21st May to 19th June, though it is flexible to change. The date range GAIP uses for the flexible window policy agrees with the planting dates suggested by Adu et al. (2014) for maize in the guinea savanna agro-ecological zone of Ghana.

Within the flexible planting period, if a community experiences three incidences of rainfall, 2 of them recording a minimum of 8mm and 1 having a minimum of 2 mm of rainfall, then the cover inception or the index insurance policy for that farmer and that community starts the next day. For example, if on the 23rd, 26th, and 28th of May a community records 9 mm, 4 mm, and 8 mm of rainfall, then the index insurance for smallholder farmers in that community begins on the 29th of May. The positions of the metric do not matter provided the rainfall threshold is met. Meaning that if between 21st May and 29th June the first incidence of rain is 4 mm, the second is 8mm and the last is 9mm, the cover inception will start for that community. The insurance policy begins because farmers have achieved the requirements set by GAIP to commence planting.

The idea behind this strategy is that farmers should not only farm because there has been one incidence of heavy rainfall. This could be misleading and farmers may not get rain after they have ploughed. Sometimes, communities can record as much as 27mm of rainfall in a day and would not get rain for another extended period. Hence, farmers are advised to wait a bit for continuous daily rainfall. According to an informant [Officer 5] “*with the introduction of these rains, chances are that the rainfall season has just started*” and the weather is wet enough for farming. Practically what GAIP does is that, they ask the smallholder farmers in Yendi when they normally plant based on previous years. GAIP then fills a proposal form (figure 12) for that farmer, and normally all

other farmers in that community with this information. The proposal form represents the contract between the farmer and GAIP

GHANA AGRICULTURAL INSURANCE POOL
Proposal form for Drought Index Insurance

Policy Number: _____ Agent Name / Number: _____

1. Name of the Proposer: _____
2. Postal Address: _____
3. Location of Proposer: _____
4. Tele phone number: _____
5. Mobile number: _____
6. Fax number: _____
7. E-mail address (if any): _____
8. Occupation: _____
9. Contract Start Date: _____
10. Contract End Date: _____
11. Participating Weather Station: _____
12. Name of district for participating weather station: _____
13. Type of crop to be insured: _____
14. Variety of crop (if known): _____
15. Total area to be insured (acres/hectares): _____
16. Total number of farmer(s) to be insured: _____
17. Location of farm(s) to be insured: _____
18. Are you taking a loan to cultivate your farm? _____
19. If yes, is it in kind or cash? _____
20. Name the institution / organisation providing the loan: _____
21. Total Sum Insured: _____
22. What services do you provide to farmers? _____
23. Have you ever made a drought index insurance claim? _____

Declaration

I declare that the statements and particulars given in this application are to the best of my knowledge and belief, true and that I agree they shall form the basis of the contract.

Signature: _____ Date: _____

Ghana Agricultural Insurance Pool
P. O. Box 13930, GPO – Accra
Location – GIA Secretariat, Adjacent Kanda Club 10
Tel: 0302 251 091 / 2 / 3; 020 146 80 10; 024 213 57 13; 020 813 31 63

Page 1

Figure 12: Contract or proposal form for drought index insurance

Source: Author, based on field data

Therefore, if farmers in the Yendi district provide GAIP with a planting window between 20th May and 30th June, that becomes the planting window for that farmer and all other farmers in the community who have bought the index insurance. There is a possibility that smallholder farmers will begin to farm even when they have not yet experienced the rainfall conditions that GAIP has set. In that case, the farmers are liable to any losses that they incur in their production. The

insurance policy is a contract and therefore farmers are advised to adhere to the terms therein, for a smooth process. GAIP uses these rainfall parameters based on MOFA recommended agronomic practices, according to a key informant [officer 5]. Conversant with the parameters outlined by Dick et al. (2011) for index insurance contracts, the drought index insurance policy available in the Yendi municipality has both the fixed and the dynamic coverage periods. Nonetheless, the dynamic window policy is popular of the two. This is because of unpredictable nature of the inception of rains in the municipality prior to the start of the cropping season.

6.3.4 Premium calculations and payments

According to UNCTAD (1994), the determination of premiums is of utmost importance in designing a crop insurance program. On the one hand, sufficient revenue has to be generated from premium collections to meet the payment of claims, and on the other, the premium should be perceived as affordable by customers (UNCTAD, 1994). Fundamentally for drought insurance in the Yendi Municipality, smallholder farmers are required to pay 10 percent of their production cost for each maize cultivated acre of land as the insurance premium. This was the premium rate as at 2016. But from 2017, premium rates have been reduced to 5 percent, following complaints from smallholder farmers that the insurance premiums are high for them noted one key informant [Officer 3]. Linnerooth-Bayer, Warner, Bals, Höpfe, et al. (2009) share similar views on the affordability of premiums. They argue that farmers in the developing world depend on post-disaster aid such as emergency loans from money lenders because they cannot afford risk-based premium payments. Smallholder farmers in the study sites had an average household size of about 11 persons (See Appendix 9). They provide meals, pay their children's fees, and have dependants from the extended family to take care of. Some of them are only into crop farming and do not have alternative livelihoods. It implies that their incomes are strained, and high premium rates will only deter them (farmers) from buying the insurance.

The production cost, from which premiums and compensations are calculated, is derived from a crop budget that farmers are required to provide. Since most of the farmers are unable to develop these crop budgets by themselves, agents from GAIP and IPA, assist farmers to develop the budgets. A GAIP official [Officer 3] provided an example of a crop budget (Figure 13), which serves as a guideline for the crop budgets that smallholders should present. This crop budget shows

cost of labor, ploughing, land preparation, seed, fertilizer, weedicides, harvesting, bagging, and cost of transportation. Though most smallholder farmers are not able to create similar budgets, they provide one (Figure 14), which clearly shows their production cost lines to represent their total production cost. According to the GAIP official [Officer 3], GAIP is not strict on farmers providing the same type of budget as shown in *Figure 6.5*. As at the time of collecting data for this study (2016), the minimum production cost a smallholder could present was GHS 100 per acre. GAIP is however revising the minimum production cost that farmers can present to GHS 300, noted the underwriter of GAIP [Officer 4]. The maximum production cost per acre of land smallholder farmers can present is GHS 1000.

The crop budgets presented vary from farmer to farmer. For instance, for some farmers, there is no cost attached to labor because they use family labor for land preparation, planting harvesting among others, but other farmers have cost attached to labor.

Again, the crop budget that maize smallholder farmers present, forms the basis for calculating compensations. Therefore, the crop budget serves as the basis for two things. It firstly provides the basis for premium calculations and secondly, provides the basis for compensation calculations. Details of how compensations are calculated and paid is explained and discussed in section 6.3.6.

