ASHESI UNIVERSITY

THE WILLINGNESS OF COCOA FARMERS TO INSURE THEIR FARMS AGAINST PRODUCTION RISKS – THE CASE UPPER WEST AKIM DISTRICT OF THE EASTERN REGION OF GHANA.

Undergraduate Thesis by

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The Willingness of Cocoa Farmers to Insure Their Farms Against Production Risks – The Case Upper West Akim District of the Eastern Region Of Ghana

DECLARATION

I hereby declare that this is my original work and that no part of it has been presented for another degree in this university or elsewhere

Candidate's signature ………………………………………………

Candidate's name : Elvis Kwaku Amponsah

Date : 11th May, 2020.

I hereby declare that the preparation and presentation of the thesis was supervised in accordance with the guidelines on supervision of thesis laid down by Ashesi University

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Abstract

Cocoa production contributes largely to Ghana's export earnings. Cocoa farmers in Ghana face both price risks and production risks. Ghana's cocoa sector faces negligible price risk because the government pays a fixed producer price. However the cocoa sector is faced with different forms of production risks due to pest and disease, climate change, variations in weather patterns and outbreak of bush fires among others. Cocoa farmers in the Atiwa District, known to be one of the major cocoa producing districts in Ghana face these uncertain production risks that cause crop failures leading to low production yields. Therefore, one strategy to mitigate such risks is to insure their cocoa farms against uncertain risks to hedge against crop loss. Insurance helps to measure risk and protect farmers against crop failures. This study evaluated the major production risks faced by cocoa farmers in Ghana, the extent of the awareness of cocoa farmers in general insurance products, identified the factors that influence the willingness of cocoa farmers to insure their farms and identify the average price cocoa farmers are willing to pay to insure their farms. A random sampling approach was used to sample 133 cocoa farmers in the Upper West Akim District in the Eastern Region of Ghana. A Contingent Valuation Model is used to infer the utility maximization levels and design an appropriate questionnaire to measure the willingness of farmers to adopt crop insurance. Using a probit and logistic model, age and other income sources of cocoa farmers were found to influence the willingness of farmers to adopt crop insurance.

Abbreviations

CVM- Contingent Valuation Model

GAIS - Ghana Agricultural Insurance Program

LBC – Licensed Buying Company

PPRC – Production Price Review Committtee

WTP- Willingness to Pay

WTA- Willingness to Accept

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CHAPTER 1: INTRODUCTION

Introduction, Background and Problem Statement

The contribution of agriculture to developing countries in the world cannot be overemphasized. African countries continue to pursue a competitive edge to promote growth in their economies. To be able to achieve this comparative advantage, developing economies tend to make efforts to increase foreign exchange to promote economic growth through commodity exports (World Bank, 2003). Many developing economies such as Ghana depend hugely on earnings from the export of major agricultural products such as cocoa.

Countries that produce cocoa get sizable proportions of their export earnings from cocoa (FAO, 2004). Over the past 19 years, the African continent, notably West African countries, have done well to be the leading producers of cocoa in the world. Africa was estimated to have produced about 3.2 million tons of cocoa beans for the 2013/2014 crop year (Ameyaw et al., 2018). This contributed to 73% of the world's cocoa production, with Cote D'Ivoire and Ghana, the two principal cocoa-producing countries (Ameyaw et al., 2018). Awuah (2002) and FAO (2004) estimated that West African countries contribute between 54% and 71% of the world's total cocoa output. For example, Cote d'Ivoire exported a record of 1.4 million tons of cocoa beans in 2001. This milestone added to 14% of the country's GDP, 40% of export, and about 20% of government revenue (Nkamleu & Kielland, 2006).

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Cocoa is successfully cultivated in the Western, Eastern, Brong -Ahafo, Volta, Central, and the Ashanti regions of Ghana (Anim-Kwapong & Frimpong, 2004). Ghana is ordered as the second highest producer of cocoa in the world, only behind Cote D'Ivoire, producing almost a fifth of the world's total output of cocoa (Vigneri & Santos, 2007). Ghana produced a record high of 1,004,000 metric tons in the 2010 and 2011 crop years (COCOBOD, 2011). Ghana is also regarded on the international market for producing the world's quality cocoa beans (Armah, 2008).

The cocoa sector in Ghana has been contributing immensely to its export earnings over the past decade (Tutu, 2011). The cocoa sector generates employment, food, foreign exchange earnings, income, and tax revenue for the Ghanaian economy. For example, out of the 38% foreign exchange earnings contributed by the agriculture sector, the cocoa sector contributed about 28.5 percent in 2008 (ISSER, 2008). The Ghana cocoa sector contributes mostly, if not only, sources of revenue, livelihood, and incomes for farmers (Tutu, 2011). The Ghana cocoa sector creates a lot of employmet for Ghanaians as it employs an estimated 3,200,000 people along its commodity chain, and about 800,000 smallholders (farmers owning less than 12 acres of cocoa land) farmers nationwide (Lundstedt & Pärssinen, 2009).

Anim-Kwapong and Frimpong (2004) provided a synopsis of the impact of cocoa producing by asserting that about 800,000 smallholder cocoa farmers in Ghana earn a lot of their annual earnings primarily from cocoa production. The Ghana cocoa sector generates domestic income and accounts for about 25 percent of foreign exchange earnings (ISSER, 2014). Reports approximate that in 2013, 16.48% (US$ 2267.3 million) of all the agriculture export receipts were foreign revenue earnings from cocoa (ISSER, 2014).

Cocoa has contributed more than 30 percent of Ghana's export earnings over the crop years 1995 to 2014 (ACET, 2014). Subsequently, other stakeholders such as the licensed cocoa buying companies, agrochemical suppliers, input and output distributors get their products, income and employment from the cocoa industry (Asamoah & Baah, 2003).

Ghana is not only known for producing high quantities of cocoa, but it is the most central origin of high-quality cocoa beans with the country's cocoa considered as the standard for measuring the quality of bulk cocoa on the international market (International Trade Center, 2001; Ntiamoah & Afrane,2008; Armah, 2009; Gockowski et al.; 2011).