Estimated Average Costs of Production for Maize Crop in 2014 Season in Northern Region		
Activity Cost	Price per Acre Correctly Grown	Price per Acre Actually Grown
Cost of Land	-	-
Cost of plowing (Range GHC 40 - 50)	50.00	50.00
Cost of land preparation (harrowing)	45.00	-
Cost of Certified Seed (Ghc 2 per 1kg seed approx)	18.00	18.00
Cost of labor for sowing (range of Ghc 15-20) depending on number of people hired and whether ropes are used for planting in rows (labor costs 1 person ranges between Ghc 4 -5 per day on average) Averaging cost of use of dibbler/manual	20.00	15.00
Cost of labor for weeding (1 st) (labor costs 1 person Ghc 5 per day on average) approx. Ghc 35 per acre	35.00	35.00
2nd Weeding	35.00	35.00
Cost of Fertilizer (3 bags of Yara Activa at Ghc 91 each)	273.00	105.00
Cost of Weedicides (1 litre per acre Ghc 8-12 per acre - average Ghc 10 each) x one application	8.00	8.00
2nd	30.00	20.00
Cost of harvesting at the field (labor) 1 person GHC 5 per day for 3 persons	15.00	15.00
Cost of Jute Sacks (Ghc 2 per bag)	30.00	14.00
equipment)	67.50	45.00
Transportation Cost (from farm to house) Ghc 3 per bag	45.00	21.00
Total Cost of Production	671.50	381.00

Figure 13: Photo of the required crop budget from smallholder farmers

Source: Author, based on field data

CROP BUDGET FOR TINDANI FARM (BAMBILA)

Number of acres: 2
 Crop: Maize
 Variety: Obatanpa

- Cost of ploughing = Ghc 50 x 2 → Ghc 100
- Cost of seed = Ghc 30 x 2 → Ghc 60
- Cost of weedicides → Ghc 50
- Cost of fertilizer (3 bags per acre) → Ghc 560
- Cost of Labour: + Planting → Ghc 120
- + Weed control → Ghc 20
- + First fertilizer application → Ghc 60
- + second fertilizer application → Ghc 60

- Others
 - Food for laborers → Ghc 80

TOTAL: → Ghc 1,120

Insurance premium = 10% of production cost

$$= \frac{10}{100} \times 1,120$$

$$= 112$$

Figure 14: Photo of a handwritten crop budget by a smallholder farmer

A representative at USAID ACDI/VOCA [Officer 7] commented that some farmers try to be smart and in the process, eliminate some of the cost lines in the production cost budget. For instance, farmers would exclude the cost of fertilizer which is arguably the highest cost item in the budget. They do this with the notion of reducing the insurance premiums they will pay because they are aware the premiums are calculated from their production cost budgets. I argue that this attitude portrayed by farmers shows that though they are interested in paying for the insurance, they are skeptical about the amounts they should commit to paying for premiums which is calculated from their total production cost. Because if a farmer, for example, says his total production cost is GHS 800, then he would pay GHS 80 as insurance premium ($800 * 10\%$), and in the event that GAIP says there was no trigger for payments, he loses all of the GHS 800. But if the farmer provides a production cost of about GHS 100, then he pays GHS 10 as premium which he can afford to lose as compared to GHS 80.

Furthermore, some institutions involved in agricultural research such as Innovation for Poverty Action (IPA) buy index policies on behalf of their farmers from GAIP. They do so by subsidizing the premiums for farmers or paying the full cost of the premiums for farmers. So, IPA agents in the communities receive the demand and take all necessary information from the farmers including their crop budgets from which their production cost is retrieved. IPA then goes ahead to buy the policies from GAIP. GAIP calculates appropriate premiums based on the production costs that farmers have provided, and then IPA pays these premiums. The rationale behind subsidizing premiums for farmers as also observed by Makaudze (2012) is to increase smallholder farmer's demand for the index insurance product, and help them to become accustomed to buying it. So, for instance, if the farmer provides a production cost of GHS 500 for 2 acres of maize cultivated land, he is required to pay GHS 50 as premium. But as at 2015, IPA subsidized and allowed farmers to pay GHS 12 as the premium for each acre of land that they cultivate, and IPA paid the difference. Therefore, in all IPA research communities, all farmers who were interested in buying the index insurance from GAIP, paid the same premium amount per acre regardless the cost of their production.

My argument is that though the intentions of IPA are commendable, the danger with these premium subsidies is that farmers may not know the real cost of their insurance until the project has ended, which may lead to a fall in demand for the product. If previously, a farmer who bought insurance

from IPA paid GHS 12 per acre of land, that farmer may not be able to pay GHS 50, when IPA's project is discontinued. I make this argument because, even with the subsidized insurance rates IPA provides, some smallholders still complained they do not have cash to buy the insurance. Also, the smallholders who pay the subsidized rates may not be depended on to continue demanding the product when subsidies no longer exist. Makaudze (2012) also argues that because smallholder farmers do not have accurate price signals regarding the magnitude of their actual risk exposure, they make economically inefficient decisions. At this point, smallholder farmers could even become more economically vulnerable as noted by Isakson (2015a).

6.3.5 Trigger / Threshold Measurements

According to one key informant [Officer 3], drought in simple terms is inadequate rainfall. Maize crop requires a specific volume of rainfall to deliver a good yield. What GAIP terms as drought for maize is rainfall less than 25mm in 10 consecutive days. He [officer 3] noted that, in GAIP's insurance terms they have what is called a 'dry day'. A 'dry day' is simply a day of less than 2.5 mm of rainfall during the crop planting season, from the day the insurance cover begins in that community. GAIP sets these parameters based on three phases of the maize plant cycle. The germination stage, the growth stage, and the maturity stage. What this implies is that the volume of water required at the various stages are different. Thus, the farmer can experience drought at the germination stage and may not experience drought in the growth or maturity stage or vice – versa.

The germination stage lasts for 25 days. The growth stage starts from the 26th day to the 120th day and the flowering or maturity stage starts from the 77th day to the 110th day which is in the growth stage as well (*Figure 16*)

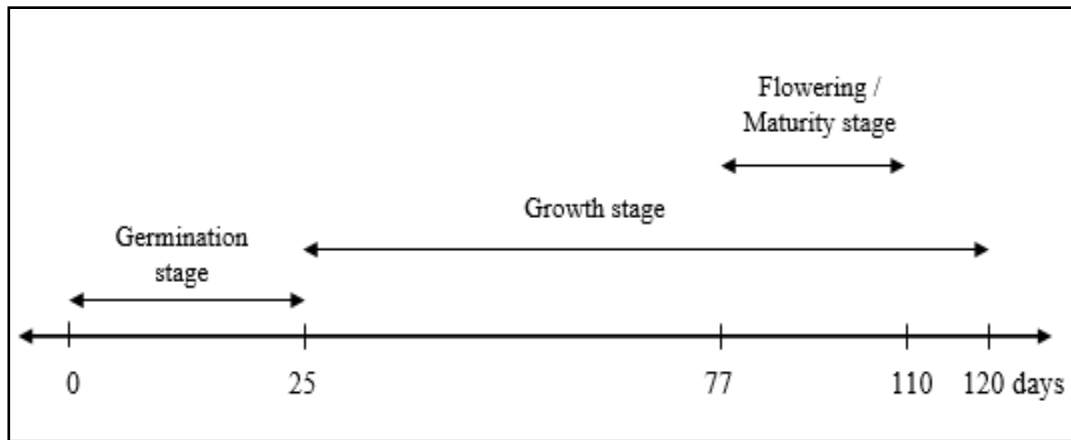


Figure 15: Stages of a maize crop life cycle (120 days)

Source: Author, based on field data

The phases illustrated in Figure 15 is the standard used for the long variety maize crops which have a crop life cycle of about 120 days. An implementation associate with IPA [Officer 5] noted that farmers usually use the long season varieties. From the study, some of the farmers pointed out that they use the varieties ‘obatampa’ and ‘wandata’. But the farmers also engage some short season varieties provided by MoFA. Currently, as stated by an informant [Officer 5], the index insurance for maize smallholders only covers the long varieties crops because of the metric (120 days) GAIP is using. However, MOFA is increasingly advising and supporting smallholders on using the short season varieties because of recent rainfall patterns.