The Ghanaian cocoa sector has seen significant progress in recent years although dependence on a small number of export commodities has often created susceptible international price volatilities (UNCTAD, 2005; Wilson, 1985). Nevertheless, with world prices of agricultural export goods increasing, and coupled with rapid global economic growth indicates how the demand-driven prices might continue (IMF, 2018; World Bank, 2007).

Ghana is a leading example, where internal reforms and favorable external conditions have brought about an increase in traditional exports with Ghana regaining its top place among the world's largest producers of cocoa (Mackay and Aryteey, 2005). It is, therefore, not coincidental that the Ghana's cocoa sector continues to perform well after a poor output performance between 1970-1990 (Armah, 2009; Ghana Ministry of Agriculture, 2005).

The contributions the cocoa market has made to the Ghanaian economy has been outstanding and immense. That notwithstanding, the Ghana cocoa sector has been witnessing fluctuations in production over the last decades. Two major risks affect cocoa farmers (Freshwater & Jette-Nantel, 2008). The risks are production and price risks. Price risk is concerned about the disparities in the market prices of cocoa seeds and production inputs. The Government of Ghana in conjunction with the Producer Price Review Committee (PPRC) and COCOBOD set a fixed producer price every year for cocoa farmers in Ghana (Lundstedt & Pärssinen, 2009). The objective is to reduce the negative impact of cocoa price fluctuations on farmers (Lundstedt & Pärssinen, 2009). The producer price is a price floor. The price restrains LBCs to buy cocoa farmers below the producer price. Considering the world market price for cocoa fluctuates, the government, PPRC, and COCOBOD (Cocoa Marketing Board) have set a difference between the actual price and the predicted price **(**Lundstedt & Pärssinen, 2009**).** The latter is the price on which the producer price is set. This means that the price fluctuation could create either a surplus or a deficit. The Government of Ghana and the cocoa farmers share the surplus, with farmers receiving the surplus in the form of bonuses at the end of the purchasing season. The Government of Ghana, however, covers all the deficits, if any, alone. In contrast to Ghana, Cote d'Ivoire, the leading exporter of cocoa in the world has a liberalized market, where the price stabilization duties of their cocoa marketing board have been eliminated (Lundstedt & Pärssinen, 2009). Since producer prices are not fixed, fluctuation in international cocoa prices will lead to a decline in cocoa revenue for farmers. This does not incentivize cocoa farmers to produce quality cocoa beans (Lundstedt & Pärssinen, 2009). In contrast, Ghana has a reputation for its high-quality cocoa beans, which allows COCOBOD to pre-finance its farmers by trading in the futures market (Armah, 2008; Sibun, 2008). This paper does not focus on the price risk faced by cocoa farmers because the Government of Ghana controls the price that farmers receive but focuses on production risk.

Production risks are the risks that affect the variations in the quality and quantity of cocoa production (Okuffo et al., 2016). The industry faces several production risks such as bush fire, low crop yield, pest and disease outbreak, whims of nature (climate change), and natural hazards like droughts and flooding (Vilalobos, 1989). Yearly cocoa production declines are a result of the uncertain risks farmers face, and since they are beyond the farmers' control, farming has become a risky occupation. Between the 1998 and 2005 cocoa season, growth in production fluctuated from 350,000 tons to about 750,000 tons. However, there has been a growth in production in the last decade with a record-high 1,000,000 tons produced in the 2012 cocoa season (Okuffo et al., 2016). There is a popular conviction that the increase in production yield is because of several interventions such as the "Cocoa Mass Spraying Exercise" (Okoffo et al., 2016). Although there has been an impressive growth in production, Ghana's per hectare yield is 400kg per hectare of land which smaller when likened to Cote d'Ivoire's 800kg per hectare of land and Malaysia 1800kg per hectare of land (Lundstedt & Pärssinen, 2009). The Ghana cocoa sector's average yield per hectare of land is shy of the expected average of about 1000kg per a hectare of land (Danso-Abbeam et al., 2014).

Johny et al. (2003) assert that pests and diseases affect cocoa production yields negatively in developing countries. It is reported that about 30-40% of cocoa produced globally is being affected and lost through pests and diseases (ICCO, 2015). The most prevalent harmful disease is *black pod*. Nkamleu et al. (2007) estimated that the *black pod* disease contributes to an annual loss of about 44% of all global cocoa production. Another damaging virus is the cocoa swollen shoot virus (CSSV) that triggers swelling of the roots and stems of the cocoa tree (Danso-Abbeam et al., 2014).

Similarly, damaging to cocoa production are insect pests, cocoa capsids, or mirids that cause substantial reductions in cocoa production. Nkamleu et al. estimated that an outbreak of these pests could cause about a 75% production loss mostly in places where cocoa trees have been abandoned. Mistletoes are also parasites that affect newly cocoa plantations after a forest has been cleared to cultivate the cocoa plant.

Due to climate change, weather patterns have as well been inconsistent. The variations in rainfall patterns are reflected by the increasing flooding cases and severe drought periods which has subsequently reduced cocoa yields (IPCC, 2014; Laux et al., 2010). Smallholder farmers depend heavily on rainfall as a source of moistness. This means farmers are likely to make production losses when rainfall patterns become inconsistent, making farmers lose significant portions of their investment and income (Laux et al., 2010). The uncertain risks associated with cocoa production grow pessimisms across farming communities as farmers lose their investments and income which leaves them stuck in the vicious cycle of poverty in developing countries (Ajakaiye, 2001). This cycle is mirrored by low output levels which leads to low income earnings, leaving farmers with less or no money to invest in the farms (Ajakaiye, 2001).

For years, some cocoa farmers have sought to cultivate other crops, use of pesticides, and fertilizer applications to hedge production risks and increase yield (Ajakaiye, 2001).

To lessen the challenges of low productivity growths, the government of Ghana has implemented several initiatives through the Ghana Cocoa Board (COCOABOD), Quality Control Division and the Cocoa Marketing Board to mitigate risks in the cocoa sector.