In calculating the threshold of rainfall for the various stages, GAIP considers two things; first rainfall amounts and secondly dry days. The underwriter for GAIP [Officer 4] noted that “*We are looking at the severity and frequency of drought*”. To begin, at the germination stage, GAIP indicates that the maize plant should have a minimum of 25mm of rainfall in 10 days, after planting. That is at least 2.5 mm of rain each day within the 25-day germination stage. The 10 day rain occurrence does not have to be consecutive. Secondly, if GAIP assesses that the farmer recorded 12 or 13 consecutive dry days (depending on the area) within the first 25 days, then the farmer has experienced drought, and as such there is a trigger to pay compensation to the farmer. Thus, at the germination stage, smallholders will be paid compensations when they have not

experienced an accumulated total of 25 mm of rainfall in 10 days and when there has been 12 or 13 consecutive dry days.

At the growth stage, GAIP only considers dry days. Here again depending on the area, GAIP checks rainfall data provided by either GMet or NOAA to see if a farmer recorded 12, 13 or 14 consecutive days with rainfall less than 2.5 mm each day. If this is so, an indemnity payout is triggered. Thus from the 25th to the 120th day, if there is 12, 13 or 14 consecutive dry days, then compensations should be paid for the growth stage. Finally, at the maturity stage, GAIP considers only rainfall amounts and not dry days. Here, farmers who fall short of a cumulative minimum of 125 mm of rainfall between the 77th and the 120th day are eligible for payouts.

I argue that using the three stages design for the maize index insurance contracts is prudent in the Yendi municipality because of the variability in the rainfall pattern. Similarly, The World Bank (2014) notes that it is an appropriate contract design especially for regions where meteorological drought is a significant potential risk. The three stages design has become popular after it was pioneered in 2004 by an Indian Insurance company ICICI Lombard and used it in the design of index insurance contracts for groundnut and castor farmers in Andhra Pradesh (The World Bank, 2014).

In relation to the parameters set out by Dick et al. (2011), it is evident from empirical data that GAIP operates a cumulative trigger measurement for the drought index policy. The trigger level at each of the phases is what determines when compensations should begin for each farmer. The trigger levels at each of the phases corresponds to the rainfall-levels at which the maize crop begins to experience water-deficient stress (The World Bank, 2014). However, the same maize crop variety which is grown in different climatic zones will require different levels of moisture or rain. For instance, if the same maize variety is grown in a cool climate, it will demand less water per day than the same maize variety grown in a hotter climate (FAO, 1991). Therefore, the water requirements been used by GAIP to determine trigger levels for compensations has been designed to suit that specific agro-ecological zone. For instance, comments from GAIP official's points to the fact that compensations will be triggered when a farmer records 12, 13 or 14 consecutive dry days depending on the area in the growth stage. This means that, from one community to another GAIP may either use the 12-dry day, 13-dry day or 14-dry day in the insurance contract design for the same maize crop variety that farmers may farm. In effect, though there may be an approximate

rainfall amount that the maize plant requires for good growth, micro-climates in different agro ecological zones may have slightly different requirements for the maize plant.

6.3.6 Payout Period, Terms and Procedure for claims payments

The underwriter [Officer 4] for GAIP stated that payouts are usually made to smallholders a month after the cropping season is over for maize, sometime in November. The officer [Officer 4] noted that

“at the end of the season we do what is called notification. This is where we come to let the farmer know how the season turned out, to explain things once again to the farmer and if there are any claims we give. Then the farmer can also tell us what happened on the field to help us modify the product”.

Most smallholder farmers have maize crop cycle from late May to August. Farmers who do long varieties of maize may go into early October, by which time he should have harvested. However, if the rains do not come early, it may shift the harvesting period further which will, in turn, push payout times even farther.

Farmers do not need to make any claims when they experience drought. According to Mr. Aswad, *“once the rainfall data indicates that a farmer in a particular location had inadequate rainfall, we move in to pay the farmer and we give them physical cash.”* Even when the season is good GAIP proceeds to inform farmers that based on the data, they had adequate rainfall and as such they are not entitled to payments. In his words, *“this is a pool of resources gathered from the fortunate many to compensate the unfortunate few”*. Farmers want to be paid whether they had a good season or not and technically, this is not possible.

An informant [Officer 3] exemplified the terms under which GAIP makes payments as he remarked that GMet and NOAA are the independent referees, whiles the farmers and GAIP are the players in a football match. When the referee says, there has been rainfall, we do not pay. If the referee says there is no rainfall, then we pay. Of course, this is in relation to the threshold's that have been set.

As exposed earlier, a farmer could experience drought at either of the three phases of the maize crop growth. Thus, per the agreements in the insurance contract between the farmer and GAIP, indemnity payments should be made. According to [officer 3], payments are made at the end of the cropping season after GAIP has fully assessed at what phases of the crop growth there have been drought or rainfall deficiencies to warrant payments. When farmers experience droughts for instance in the germination stage, no payment is made until at the end of the season. This is because, GAIP waits to see if the farmer will face drought at any of the other two phases.

When a smallholder farmer experiences drought in the germination stage of the crop, GAIP pays 20% of the total production cost of the farmer which is also the farmer's investment in the farm for that cropping season. This is because at this stage the farmer has not invested much on the farm in terms of fertilizer application and other cost components, explained [Officer 3]. If drought is experienced at the growth stage, 50% of the farmer's investment is paid. According to Fiondella, Hansen, Peterson, and Ward (2007) to the maize crop is most sensitive to drought during tasselling and filling stage, which corresponds to the second phase of the crop growth stages. Therefore, if a smallholder experiences drought in the second stage based on the parameters outlined by GAIP, it will be very detrimental to the development and subsequent crop yield of the crop. Thus, the index insurance is targeted to protect this stage with the highest compensation rate (50%) for farmers when they experience drought in this stage. Similarly, in Malawi, the maize index contracts were designed to target protection for the second phase which included the tasselling and filling stage (Fiondella et al., 2007)

When a farmer experiences drought at the maturity stage, it warrants 30% of his total production cost. Some countries that provide maize index insurance use only two stages. According to Fiondella et al. (2007), contracts designed for farmers in Kenya and Tanzania covered only 2 stages because the 3rd stage of the maize growing cycle does not experience much yield stress, unlike the first two stages. Thus, when a smallholder farmer in the Yendi Municipality experiences drought at all stages of the crop growing cycle it warrants 100% payback of the farmer's investment. As disclosed earlier, the farmer's investment is the production cost of the farmer for that cropping season. However, the marketing officer for GAIP [Officer 3] expressed some concerns over the difficulty GAIP has in cross-checking whether farmers invested the amount they presented in their budgets.

The payment example illustrated by Skees (2008) in section 4 of chapter 3, described a structure that pays based on each millimeter deficit of rainfall below the threshold that has been set. However, in the drought index insurance contract in the Yendi district payment is made incrementally, not based on each millimeter of deficit rainfall, but based on the three stages of the crop growth. Hence, the payment is made per deficits of rainfall below the threshold in each phase of the maize crop life cycle.

One can argue that, when a farmer experiences drought in the first stage, it implies the maize crops will not germinate, and therefore there will be no development of the crop for yield at the end of the cropping season. In that instance, the farmer is eligible for payouts for the first stage. However the farmer can try planting again. The insurance cover has already started and it will not be discontinued for the farmer. Unfortunately, when there is no incidence of drought in the second and third stages, GAIP will not pay the farmer because the index (rainfall) has met the threshold. This is one disadvantage of the drought index design. Because it is not tied to actual losses but on an index, which may or may not reflect the actual happenings on the farm.

6.4 Challenges

6.4.1 Basis Risk

The novelty within index insurance is that no on-field assessments are made to assess losses, and payouts are entirely based on an index measurement. There is a high possibility for disparities between the indemnity payments and the actual losses realized by the farmer. This is called basis risk. According to Mahul and Stutley (2010, p. 20) “basis risk is the most problematic feature of index insurance”. There is a potential mismatch between a farmers crop losses and the insurance indemnity payouts which arises because the index is unable to measure farmers crop losses (Ceballos, 2016). Indeed, a key informant [Officer 3] also mentioned that basis risk is their biggest challenge. This is because the GMet weather station collects rainfall data for communities within a 20km radius. He noted [Officer 3] that this was too large a distance for GAIP to measure losses using the index. Though GAIP has adopted the satellite system (NOAA), which provides rainfall data in 10 x 10 km pixel, to improve the problem, it is still too large a distance to correctly measure crop yield losses linked to rainfall index. Ideally, there should be weather data covering a 3 x 3 km radius, and this will suffice, to provide accurate rainfall data which can be linked to crop loss,

according to [Officer 3]. Smallholder farmers unsurprisingly also expressed concern about the basis risk problem. A 30-year-old farmer from Nkwanta noted that *“I did not receive any rain but they came and said it rained on my farm. So they did not give me anything”*. The farmer then asked me to observe the weather in a distance.

“.... Look at that side, it looks like it is raining there, but it will not rain here. But they will come and say it rained here, so they will not give me any money. It is not good” [30 year old farmer in Nkwanta, Farmer 7]

If the meteorological agency provides data for a 20km radius and NOAA provides for a 10 x 10 km pixel size, then it is only logical to switch to NOAA, because the distance covered is shorter and as such reduces basis risk by some margin. However, [Officer 3] mentioned that, though this is true, it may not be feasible presently, because GAIP needs to collect GPS coordinates for NOAA from each smallholder’s farm for rainfall data. If there are about 10000 smallholder farmers, it is practically impossible to visit all farms not only because of inadequate personnel but because smallholder farmers are so scattered all over. Also, GAIP considering the sales period within which they have to sell is unable to use just the satellite system. So, GAIP still uses the data from the meteorological agency to cover farms that cannot be visited for GPS coordinates.

Because of the information asymmetry that exists between observed rainfall on farms and at the weather station, both smallholder farmers and GAIP may be at a loss. Some farmers may receive payments that they do not ‘deserve’ because they had good rainfall but the meteorological station did not record it, and as such bad for GAIP. On the other hand, other farmers may be denied legitimate indemnity claims because meteorological or satellite data records rainfall which was not experienced on the farm. When Basis risk occurs, the contract has failed because smallholder farmers have paid premiums, they have suffered losses, but payments are not forthcoming because the rainfall data available points that there has been good rainfall. According to Carter et al. (2014, p. 19) “the individual is left worse off than if the insurance had not been purchased at all.” Particularly, risk-averse farmers will be sensitive to the effects of basis risk (Carter et al., 2014). This is because, they adopt insurance so that they can still provide for their families in the event of crop loss. Thus, if basis risk deprives them of their compensation, they may not be in a position to fulfill their household goal, which is protecting their family from starving.

6.4.2 Inadequate weather data infrastructure

Mahul and Stutley (2010, p. 36) note that “an important supply-side impediment to the provision of agricultural insurance in developing countries is the lack of infrastructure support”. Index based insurance schemes are very data intensive, and therefore dependent on a dense number of weather stations that provides accurate and quality data (Mahul & Stutley, 2010). According to [officer 3] there is a need for every community to at least get a simple weather station which will improve the quality of the data to reduce the incidence of basis risk.

6.4.3 Literacy level

Officials of GAIP noted that one problem faced in implementing the drought index insurance is the low level of literacy of the smallholder farmers. Deducing from the educational levels of the smallholder farmers (Appendix 9), most of them either have no formal education or only basic education. According to GSS (2013), THE Northern region has the lowest literacy rates in Ghana with just about 33% of the population aged over 15 years being literate. This may well be very instrumental in their understanding of insurance contracts and design. According to the underwriter of GAIP [Officer 4], “*we try our best to explain to them to make sure they understand. At the point of sale, we try to explain before they buy*”. At a very basic level, smallholder farmers arguably have little knowledge of how insurance in general works. In the first place, smallholder farmers do not have any experience or knowledge about traditional insurance. Therefore, introducing an entirely new concept like index insurance, with its seemingly complicated design, may be too much for farmers to comprehend. Drought index insurance is still in its early stages in the study areas, so maybe with time farmers might understand how it works better. Efforts are still being made by GAIP and other donor agencies to enhance the knowledge of farmers about the drought index insurance. As observed by BalmaIssaka, Wumbei, Buckner, and Nartey (2016), education enhances farmers ability to understand the product even though they have little or no prior experience.

6.4.4 Lack of political will and inadequate government support

Political will and government support play critical roles in promoting commercial agricultural insurance programs, through means such as policy directives and premium subsidies. Due to

government support, China's agricultural insurance market in 2008 became the second largest in the world after the United States (Mahul & Stutley, 2010). Thus, the influence of government support for the growth of agricultural insurance cannot be overstated. There has been no clear policy directive from the government of Ghana promoting agricultural insurance. According to a key respondent [Officer 7], there was a provision for agricultural insurance in the national budget in 2014, but the money never went to GAIP. Interestingly, though the government has demonstrated concern and commitment in 'words' to support agricultural insurance, they have not shown commitments in 'action'. I make this argument because, the 2015, 2016 and 2017 national budgets do not have provisions for agricultural insurance. Secondly because the initial commitment made in 2014, has not been fulfilled.

One key informant [Officer 3] stated that there are reports of discussions championed by MOFA and the Ministry of Finance and Economic Planning (MOFEP) to get the Bank of Ghana (BoG) to pass some legislation that will make it mandatory for financial institutions to insure the loans that they give to smallholder farmers. But this initiative has not been implemented yet.

6.5 Sustaining Index Insurance

Per comments from an informant [officer 5], scalability is needed to sustain the insurance scheme. According to Smith and Watts (2009), there are three major elements to ensure scalability; access or coverage, participation and cost of operating the program.

6.5.1 Access or coverage

Access to the insurance is concerned with how many smallholders can be insured. It can also be related to local insurance provider's access to the reinsurance market and specialized agencies that improve capacities of countries to adapt to extreme weather events. GAIP aims at increasing demand for the product, so that more farmers can have access to it. The basic requirement is that smallholders should be able to pay the premium rates. If premiums are high, then smallholders may not be able to access it. Consequently, GAIP has reduced the premium rates effective 2017, from 10% of total production cost to 5% of the total production cost. Nonetheless, it will be interesting to know if smallholder farmers will be willing to pay actuarially fair premium rates to obtain coverage under the drought index policy. According to (Smith & Watts, 2009) willingness to pay actuarially fair risk premiums is low among farmers in both developing and developed

countries. As at now smallholder farmers in the communities studied enjoy premium subsidies from IPA and are not paying full premium rates. I argue that farmers may be unwilling to pay full premium rates when IPA discontinues their support.

Furthermore, Ghana signed a memorandum of understanding with the African risk capacity (ARC) on June 7th 2016 (ARC, 2017). The ARC is a specialized agency of the African Union (UN) that assists member states to improve their capacities in planning, preparing and responding to extreme weather events and natural disasters. According to a key respondent [Officer 6], Ghana's decision to join ARC will be beneficial to the agricultural insurance landscape of Ghana.

6.5.2 Participation

According to Smith and Watts (2009) participation is concerned with what proportion of farmers are willing to be part of the program from one year to the other. Participation can be influenced by the knowledge and perceptions that farmers have about their experiences with the insurance scheme. Participation and continuous adoption of the insurance product can also be informed by the willingness of farmers to pay the full premium rates, most especially after donor-subsidized premiums no longer exist.