COCOABOD and its divisions were established in 1947. It is the statutory public institution mandated to regulate the cocoa industry in Ghana (COCOABOD, 2019). Over the years, COCOABOD has implemented policies like Cocoa Swollen Shoot Virus Disease Control Unit (CSSVDCU), Seed Production Unit (SPU), Cocoa Diseases and Pest Control Program(CODAPEC) popularly known as the *Cocoa Mass Spraying* all were aiming to mitigate risks that affect cocoa production (Danso-Abbeam et al., 2014). Through the *Cocoa Mass Spraying* program, inputs and labor to help control *black pods* and *capsids* are provided. COCOABOD has assumed a wide range of responsibilities that aims at monitoring, rehabilitation of old cocoa farms affected with pests and diseases, and spraying more than 3 million hectares for capsid and black pods (Choudhary & D'Alessandro, 2015). Fertilizers are also provided to farmers mostly on credit to boost production levels. Cocoa farmers are required per the regulations of COCOBOD to spray their cocoa farms four times in a cocoa season from August to December but leaving out November to harvest the cocoa fruits (ICCO, 2008; Adu-Acheampong et al., 2007).

Despite the positive impact that COCOABOD has played, several challenges still exist. Mass pilfering and sale of subsidized inputs for "mass spraying' of cocoa farms, subsidized fertilizers not reaching farmers, political interference in the "mass spraying" and "pollination" programs, the emergence of new cocoa diseases and pests, climate change and low adoption of technology among other challenges are existent (Quartey, 2013).

Considering the production risks in the Ghanaian cocoa market, crop insurance could be used as a risk management tool to enable cocoa farmers hedge against production losses.

Insurance is a policy that helps reduce the financial burden of uncertain events like loss of property, life, weather damages, accidents involving automobiles, and medical risks (Quagrainie, 2006). Similarly, Adams (1995) defined insurance as an agreement between parties or groups of parties where one party (insuree) pays a premium to the insurer so that the insurer pays a fixed amount of money to the insuree in the incidence of unexpected events.

Therefore, the adoption of crop insurance will protect farmers against completely losing all their investments or income should an event occur. With crop insurance, crop failures in a crop year will be moderated to provide a sense of production security for years (Ray, 2001). This would to make plans on how production risks could be effectively managed to help farmers hedge against losses now and in the future. Although important, several insurance schemes are provided by insurance schemes like health insurance, fire insurance, and auto insurance among others but none of the products of crop insurance to protect crop failures (Aidoo et al., 2014).

Research Question

What factors influence the the willingness of cocoa farmers to adopt crop insurance?

1.4 Research Objectives

1. Evaluate the major production risks cocoa farmers in Ghana face.
2. Evaluate the awareness levels of cocoa farmers on insurance policies and products.
3. Identify the factors influencing the willingness of cocoa farmers to use crop insurance.
4. Identify the average price cocoa farmers are willing to pay to adopt crop insurance.

1.5 Stakeholders

The stakeholders of the study include are but not limited to cocoa farmers, insurance firms, the Government of Ghana, COCOBOD and policymakers that will be interested in how the insurance policies will benefit or cost cocoa farmers.

1.6 Relevance of the study

This study would provide information on the major production risks cocoa farmers face in Ghana. Considering that a crop insurance policy is advocated to help them mitigate the production risks that affect their crop yield, which will subsequently increase their capital savings to both reduce the poverty cycle. The findings from this study could be used a guide for insurance companies when they consider selling crop insurance products. The government and other private cocoa purchasing firms will gain an increase in the production of cocoa production when production risks are minimized substantially.

1.7 Structure of the study

This study has five chapters. The first chapter, which is the introduction, consists of the background, description of the research problem, objectives, significance, and how the research is organized. The second chapter, the literature review, reviews existing literature on crop crop insurance, and theoretical and analytical framework. The third chapter of the study, methodology, describes the study area, how data was collected and how the data was analysed. The fourth chapter, the results, explains the findings of the study. The last section, conclusions and recommendations presents a summary of the study and possible recommendations for relevant stakeholders.

CHAPTER 2: LITERATURE REVIEW

2.1 Crop Insurance

Consistent with economic development theories such as Rostow's stages of Growth.The model proposed by Walt Rostow in 1960 and Lewis' Structural Change Models proposed by Arthur Lewis in 1954, the process of economic development starts with a focus on agriculture and then branches into other sectors of the economy such as manufacturing and service production as development advances. It is, hardly surprising that a large proportion of the population in developing countries relies on agriculture, often subsistence agriculture as their primary source of household income. According to Rostow, development economies go through five growth paths: traditional society, transitional stage, take-off stage, drive to maturity, and the stage of high mass consumption (Li & Hung, 2013).

The first stage is when agriculture is the primary industry with the majority of the population engaged in agricultural production, and the government having higher political power. in the first stage, factors such as climate change has a substantial effect on economic growth. Agriculture production develops, another business surface, and investment and savings in the economy increase because trade activities increase in the second stage. In the third stage, a lot of opportunities emerge for entrepreneurs to make use of technology to improve the economy, capitalism is encouraged, and gross national income subsequently increase. In the fourth stage, although innovative technology moves to other sectors of the economy, savings and investments generally decrease. In the final stage, as industrialization reaches its peak, the income of the working population rises. They, therefore, demand many consumer goods (Anthony et al., 2009).

Lewis' model proposes that labor in dual economies is available to the urban industrialized sector at a constant wage determined by the existence of subsistence farming systems due to disguised unemployment in agriculture". Lewis argues that it is only an increasing wage rate that will be able to draw more labor out of agriculture.

The majority of Ghana's population, just like other developing countries depend heavily on income generated from agricultural practices as their solitary source of income (Etwire et at., 2013). Etwire et al. (2013) asserted and emphasized that a lot of the countries in the world experience volatilities in crop yield and agricultural practices due to unpredicted variations in weather conditions caused by across-the-board climate change. Etwire et al. (2013) also determined that the contribution of agriculture to the economy of Ghana has been negatively affected due to the variations in the weather. These variations potentially reduce agricultural income through, for example, crop losses, forcing farmers into poverty without proper risk management mechanisms. Barnett et al. (2008) emphasized that income losses cause farmers to manage their financial risks badly, making them earn low returns on their assets and forcing farmers to make an untimely sale of their assets. These effects can potentially affect the general performance of a country's economic performance (Barnett et al., 2008).