6.5.2.1 Farmers understanding, experience and perceptions

To assess smallholder farmers' willingness to participate, farmers were asked about their understanding and experience of the insurance scheme which can potentially inform their decisions to adopt or continue with the insurance product. All the smallholder farmers who were interviewed had heard about the drought index insurance product. One farmer [Farmer 11], aged 49 in Sunsongbon indicated that,

“they came here three years ago and spoke to us about it. Some farmers paid for it and they were helped when they had bad yields. For that reason, many people bought the insurance this year”.

As Rogers (1995) argue, the first step in the decision-making process of adopting an innovation is acquiring knowledge about that innovation. The responses and views of the smallholder farmers about their knowledge of the product showed that, there are some misconceptions about what this drought index policy is about and what it would do for them. Farmers perceive insurance as an investment. A key informant [Officer 3] noted that

“they want it be like an investment so we go to sell and they say so if nothing happens what happens to their money? We have farmers who have bought and are no longer buying because they bought and had no claims. They want to look at it from the investment perspective so if they give some money at the end of the season they expect some. They are not bothered about the amount they just need some back”.

Per the arguments of Rogers (2010), words are the thought units that structure our perceptions, and the perceptions that potential adopters have about the name of the innovation affects its adoption. In other words, “the perception of an innovation is colored by the word-symbols used to refer to it” (Rogers, 2010, p. 228). In the study areas, the drought index insurance policy is called ‘Faarigu’. ‘Faarigu’ is a Dagbani word which means ‘Savior’.

“When they came, they said they will help us. They said when we pay and we farm and we have poor yield, they will come and pay for the money that we lost depending on how we lost. So we got interested. We thought they will just pay for everything”. [Farmer 3 from Sunsongbon]

Based on such responses, smallholder farmers expect to be restored, at least to a position where their losses on the farm does not prevent them from feeding their families or even preparing for a new cropping season. Therefore, to improve participation, farmers must be privileged to a complete and clear understanding of what ‘faarigu’ offers. If they accept the terms, then it is a step forward to improve their participation in the program.

Furthermore, smallholder farmers express some level of dissatisfaction in the comments below with the amounts that they are paid or compensated. As much as they perceive the indemnity payments helps them to cover some costs, it appears that they expect more money to cover their investments on the farm.

“The insurance is good but it is not good enough for us. Because when you get the tractor to come and plough an acre you pay about GHS 50. And then you buy your seeds to plant about GHS 40. And then ‘condemn’ (a local weedicide) about GHS 11. One (1) bag of fertilizer is also GHS 105 and I have to buy two. And there is another powdered one and I must buy two of that, which is GHS 90. So the GHS 25 that the insurance people give us is not enough at all. Even though they pay us for what we have lost. It is still not enough to even buy the things we were able to buy before the loss” – [a 65-year-old farmer in Sunsongbon., Farmer 8]

“How much does a lorry plough an acre? How much does a bag of fertilizer cost? And they gave me only GHS 25. I know very well that what they gave me is not anything but I cannot complain about it, because they have given me something. I didn’t ask them why they gave me that amount because I do not know anything about how they calculate the money” – [a 55-year-old farmer in Kpatia.- Farmer 2].

“I think they have to change the way they pay. They should pay in such a way that, it will cover all the losses. What they pay us should satisfy us”. – [41-year-old farmer in Nkwanta-Farmer 12]

6.5.2.2 Trust

Furthermore, farmers make their own assessments in deciding to purchase the insurance or not depending on the level of trust that they have in the insurance providers. According to Carter et al. (2014), trust in insurance providers is very crucial especially in a developing country context where there is arguably little legal recourse in reclaiming indemnity payment. Therefore, it is important for GAIP to improve the relations of trust with smallholder farmers. I argue that if ordinary literate Ghanaians perceive insurance companies as lacking integrity and transparency (Suale, 2011) and are skeptical about insurance, how much more smallholder farmers who have low education or have never been to school before. It may be a lot to ask of smallholder farmers to accept the trajectory that index insurance is good for them. Nonetheless, farmers know the risk they face in production. They experience the uncertainties in the rainfall amounts and timing. Therefore, it makes sense at least to the smallholder farmer who has a mandate of protecting the survival of his family to participate in the insurance scheme, most especially when he has been promised compensation.

6.5.3 Cost of operating and administering the program

GAIP administers the drought index insurance policy. GAIP's operation has been funded by donors in addition to the premiums that are being collected from farmers. There is a likelihood that, the donor support will end at some point. In the absence of donor support, GAIP aims at economically sustaining the program by using premium collections, according to an informant [Officer 3]. My argument is that; premium collections may not be enough to sustain the operations of GAIP over the long-term. Comments from one key informant [Officer 4] further corroborates my argument. She noted that *“We are not able to scale up as fast as we want to”*. If the drought index insurance product can be sold as part of another agricultural extension program or facility, it may increase uptake and consequently reduce the cost of the package (UNCTAD, 1994). Smallholders will then have access to insurance, a credit facility or some farm extension support. Treating insurance as a stand-alone activity may not be the most prudent method.

6.6 Summary

Drought index insurance has been implemented and rolled out on a commercial basis in the Northern region of Ghana. Drought index insurance is a product specifically for maize smallholder farmers. Though the insurance product is aimed at providing farmers with a buffer against economic stresses when they have bad yields due to drought, providers also acknowledge the profit-making potential of it. GAIP, serving as the product designer and marketer constantly amends the product to suit the needs of farmers. As a matter of fact, there have been challenges facing the development and economic sustainability of the product. However, GAIP continuous to engage stakeholders including farmers, donor and non-governmental institutions and the government to make the product worthwhile for both farmers and the providers.

7.

SUMMARY, CONCLUSION AND RECOMMENDATION

7.0 Introduction

This chapter presents a summary of findings from the study as well as conclusions and recommendation. It also provides an overview of the themes tackled in this research and information gaps that can be filled by further studies.

This study sought to explore the production risk perceptions of smallholder maize farmers in selected communities in the Yendi Municipal Area of the Northern Region of Ghana. Also, the study aimed at investigating the risk attitudes of smallholder maize farmers. Production risk perceptions and risk attitudes of smallholders inform their risk behaviors and risk management strategies.

However, the core of this study was to bring to the fore the concept of index insurance in Ghana and how it is designed for maize smallholder farmers in the study area. The study also discussed the motivation for providing index insurance with a political economic lens. Exploring the index insurance product was necessary because not much research work had been conducted on it in Ghana and this study sought to reveal in some detail how it works.

This study drew insights from two classical theories that aid in explaining farmers attitude and consequent behaviors towards risk. These are the theory of the optimizing peasant and the risk aversion theory. Both theories are grounded in the assumption that smallholders maximize a household objective or utility function. Firstly, the theory of the optimizing peasant is a neo-liberal theory which assumes that farmers have perfect knowledge in production and will take decisions that maximize income. On the other hand, the risk aversion theory assumes smallholder farmers are not risk loving, and will therefore employ risk management strategies that protects their households from starvation. In addition to the theories aforementioned, this study adopted a set of principles proposed by Dick et al. (2011), that serves as a general guide in designing an index insurance contract and was used to explain the design of the drought index insurance provided in the Northern Region.

This study was explorative in nature and a qualitative methodology was deemed as the best approach to use because the researcher is privileged to both solicited and spontaneous information from target participants. Also, the qualitative methodology allows the researcher to ask follow-up questions and gives the participant more room to express his opinions, perceptions, and experiences.