In a lot of aspects, agricultural practices are subject to a sizeable amount of uncertainty (Ray, 1981). Ray (1981) underlines that agriculture is particularly susceptible to physical insecurities of nature since it requires continuous, widespread, and direct contact with the force of nature compared to other forms of business setups. Uncertainties in businesses related to agriculture range from disease and pest related, and weather-related hazards such as variations in rainfall leading to floods, windstorms, droughts among others. These uncertainties create pervasive risks to a lot of farmers in developing countries, especially those depending heavily on agricultural practices (Miranda & Farrin, 2012).

With a lot of the farming activities centered in rural communities in developing countries, farmers use numerous management approaches to reduce the occurrence of risks in their farm activities. Diversification of crops, cultivating resistant crops on farmlands where such crops are vulnerable, hedging, contracting farmers to work on producing specific crops, and crop insurance are some of the management approaches used by farmers to mitigate risks on their farms. Comparatively, the use of crop insurance is not a common practice in developing countries like the other approaches listed. Ramiro (2009) defined crop insurance as a system of a risk management approach that is used to protect against a conditional loss. In essence, insurance allows for an impartial shift of risk of loss from one entity to another in exchange for a premium or a promise of a guaranteed small loss to avert a possible huge overwhelming loss (Swiss, 2007).

Crop insurance is a form of insurance policy that is used by agricultural firms, which enables farmers to hedge against production losses. Despite its various advantages, there are several challenges involved in covering crop losses. Crop insurance is different from other special lines of insurance such as life insurance, automobile insurance, and even insurance for livestock. This renders it challenging and problematic to implement.

First of all, Aidoo et al. (2014) asserted that territorial or geographical interrelated risks involved in crop insurance make it even more challenging to insure it. When a production risk occurs over a large area, yield losses could be huge, which will consequently generate a huge financial loss. This means that the risk attached to crop insurance could be devastating if a production risk affects crops over a large area. Contrastingly, the other forms of insurance address idiosyncratic risks that do not create high risks over a large area and creating huge financial loss. Secondly, the losses experienced in crop insurance is not stable but varies over time, and could vary from scanty, average to extreme losses. Karthikeyan (2005) portrayed this variability nature of crop insurance as a long tail distribution of losses. This distribution tail occurs when due to the variability in losses, farmers pay high premiums to insurance firms but with little occurrences of crop losses. Farmers then face the risk of paying high premiums to insurers.

Additionally, Karthikeyan (2005) asserted that there are challenges that increase the administrative costs of insurers, which forces them to charge higher premiums beyond what farmers can afford to pay. He found that farmers with a high risk of crop loss most often choose to insure their crops than farmers who face low risks. This is because farmers know the state of their crops than the insurance firms. Such opposing selection choices make crop insurance unsustainable. Another difficulty is that farmers change their attitude towards observing precautionary measures to reduce the risk of crop loss after insuring their crops. Most farmers leave the crops unprotected knowing that a loss in yield will make them eligible for indemnity.

Considering the challenges that traditional indemnity crop insurance faces, its implementation has not been successful throughout the world (Aidoo et al., 2014). Consequently, Ramiro (2009) maintained that there has been a shift from the indemnity-based crop insurance to area yield index and lately to a weather index insurance to help discourse the difficulties of the indemnity-based crop insurance. Despite the shift, area yield crop insurance has not been sustainable due to technical and implementation issues (Karthikeyan, 2005).

Karthikeyan (2005) found implementation problems in India such as reaching a small population of the farmers (less than 5 percent of the total number of farmers) and farmers receiving insurance based on whether they had taken loans from banks or not. Most of the farmers did not even know they were covered as farmers, especially borrowers were involuntarily covered. Karthikeyan (2005) also found that there was a level of opaqueness involved in the operations. Claims were made by assessing only a few farms, the results made to represent a big geographical area, typically a bloc and the results not published for public notice. Karthikeyan (2005) also found that farmers were made to pay similar amounts of crop insurance premiums although the faced different levels of risks. There was also the problem of paying indemnities late to farmers with the claim procedure lasting for between six months and two years. As noted by Aidoo et al. (2014), these implementation challenges cut the impact of the area yield-based crop insurance scheme.

Some of the technical issues are that risks are more concentrated in a geographical area, current area yields could be exploited by politicians and farmers, there is no existing data of yield of crops per a geographical area and unpredictability of historical area yield data (Aidoo et al., 2014).

Hess (2003) also identified that there exists an absence of variability. Hess (2003) used estimates between 1985/6 and 1999 to find a loss ratio of 5.72 (not including administrative costs). He later found in 2002 that the claim to premium ratio was 4.17. This depicts that the use of crop insurance to hedge against crop risks is not viable. Hess (2003) also found administrative costs as very high in India because the system used to cut down crops for assessing the severity of crop loss. He also found that the payment of premiums was inequitable across different crops and states. Just like Karthikeyan (2005) found, Hess (2003) also determined that politicians largely interfere with this crop intervention as politicians used it as a way of winning over the people.

The other alternative, weather-based crop insurance, has challenges as well. Karthikeyan (2005) determined that the apparent problem is the “basis risk”, which is the difference between the actual risk farmers face and the risk evaluated by the insurers. The efficiency of what the insurers are offering is reliant on the synergy of the day the policy was started and the owing date, and then calculating indemnity based on actual rainfall in each village (Karthikeyan (2005). Insurance companies in India rely on one bloc station to provide data on the weather for a large number of villages. This makes their data unreliable and difficult to predict weather patterns for each village over a large area. Karthikeyan (2005) also found that risk premiums were high in optimum sowing seasons were high because the risk of crop loss was high compared to insurers charging low premiums in lower yield seasons. Karthikeyan’s (2005) study in India also found that there was a lack of dependable weather data and weather recording instruments in many areas in the country. This reduces the participation levels and raises many questions about the feasibility of crop insurance.