The study was conducted in the Yendi Municipality of the Northern region of Ghana. I selected three (3) communities named Sunsungbon, Nkwanta and Kpatia for the study. These communities were selected based on two criteria. Firstly, they should be within a 20-km radius of a weather station operated by the Ghana Meteorological Agency and secondly, smallholder farmers should be aware of the drought index insurance product. Farmers were selected using a snowball sampling technique. Thirty-four (34) smallholder farmers were interviewed with a semi-structured interview guide. All these interviews were conducted in the Dagbani language, so I employed two field assistants to assist in translating and transcribing the data. There were seven (7) key informants who provided information on various aspects of the study and the interview with the informants were conducted in English.

7.1 Summary

Below is a summary of key findings from the study.

What are the common types of risks in production that smallholder farmers face?

- Smallholder farmers noted that drought, ‘*Sanzali*’, was the major risk they face in their crop production. The farmer’s comments indicated they were describing meteorological and agricultural drought. Smallholder farmers described drought as inadequate rainfall which causes poor crop yields. The inadequate rainfall refers to meteorological drought, while the consequent effects of inadequate rain causing poor yield, depicts agricultural drought. Furthermore, a few of the smallholders also noted pest and diseases as another challenge in production.

What are the risk attitudes of smallholder farmers?

- Smallholder farmers in the selected communities portrayed attributes of risk aversion. From the comments of the smallholders, the overriding objective was to provide food for

their families. The smallholders therefore aimed at safeguarding their household from starvation, which was the ultimate household objective. There was little indication that smallholders were interested in making profits or large incomes from their production, as the theory of the optimizing peasant posited.

What are the existing risk management strategies?

- As a response to the risks that smallholder farmers face in production and their risk attitudes, various risk management strategies have been employed. These strategies can be grouped on 3 levels; Micro (household) strategies, Meso (community), Macro (government or donor led).
- At the household level, the study revealed that farmers were into crop diversification. Farmers in addition to the maize crop, also farmed millet, groundnut, cassava, guinea corn, soya beans, beans, rice, yam, pepper, okro, cowpea and onion. Another household strategy realized was that farmers diversified their incomes by having off-farm jobs. Some traveled to other communities to work, while others reared animals for sales.
- At the community level, the study revealed that there were associations in all 3 communities which farmers could voluntarily join. Farmers were not obliged to pay any money as dues, but some of them gave a part of their produce to the association after harvesting. Also, the study revealed a system of mutual help, where smallholder farmers assisted each other by giving a part of their produce to colleague farmers if the farmer did not get good enough yields to feed his family. The Ghana Agricultural Pool (GAIP) has developed an index insurance product that farmers can adopt in managing their production risks.
- Finally, donor agencies present in the municipality such as IPA, also provide farmers with community extension services where they teach farmers how to plant 'right'. They teach farmers how to plant in lines, how to apply fertilizer among others.

How is the drought index insurance product designed for smallholder maize crop farmers?

- The drought index insurance product is provided by GAIP. GAIP is a pool of 17 insurance companies, that have come together to share the risks and benefits in providing agricultural insurance for farmers.

- The index insurance product is known as ‘Faarigu’ in the local Dagbani language which means ‘Savior’. The drought index insurance is available to smallholder farmers who have farmland holdings between 1 and 49 acres.
- Smallholders can access this product by buying the insurance from a sales agent of GAIP or IPA. The farmers can buy the insurance during the period of sales which is between May and June, subject to changes.
- When farmers buy the insurance, the geographical coordinates of their farms are taken for rainfall data. GAIP relays the geographical coordinates to GMet and NOAA for rainfall data. GMet provides rainfall data for communities and farms that are in a 20km radius of the weather station. NOAA provides rainfall data for communities and farms within a 10 x 10 km pixel.
- Furthermore, smallholders must provide a crop budget to GAIP showing their total production cost. The total production cost should not be less than GHC 100 and not more than GHC 1000 for the cropping season. Farmers are required to pay 10 percent of the total production cost as their insurance premium. From 2017, the insurance premium rate has been reviewed to 5 percent.
- The insurance policy for the smallholder farmer begins a day after his community experiences three incidences of rainfall. Two of these rainfall incidences should be a minimum of 8mm and the other 2mm. Usually it is between 21st May to 19th June, though it can change.
- The growth stages of the maize crop have been divided into three stages and these stages provide the basis for compensations. There is a germination stage, a growth stage and a maturity stage.
- The germination stage starts from the 1st day to the 25th day after the index policy has begun. At this stage, two parameters are considered. Rainfall must not be less than 25mm in 10 consecutive days. Secondly, there must not be 12 or 13 consecutive dry days. A dry day is a day of less than 2.5 mm of rainfall. If both conditions are not met, then a farmer is entitled to 20 percent of his total crop production cost.
- At the growth stage, there should not be record of 12, 13 or 14 consecutive days of less than 2.5 mm of rainfall. If this happens, smallholders are entitled to 50 percent of their production cost. the growth stage is from the 25th day to the 120th day.

- The maturity stage lasts from the 77th day to the 110th day. At the maturity stage, farmers who fall short of a cumulative total of 125mm of rainfall on their farms are eligible for 30 percent of their production cost.
- GAIP at the end of the season goes to the farmers to perform what is called notification. Here, they give out cash to farmers who are entitled to compensation.

What challenges do providers and smallholder farmers face in the provision and adoption of the insurance product?

- The first challenge expressed by both farmers and GAIP has been basis risk. Basis risk is the potential mismatch between rainfall records and the actual losses on the farm. Providers indicate this happens because the range covered by GMet (20km radius) and NOAA (10 x 10 km pixels) is too large to provide accurate rainfall readings reflecting the actual occurrences on individual farms.
- There is a certain lack of political will and government support for the insurance scheme. Though government has publicly supported the novel product, there has been no clear policy directive to help GAIP with finance or providing re-insurance cover.
- Inadequate weather data infrastructure is a challenge. GAIP indicates that more weather stations are needed to provide accurate data to prevent the basis risk problem.
- Providers have indicated that the low literacy levels of smallholder farmers has been a challenge, because farmers do not understand insurance. Some of them regard it as investment and hence assume that some compensation must be paid at the end of the season regardless of whether there was drought or not.

How do providers intend to make the product sustainable for smallholder farmers?

- Providers intend to make the product economically sustainable by scaling it up. Scaling up involves increasing the customer base in terms of numbers. This will increase premium collections from smallholders which can be used to make claim payments. In line with increasing the customer base, GAIP has reduced the premium rates from 10% to 5% to make it more affordable for farmers.
- Secondly, providers are committed to scaling up the product by improving farmers experience with the product to increase participation.

7.2 Conclusion

By using the conceptual framework in Chapter 3, section 3.8, I have explained and discussed the findings in this study. In my theoretical framework, I noted that smallholder farmers experienced risks in their production and the major production risk was drought. I presented the various types of drought placing emphasis on meteorological drought. My empirical findings supported this claim by proving that (meteorological) drought was a significant risk and served as a basis for the index insurance product in the Yendi municipality of the Northern region. Also, I suggested that the risk attitude, particularly the risk averse behavior of smallholders, informs smallholder's decisions to adopt risk management strategies. The empirical findings further corroborated that assertion, pointing out the various risk management strategies that smallholders have adopted including crop and income diversification and drought index insurance, to protect their families from starving. Hence, the study findings and discussions have been guided by the conceptual framework and a strong link exists between the empirical data and the conceptual framework that was used for the study.