Similarly, Glauber (2004) in a study on vegetable farmers in Catalonia, Spain found that there is a low involvement in crop insurance. Glauber (2004) found a lowly 5 percent of vegetable farmers in Catalonia adopted crop insurance and about 20 percent for the whole of Spain. Diversification of risk, cost of insurance premiums, rules governing crop damage assessment and perception of risk were some of the factors affecting the vegetable farmers' crop insurance participation levels in Catalonia (Glauber, 2004). Enjolras et al. (2012) found that the use of crop insurance has leaned towards the added cost and low profit. Enjolras et al. (2012) indicated that due to the high cost over profit, countries like Italy and France substantially subsidize the payment of crop insurance. Equally, a study by Hazell et al. (1986) in Mexico and Panama found crop insurance greatly reduces the risk of low yields and incomes but can only be efficiently be achieved through government subsidization of crop insurance schemes. However, the cost of subsidizing insurance schemes by respective governments in developing countries have been decried in studies by Hazell et al. (1985), and Siamwalla and Valdes (1986; 1992). They argued that government subsidies cause net social losses and as such subsidies may not be reasonable. They further explained that such funding could be invested in other sectors of the economy that would benefit society. Ray (1981) and Koropecky (1980) disproved the claims that government subsidies supporting crop insurance cause losses and argued that perhaps only "one side of the crop insurance subsidization story' was painted. Ray (1981) and Koropecky (1980) asserted that government subsidies in crop insurance provide further support in agricultural-related investments such as research, price support, and conditions of perils from natural hazards. Additionally, the government has a social responsibility to seek to provide better living standards, and increasing the welfare of its citizens hence subsidizing crop insurance costs is not a misplaced investment (Ahsan & Kurian, 1985).

Ahsan and Kurian (1985) determined that agricultural output increases with crop insurance compared to cases with no crop insurance schemes. The wellbeing of society improves when the government takes some burden off the cost of some risks (Ahsan and Kurian, 1985). Pomareda (1986), however, maintained that the efficiency of crop insurance implementation depends on its management, monitoring, and implementation.

Richards (2000) in determining the demand for crop insurance in California, USA revealed that high premium charges reduce the incentive for more participation. Sargazi et al. (2013) in a study on effective factors that affect demand for insurance in Iran discovered that farmers that earn relatively higher incomes are more likely to adopt crop insurance, older farmers were found to be highly likely to insure their crops and years of farming experience proving to be insignificant in farmers' decision to adopt crop insurance. Similarly, Karbasi and Kambozia (2003) in a study in Iran found the educational level of farmers to significantly affect how likely farmers are to insure their crops. Smith and Boqluet (1996) in a study conducted in Montana, USA determined that risk factors such as debt to banks, educational level of farmers, insurance premiums, and history of using crop insurance are sources of effective crop insurance.

Crop insurance is not extensively used in Sub-Saharan Africa, except by large scale commercial farms (Kwadzo et al., 2013). Even in the case of commercial farms, it is only farm equipment, machinery, building and structure are some of the major items that are insured (Anaman, 1988). In Ghana, there is no crop insurance per se, but there is a pilot formal market-based insurance scheme that helps farmers to hedge against high production and marketing risk (Kwadzo et al., 2013).

2.2 Theoretical and Analytical Techniques

To evaluate the demand for a hypothetical crop insurance scheme, the contingent valuation method (CVM), which is often used by researchers to value the preference levels of farmers for nonmarket commodities that do not have a defined price (Kealy & Turner, 1993; Breidert et al.,2006; Nganje et al., 2008; Taneja et al., 2014).

A review of the literature on willingness to pay for crop insurance has suggested several theories that can be used to evaluate a farmer's willingness to pay (WTP) for agricultural insurance. Okoffo et al. (2016) determined that the stated preference (contingent valuation) theory, the revealed preference theory and, or a combination of theory based on microeconomic household variables and market variables to indirectly assess a suitable market premium have been used. The revealed preference theory assumes a substitutability relationship between a market good and not market well in a study (Nganje, Hearne, Gustafson, & Orth, 2008). Contingent valuation method, however, makes inquiries about respondents' preferences (Nganje et al., 2008).

Okoffo et al. (2016) recommended the use of the contingent valuation theory to estimate the willingness to pay (WTP) of agricultural producer groups. Since there is little or no market information about such groups, using the contingent valuation theory is highly endorsed for use (Vandeveer and Loehman, 1994; Roe, Haab, & Sohngen, 2004; Bourgeon & Chambers, 2003; Carson, Flores, & Meade, n.d.; Noonan, 2003; Sarris et al., 2006; Nganje et al., 2008; Liu and Zhang, 2011; Taneja et al., 2014).

Mitchel and Carson (1989) elaborated on the importance of the contingent valuation theory by claiming that researchers use it to infer immediate responses from research respondents to reveal their preferences for a good or service. To evaluate the theory, respondents are given a hypothetical situation to value. The value estimates are dependent on the hypothetical estimates (Carson, Flores, & Meade, n.d.). Eliminating biases such as theoretical, strategic and misspecification biases is crucial to reducing limitations of findings from a study. It is therefore vital that appropriate questions are asked to get corresponding responses and the level of awareness among the selected population of study to evaluate the true WTP.

Otherwise, Cohen and Zilberman (1997) predicted that poor framing of questions and poor awareness among the research participants could create a considerable difference between predicted and actual WTP.

Contingent Valuation critics argue that it appears a trivial task to ask people how much they are willing to pay for a service or good (Carson et al., n.d.). The critics, however, fail to appreciate that asking such questions is difficult. Since it is not so easy to measure consumer preferences, then critics should argue how plausible survey questions are to respondents. Given that premise, CVM can be said to violate economic theory to some extent if the questions are implausible. However, it is not reasonable to give survey questions a direct economic interpretation when a good or service is clearly defined or explained (Carson et al., 2000).

Even if all the challenges raised by CVM critics are cleared, there exist two basic limitations (Sagoff, 1994). WTP evaluations are limited by wealth. Many believe that government responsibility should not be influenced by any ability to afford or not. Provisions should be made as and when they are needed (Sagoff, 1994; Carson et al., 2000). Also, the theory only considers the preferences of the current generation and not future generations. Sagoff (1994) argued that whatever these limitations could mean, they do not influence the measurement of economic value.

Although there have been heated arguments about contingent valuation, it has been productive. The contentious issues raised by critics have evolved to support the view that using contingent valuation properly in a study provides a reasonable basis for evaluating the opportunity cost of obtaining a good or service (Carson et al., 2000). Concerning agriculture, the use of the contingent valuation theory helps to evaluate farmers' awareness and WTP for introducing novel goods and services before deciding on prices. Although ideal for firms and consumers, it also allows governments to appraise and review its policies to a sector of the economy. For example, the CVM has been applied to works relating to natural resources and in supplying water in developing countries as applied by Ahmed et al. (2002) in Bangladesh. Notwithstanding the debate on the methods and application of CVM, a necessary condition to achieve the objective of CVM is to find out the factors that affect farmers' willingness to invest in a particular good or service, and a significant variety of other topics (Noonan, 2003). Thus, in an agricultural context, the CVM enables researchers to define the nonmarket preferences of farmers. It is not surprising to note that many researchers have employed the CVM to create the relationship between WTP and the characteristics of the survey population and other topics (Mwangi, 1998).

A lot of the variations in the application of CVM has been reflected by the differences in the quality of research conducted (Noonan, 2003). Often, it is common for researchers to ignore some of the NOAA guidelines presented by Arrow (1993) and other experts. For example, financial limitations and practicability of the study often force researchers to abandon the qualified guidelines. The literature on CVM acknowledges many problems that affect research outcomes. Schwer and Daneshwary (1995) pointed out a lower response level, Holt et al. (1999) found a “questionable good” and Glass et al. (1999) finding that goods that are defined poorly as examples of the problems affecting the quality of research. Noonan (2003) noted that the case of the poorly defining good is frequent. For example, the Kansas Arts Commission asked respondents about increasing the number of arts in their local area without detailed information on the rudiments of the increase (Glass et al., 1999). Other research works indicate the degree of a change in activity by presuming some information of the existing quantity (Papandrea, 1999; Thompson et al., 2002). Research by Bille Hansen (1997) only asked respondents how much they are willing to pay as tax when the government increases spending in any area of the economy. The differences in research quality are directly affected by the validity of the estimates in a study. The validity of the estimates, therefore, needs to be assessed on individual research works.

Applications and determinants of CVM

Ulimwengu and Sanyal (2011) in a study conducted in Uganda, used a multivariate *probit model* to evaluate farmers’ WTP for farming services such as disease control, crop protection, soil fertility management, and marketing. The study found that farmers’ previous use of service, lack of land and income reduced their WTP. Generally, the level of awareness affects the choices made by a farmer or a consumer. However, research by De Chaisemartin and Mahe (2009) established that farmers’ degree of awareness did not affect their WTP.

In a research conducted in Rwanda by Haba (2004), farmers' level of education and corporative membership was perceived to provide more information about the goods or services on offer. She, therefore, concluded that WTP decreases with farmers' educational level and time of being a member of a coffee corporative group.
Haba (2004) also found that farmers' WTP for agriculture delivery technology was strongly correlated with many of their demographic traits such as age, gender, educational level, number of dependents, marital status, corporative membership period, income, etc.). She observed that age and gender greatly correlated with WTP as younger male farmers showed more WTP and 48% of respondents said it is the government's responsibility to provide agricultural technology to farmers. Paralleling it to research conducted in Southeast Asia, farmers considered the provision of agricultural extension services as a responsibility of the government (Ali et al., 2008). Cohen and Zilberman (n.d.) found that there are problems inherent with WTP measures in assessing a market's technology potential. They argued that respondents were inexperienced with technological services. This means that adopters will have to see or feel what is being offered to make good choices. Cohen and Zilberman (n.d) asserted that such misinformation underestimates the validity of a study.

The price of many nonmarket commodities has been evaluated using CVM. Alberini et al. (1997) used CVM to value the health effects of air pollution in Taiwan by using dichotomous choice questions to estimate the maximum likelihood (interval -data model) of a respondent having a health issue through air pollution. The authors found that WTP increases with income and education. Similarly, research conducted by Chesnut et al. (1998) to evaluate the health effects of air pollution in Bangkok using CVM and modeled as OLS and Tobit regressions. Chesnut et al. (1998) determined that age, education, and income affected WTP.

Anjum Altaf and Hughes (1994) used CVM to measure the demand for sanitation in Burkina Faso and used a probit regression model to conclude that households with a pit in a good condition had a greater WTP compared to those who had no improved pit. Altaf et al. (1993) conducted research in Punjab, Pakistan on rural water supply using CVM. The authors modeled survey data using a dichotomous choice (elicitation method) and found WTP to increase with income. Similar research on improving water quality in Davao, Philippines by Choe, Whittington and Lauria (1996) also used CVM to estimate the maximum likelihood (interval -data model) and found that WTP increased with the welfare of participants.

In India, Hadker et al. (1997) used CVM to evaluate the WTP for Borivli National park and found no correlation between WTP and income using the double-bounded interval data model to estimate the maximum likelihood of participation.

Okoffo et al. (2016) in research on cocoa farmer's willingness to pay for agricultural insurance and insurance companies' willingness to sell agricultural insurance products in Ghana found WTP to increase with age, marital status and education by using a double hurdle model. Similar research was conducted in Nigeria by Falola, Ayinde and Agboola (2013) used the CVM to evaluate the factors affecting cocoa farmer's willingness to use agricultural insurance and found WTP to increase with age, educational level, income and access to inputs by using the probit model regression. This study uses the probit model regression to estimate the significance of the variables in the dataset. However, logistic regression is modeled simultaneously to confirm the prior assumption as determined by Caudill and Jackson (1989) and Greene (1999). that the marginal effects of logit and probit are almost the same.

CHAPTER 3: METHODOLOGY

3.1 Introduction

. The research was conducted in two parts. . The first part involves primary data collection via questionnaires and interviews. The second part uses the data from the first part to estimate a relevant empirical model. In the first part, the study area, sampling technique and size and instrument for data collection and the type of data needed for the study are discussed. The second part focuses on the empirical model of the study.