7.3 Recommendations

- GAIP may only stand the test of time if the Government of Ghana (GoG) provides it with the necessary support. From the study, GAIP officials have indicated that a clear policy directive aimed at making all banks and microfinance institutions insure their agricultural loans will be key to making the product sustainable. This policy directive can come from the Bank of Ghana (BoG), who is tasked with the mandate of regulating activities of financial institutions. Countries like China have seen their agricultural insurance markets grow because the Chinese government acts as a reinsurer. If GoG can provide a reinsurance cover for GAIP, it will go a long way to improve their services and make it sustainable.
- GAIP must also aim to make all contracts as simple as possible for the smallholder farmers. When farmers understand the contracts very well, it will foster trust between GAIP and the farmers. As noted, smallholder farmers have low literacy levels. For that matter, more time should be spent in the communities by GAIP agents to explain the details of the contract to the smallholders. Having so many smallholder farmers buying the insurance in its early

stages may not be enough to make it sustainable. The success of the product may lie in the positive perceptions that the farmers create over time, based on their experiences.

- GAIP and IPA should aim at paying smallholders their compensations on time when they are eligible for it. If meeting the smallholders in person to pay cash would cause delays, GAIP and IPA should consider paying farmers using a mobile money account which is connected to their mobile phone numbers. Currently telecommunication giants in Ghana such as Vodafone, MTN, Tigo, Airtel all have mobile money services which makes it simple to transfer and receive cash. Delaying payments to farmers can dent the trust that farmers have in the product.
- GAIP should also aim at installing simple weather stations with rain gauges in all communities to record rainfall. The issue of basis risk can be significantly addressed if more weather stations are installed.

7.4 Limitations and Further Studies

- The perceptions that farmers in the research communities have about index insurance may be different in other communities. This is because, in the three communities studied, the insurance premiums are subsidized by IPA and therefore farmers may not know what it feels like to pay full and fair actuarially correct premium rates. The perceptions of farmers in other communities may be different if IPA does not subsidize the premiums in those communities.
- Though the motivation for providing index insurance was discussed, the study could have concentrated more on whether Ghana as a developing country should follow the path of the developed world in using agricultural insurance as a risk management strategy. I make this argument because questions have been raised in relation to whether there is too much hype about index insurance and if it really has positive impacts on farmers.
- Also, the study did not discuss the effects of adopting insurance on smallholder farmers. Though it is a critical theme to discuss, this study did nothing on it, mainly because index insurance is relatively new in Ghana, and as such the data needed for assessing effects of adopting index insurance on farmers may not be available.

- The study also did not discuss what influences the production risk perceptions and risk attitudes of smallholders. The influences of age, gender, socio economic characteristics have not been adequately dealt with. Further studies can focus on these aspects as well.

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APPENDICES

Appendix 1

KEY INFORMANT INTERVIEW WITH SARI

1. Please tell me your name and portfolio
2. Please tell me about your organization and what role you play for crop farmers in the region.
3. Is climate change a significant concern for your organization and how are you dealing with it?
4. How has climate change impacted agricultural yields
5. What are your organizations predictions of the impacts of climate change on crop farmers?
6. How do you intend to deal with the impacts? Please provide specific programs.
7. Are you aware of agricultural insurance for crop farmers in the region?
8. Do you have any collaboration with the insurance providers?
9. How do you think insurance can respond to the effects of climate change

Appendix 2

SEMI-STRUCTURED INTERVIEW GUIDE FOR MINISTRY OF FOOD AND AGRICULTURE

1. Please tell me your name and portfolio in your organization
2. Please tell me about your organization and what services you provide to farmers.
3. How has the rainfall pattern been like over the past 10 years?
4. Does it have any impact on crop production? If yes, what kind of impacts?
5. Do you know about crop insurance for farmers in the Northern region?.
6. Which crops are insured?
7. When did the insurance scheme for crop farmers begin?
8. Do you think it is a good product? If yes, why. If no why?

Appendix 3

SEMI-STRUCTURED INTERVIEW GUIDE FOR GHANA AGRICULTURAL INSURANCE POOL

1. Please tell me your name and portfolio in your organization
2. Please tell me about your organization and your motivation for pursuing insurance for crop farmers.
3. Kindly explain how insurance can respond to the effects of climate change.
4. What forms of agricultural insurance are available for smallholder maize crop farmers?
5. What are the requirements for smallholders to take insurance?
6. How is the insurance fee calculated, how is the compensation calculated?
7. Which crops are insured?
8. When did the insurance scheme for smallholders begin in the Yendi municipality?
9. Have you made any indemnity payouts? If yes, when? What were the reasons for the payouts?
10. Were farmers or farmer associations (in that locality) involved at any level of the development of the scheme? If yes, at which level?
11. How is the insurance scheme introduced and marketed to farmers?
12. Have farmers proposed any suggestions to amend the product?
If yes what are they?
13. Which of the insurance types has been most patronized in the municipality? What do you think accounts for it?
14. What challenges do/have you encountered in implementing the insurance program for farmers?
15. Have there been any policy and institutional adjustments in favor of agricultural insurance? If yes, what are they?
16. What is the role of government in the insurance program?
17. Do you have any support from other organizations?
18. What amendments can be made to the product to make it sustainable?

Appendix 4

SEMI-STRUCTURED INTERVIEW GUIDE FOR INNOVATION FOR POVERTY

ACTION (IPA)

1. Please tell me your name and portfolio in your organization
2. Please tell me about your organization and your motivation for pursuing insurance for crop farmers.
3. What kind of relationship do you have with the insurance providers?
4. Kindly explain how insurance can respond to the effects of climate change.
5. What forms of agricultural insurance are available for smallholder maize crop farmers?
6. What are the requirements for smallholders to take insurance?
7. How is the insurance fee calculated, how is the compensation calculated?
8. Which crops are insured?
9. When did the insurance scheme for smallholders begin in the Yendi municipality?
10. Have you made any indemnity payouts? If yes, when? What were the reasons for the payouts?
11. How is the insurance scheme introduced and marketed to farmers?
12. Have farmers proposed any suggestions to amend the product?
If yes what are they?
13. Which of the insurance types has been most patronized in the municipality? What do you think accounts for it?
14. What challenges do/have you encountered in implementing the insurance program for farmers?
15. Have there been any policy and institutional adjustments in favor of agricultural insurance?
If yes, what are they?
16. What is the role of government in the insurance program?
17. Do you have any support from other organizations?
18. What amendments can be made to the product to make it sustainable?

Appendix 5

SEMI-STRUCTURED INTERVIEW GUIDE FOR GIZ

1. Please tell me your name and portfolio in your organization
2. Please tell me about your organization and your motivation for pursuing agricultural insurance for farmers.
3. What kind of support do you provide to the providers of agricultural insurance?
4. Kindly explain how insurance can respond to climate change.
5. What challenges do/have you encountered in supporting the insurance program for farmers?
6. Have there been any policy and institutional adjustments in favor of agricultural insurance? If yes, what are they?
7. What is the role of government in the insurance program?
8. Based on your experience, what amendments can be made to make the insurance scheme sustainable?

Appendix 6

SEMI-STRUCTURED INTERVIEW GUIDE FOR ADVANCE GHANA

1. Please tell me your name and portfolio
2. Kindly tell me about your organization and what you do.
3. What programs do you undertake for crop farmers in relation to issues of climate change?
4. Are you aware of agricultural insurance for crop farmers?
5. Is your organization involved in pursuing insurance for crop farmers? If yes, how are they involved?
6. Which organizations do you have collaborations with regarding agricultural insurance
7. Have you been involved in any claim payments to crop farmers?
8. What necessitated these payments?
9. How do you go about the payments?
10. What challenges do you think the insurance providers are facing?
11. How can the insurance be made economically sustainable for farmers?

Appendix 7

SEMI-STRUCTURED INTERVIEW GUIDE FOR SMALLHOLDER FARMERS

Village name/Location:

Demographic Information

1. Name (Optional):
2. Position in Household:
3. Family Size:
4. Gender:
5. Age:
6. Land size:
7. Educational Level:
8. How long have you been farming?

Crop cultivation and harvesting

9. Which crops do you grow?
10. When do your crop planting seasons begin and end?
11. How long does it take to cultivate and harvest your crops?
12. Have your crop yields been the same in the past 10 years?

If no, what do you think is causing the change?

Knowledge of a change in climate or weather pattern

13. Have you observed any changes in the rainfall pattern in the past 10 years?

How has the rainfall pattern been like?

14. Are there any changes in the start and end times of your crop planting periods in the past 10 years?

If yes, what do you think is the reason for the change?

15. Are there any changes in the start and end times of your crop harvesting periods in the past 10 years?

16. What is drought?

Have you experience this in the past 10 years?

Existing local adaptation strategies

17. Do you have an irrigation scheme in your community?
18. Are you provided with seedlings?
19. Which other activities apart from crop farming do you engage in for income?
20. Where do you sell your produce?

Knowledge of insurance for crop farmers

21. Do you belong to a farmer association?

If yes,

- i. What is the name of the association?
- ii. How long have you been in the association?
- iii. What benefits do you derive from the association?
- iv. Do you pay dues or a fee? How much do you pay?

If no,

Can you explain why you are not in any?

22. Do you know about agricultural insurance for crop farmers in your area? If yes, how did you get to know?

23. Who sold the insurance to you?

24. Have you taken the insurance for your crops? If yes,

- i. Which crops are insured?
- ii. How much did you have to pay for the insurance?
- iii. How would you describe the process of acquiring it? Was it simple?
- iv. Have you been compensated before?
 - i. If yes, what was the compensation process?
 - ii. How long did it take for you to get compensation?
- v. Do you think the insurance package is helping you? If yes how?,

if no, why?

25. Do you have a reason for not taking it? What is the reason please?

Appendix 8

List of key informant interviews

Officer No.	Institution	Portfolio	Date of Interview
Officer 1	SARI	Head of Climate Change Adaptation Unit	4th July 2016
Officer 2	MOFA	Head of crops division (Northern Region)	5th July 2016
Officer 3	GAIP	Marketing Officer, Northern Region	02 July 2016
Officer 4	GAIP	Country Underwriter	22nd July 2016
Officer 5	IPA	Implementation Associate	4th July 2016
Officer 6	GIZ	Head of ICRM, GIZ Ghana	25th July 2016
Officer 7	USAID ADVANCE	Snr. Business Services Specialist	7th July 2016

Appendix 9

Background information of smallholder farmers who were interviewed one-on-one.

Community	Farmers	Family Size	Age	Land Size (Acre)	How long in Farming	Educational Level	Crops Cultivated
Nkwanta	Farmer 1	7	25	15	10	None	Maize, Soyabeans, Yam, groundnut
	Farmer 2	N/A	90	12	73	None	Maize, Groundnut, Guinea corn, Cassava
	Farmer 3	8	35	12	16	None	Maize, Yam, Cassava, Guinea corn
	Farmer 4	11	22	6	8	JHS	Maize, Yam, Guinea Corn, Soyabeans, Millet
	Farmer 5	6	30	8	20	Primary	Maize, Cassava, Groundnut, Soya beans
	Farmer 6	13	35	20	27	None	Maize, Guinea corn, Groundnut, Yam, Soyabeans, Millet, cassava
	Farmer 7	25	30	8	15	SSS	Maize, Yam, Guinea corn, Millet, Beans, groundnut, Soyabeans, Cassava
	Farmer 8	7	21	7	14	JHS	Maize, Yam, Guinea corn, groundnut, beans
	Farmer 9	12	51	9	25	None	Maize, Millet, Yam, Cassava, Guinea corn
	Farmer 10	16	18	8	10	None	Maize, Groundnut, Soyabeans, Yam
	Farmer 11	11	58	17	40	None	Maize, Yam, Guinea Corn, Soyabeans, Millet
	Farmer 12	11	41	10	21	None	Maize, Yam, Soyabeans
	Farmer 13	8	34	7	12	None	Maize, Guinea corn, Groundnut, Yam,
Sunsungbon	Farmer 1	7	46	8	15	None	Maize, Soyabeans, Guinea corn, groundnut
	Farmer 2	27	30	20	20	SSS	Maize, Soyabeans, Groundnuts, beans, Yam
	Farmer 3	7	27	6	16	JHS	Maize, Yam, Soyabeans
	Farmer 4	10	29	10	15	JHS	Maize, Guinea corn, Groundnut, Yam, Soyabeans, Millet, beans, cassava

Community	Farmers	Family Size	Age	Land Size (Acre)	How long in Farming	Educational Level	Crops Cultivated
	Farmer 5	5	20	2.5	8	SSS	Maize, Yam, Groundnut, Soyabeans, Beans, Millet
	Farmer 6	10	57	9	49	None	Maize, Yam, Guinea Corn
	Farmer 7	7	45	12	30	Primary	Maize, Groundnut, Rice, Yam
	Farmer 8	6	65	4	N/A	None	Maize, Cassava, Groundnut, Soyabeans, Pepper, Okro
	Farmer 9	12	45	9	25	None	Maize, groundnut, Yam, Soyabeans, Millet
	Farmer 10	17	N/A	9	70	None	Maize, Groundnut, Soyabeans, Yam
	Farmer 11	19	49	31	23	None	Maize, Yam, Groundnut
Kpatia	Farmer 1	15	32	16	20	SSS	Yam, maize
	Farmer 2	5	55	8	37	JSS	Maize, Soya beans
	Farmer 3	12	45	12	35	None	Maize, Guinea corn, Yam Cassava
	Farmer 4	10	24	6	14	Primary	Maize, Yam, Groundnut, Soya beans
	Farmer 5	14	70	42	60	None	Maize, Groundnut, Yam, Guinea Corn, Cassava, rice, beans, cowpea, onion, pepper
	Farmer 6	16	27	40	10	JSS	Maize, rice, groundnut, soya bean, cassava, yam
	Farmer 7	6	80	4	70	None	Maize, Soyabeans
	Farmer 8	16	75	8	52	None	Maize, Yam, Soyabeans
	Farmer 9	10	28	10	5	SSS	Maize, Yam, Soyabeans
	Farmer 10	12	25	5	10	Primary 6	Maize, Soyabeans, Yam
	Farmer 11	11	25	8	13	SSS	Maize, Groundnut, Yam, Cowpea
	Farmer 12	22	35	15	20	None	Maize, Yam, Beans, Millet
	Farmer 13	9	60	15	42	Primary 6	Maize, Yam, Groundnut, Soyabeans, Millet

Appendix 10

Geographical Coordinates of reference weather station

Elevation	Latitude	Longitude
195.2m	09°27'00"	000°01'00"

Geographical Coordinates of Communities

Communities	Latitude	Longitude
Sungbon	9°35'17.45"	-000°2'18.17"
Kpatia	9°31'26.04"	-000°1'49.58"
Nkwanta	9°36'36.14"	-000°2'36.60"

Rainfall Averages in Yendi municipal district from 1980 to 2013 provided by GMet

Month	Monthly Averages
January	3.9
February	9.3
March	48.9
April	101.9
May	128.9
June	195.5
July	202.5
August	243.9
September	283.9
October	113.1
November	6.9
December	2.7

Appendix 11

Some pictures from interviews and focus group discussions