3.2 The Study Area

The study was conducted in the Upper West Akim Constituency of the Eastern Region of Ghana. The population of Upper West Akyem District, according to the 2010 Population and Housing Census is 87,051 representing 3.3 percent of the region's total population. As high as 74.0 percent of households in the district are engaged in agriculture Ghana Statistical Service, 2010). In the rural localities, eight out of ten households (82.5%) are agricultural households while in the urban localities, 52.5 percent of households are into agriculture. Most households in the district (96.3%) are involved in crop farming (Ghana Statistical Service, 2010).

Adeiso is the capital of the Upper West Akim. It lies between longitudes 0 degrees 25 minutes West and 0 degrees 47 minutes West and latitudes 5 degrees 40 minutes North (Ghana Statistical Service, 2010). It shares boundaries with Ayensuano District to the east, West Akim Municipality to the north, Nsawam Adoagyiri Municipality to the southeastern part, Ga South Municipality to the south and Awutu-

Afutu Senya District in the Central region to the west. The Upper West Akim District is the only district in the Eastern Region that shares boundaries with the Central and Greater Accra Regions. It has a total land size of about 342.3 km2.

The District has an appreciable undulating high and low lands with the highest point being at Adeiso which rises to about 500m above sea level and a bi-modal rainy season. The bi-modal rainy reaches its peak between April-July and September-October. The district experiences an annual rainfall between 1,250 mm to 1,750 mm (Ghana Statistical Service, 2019).

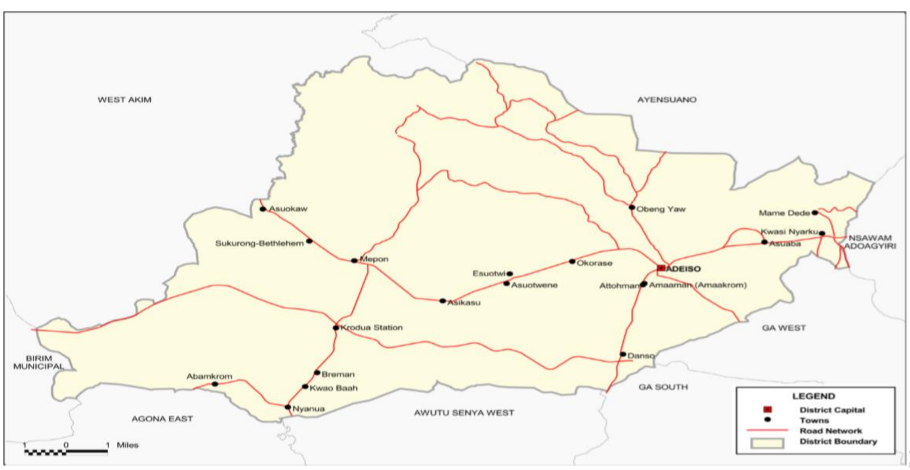
The temperature ranges between 26 degrees Celcius and 30 degrees Celcius (Ghana Statistical Service, 2013). The climate is conducive for agricultural activities: cash crops and food crops (Ghana Statistical Service, 2013). The district has high forests that are rich in timber and other forest products(Ghana Statistical Service, 2013). The district has a mist mini-deciduous forest with predominant reddish-brown, well-drained, deep gravel-free silty loams and silty clay loams (Ghana Statistical Service, 2013). The presence of the forest makes it possible for the district to experience double maxima rainfall throughout the year. The rapid expansion of the cocoa and oil palm industries in the district is changing the original forest into a secondary type (Ghana Statistical Service, 2010). This vegetaion pevents erosion from taking place to maintain the nutrient level in the soil. This makes cocoa grow well in the area.

The district is endowed with rich soils that make it suitable for farming activities (Ghana Statistical Service, 2013). According to the 2010 Population and Housing Census, households engaged in agriculture in the district are 15,014 (74%) of the total households in agriculture (Ghana Statistical Service, 2013). More than half (52.5%) of the urban households are engaged in agricultural activities compared to a higher percentage of (82.5%) of the rural households who are engaged in agricultural activities (Ghana Statistical Service, 2013). The major economic activity in the district is crop farming and tree planting followed by livestock and fish farming (Ghana Statistical Service, 2010). Farmers in the district cultivate food crops like cassava, maize, plantain, cocoyam, and yam and cash crops like cocoa, oil palm, coffee and citrus on the land (Ghana Statistical Service, 2013).

Due to the bimodal nature of rainfall patterns, farmers in the district depend on the vast river sources during the dry season to cultivate food crops such as tomatoes, okra, and vegetables. It has River Ayensu as the main river that drains through from Ayensuano District in the eastern part of the district to join the Central Region in the west.

Figure 1

Map of Upper West Akyem District



Source (Ghana Statistical Service, 2010).

3.21 Sample Size And Sampling Technique

Cocoa farmers were the main target population of this study. A total of 113 cocoa farmers were randomly selected and interviewed in the study area. The study used a purposive sampling technique to select the study area whilst the subjects were randomly selected for interviews once the study areas was selected. Three cocoa-growing towns namely Kofi Asare, Ampofo and Darmang were purposively selected as the study areas due to the high number of cocoa farmers in those communities.

The Eastern Region of Ghana was chosen because of its rich history in cocoa production. Cocoa production was started in the Eastern Region of Ghana after the introduction of the cocoa crop in 1879 (Hay & Okali 1985; Amanor & Hill, 2000). The Eastern Region of Ghana produced an average of 55714.95 tonnes between 1948 and 2017 cocoa seasons (Ghana Cocoa Board). In that period (1948-2017), the Eastern Region was only behind Western Region (148120.2 tonnes), Ashanti Region (108049.5 tonnes), Brong Ahafo Region (65726.34 tonnes) on average. Considering the region's contribution to the Ghanaian cocoa industry, it was justifiable to conduct such a study in the region.

3.22. Instruments For Data Collection

A pre-evaluated semi-structured questionnaire was used as the major instrument for the study. The questionnaire consisted close-ended and partially close-ended questions. The survey data was collected in March 2020.

3.23 Data Collection

Both primary and secondary data were sourced for this study. The semi-structured questionnaire was used to collect the primary data from cocoa farmers in the study area. Secondary data from both the literature and websites relevant to the study and documents were used for this study.

3.3 Descriptive Analysis

Utility maximation is the basic theory behind this study. The cocoa farmer does not only contemplate the best out of the new innovation or technology but on how to achieve a satisfying utility level when a farmer makes a decision on whether to accept new technology or not (McConnel et al, 2009). Sadoulet et al. (1996) determined that consumers have a level of utility they want to attain, and so they tend to make choices according to their level of utility. For example, considering a number of utility levels say "U", a cocoa farmer will make a choice according to their maximum level of utility given her budget (Lubungu et al., 2012).

Given the utility of a cocoa farmer as *Uij,* from selecting a preference *q,* a cocoa farmer will select an alternative on whether or not they are willing to accept crop insurance or not. The cocoa farmers' choices will rely on their relative utility levels associated with the two options given (Lubungu et al., 2012).

Generally, the choice of the cocoa farmer (regarding whether to get crop insurance or not) will be considered as a binary result;

qi Î q = {1 if J >0, 0 otherwise}…………………………………… Equation 1 where *qi* is the given alternative (two choices of an ith observation, *i*=1, 2, 3…., *q* is the farmer, *q*=1,2,3…. J is the difference in the utilities of acceptance and non-acceptance.

The study assumed that a cocoa farmer's choice: acceptance and non-acceptance of crop insurance will depend on their maximum utility level. This means that if a cocoa farmer decides that accepting crop insurance brings him a maximum level of utility, then he/she will choose such an option.

Given equation (1), the categorical data or choices of acceptance of farmers were modeled to dummy variables to represent numeric variables. The difference in utility acceptance or non-acceptance is the dependent variable in the model.

3.4 Empirical Model

Econometrically, the study is modeled to evaluate the factors that influence willingness to use crop insurance. A probit and logistic regression is modeled to evaluate the significant levels of factors influencing the willingness to accept or not is displayed as:

$WTCI = B0 + B1Gender + \beta 2MaritalStat + \beta 3Age + \beta 4Edu\text{Level} + \beta 5HHsize + \beta 6SizeCrA + \beta 7Income + \beta 8IncOther + u$…………. …………………..Equation 2

Where *Gender* is the gender of a cocoa farmer,

MaritalStat is the marital status of a cocoa farmer,

Age is the age of a household head,

Edu is the educational level of a cocoa farmer, *HHsize* is the household size of a cocoa farmer,

SizeCrA is the size of the crop area owned by a farmer measured in acres

Income is the income earned by a cocoa farmer from a cocoa season

IncOther is another income source of farmers.

u is the error term.

3.41 Description Of Variables

Gender of a cocoa farmer(*Gender*). The gender of a farmer was measured as a dummy variable: male = 1, otherwise =0. Gender was put forward as a positive variable because male farmers have greater access to ownership of land than females in Ghanaian farming communities (Amanor & Hill, 2000). Therefore, the study assumed males are more likely to accept crop insurance.

Marital Status of a cocoa farmer(*MaritalStat*). The marital status of a farmer was measured as a dummy variable: married = 1, not married= 0. The study posited the marital status of a cocoa farmer to be positive because the study assumed that married farmers are concerned about how their families will survive should an unexpected risk happens (Danso-Abbeam et al, 2014). It was, therefore, assumed that farmers who had spouses were more likely to use crop insurance their counterparts who are not.

Age of a cocoa farmer(*Age*). The age of a cocoa farmer was measured in years. The study posited that age has a negative correlation with the willingness to accept crop insurance because there is a high chance that younger farmers will accept crop insurance than older cocoa farmers. Baidu-Forson (1999) determined that older farmers tend to use their experience and commit to primitive ways of farming than adopt innovative ideas.

The education level of a cocoa farmer (*EduLevel*). The study postulated that cocoa farmers who have attained some level of education are able to analyze technology and make decisions (Annan, 2015). The study further hypothesized that cocoa farmers with formal education were more likely to accept crop insurance.

Household size of a farmer(*HHsize*). The study assumed that the size of a household either positively or negatively influenced a farme's willingness to accept crop insurance. The study hypothesized that farmers with bigger household sizes would rather spend more money on the family than direct investment into crop insurance. Smaller households, however, consider the situation of the family in case an uncertain risk happens.

Size of crop area ($sizeCrA$). The size of land containing the cocoa crop was measured in acres. The study assumed that a farmer who owns a small crop land is less likely to accept crop insurance. Contrastingly, cocoa cocoa farmers that have big crop lands are more likely to accept crop insurance because large crop areas are difficult to manage and that the effect of the uncertain occurrence of risks such as infection *black pods* will be greater compared to smaller sized crop areas.

Income from cocoa farming (*Income*). The study assumed income of cocoa farmers received from a cocoa season to influence their willingness to accept crop insurance or not. The income of farmers was measured by looking at the quantity of kilograms of cocoa beans sold in the year 2018 multiplied by the price of per kilogram. The study posited that farmers who earn higher incomes were more likely to accept crop insurance than their counterparts who earned less.

The income of a cocoa farmer from other sources ($IncOther$). The study hypothesizeD income from other sources as positive. This was because income from other sources increased the income levels of cocoa farmers. Therefore, cocoa farmers who received higher other incomes to get a higher total accumulated income were more likely to accept crop insurance.

3.5 Data Analysis

STATA and Excel are the statistical software that were used to analyze the data. Data was cleaned, summarized, organized and then inputted into an excel worksheet. A summary statistic of all variables was run using excel. This gave a quantitative description of the dataset which includes where the average lies and whether or not some of the data were skewed. A correlation matrix of the data set was run to find if there was a collinearity between some of the variables or not

A *probit* and logistic regression were run using STATA and R statistical software.

CHAPTER 4: RESULTS AND ANALYSIS

4.1 Introduction

This chapter analyses the survey data collated from the field survey. STATA and R statistical tool are used to run a regression to evaluate the determinants that affect the willingness of cocoa farmers to adopt crop insurance.

4.2 Socio-economic Characteristics of the Respondents

Table 1 shows the demographic characteristics of the research subjects. Proportionally, male respondents were more than female respondents with 78.8% of the respondent's males and 21.2% females. Most of the respondents' age ranges between 55 and 64 years, 45 and 54 years, 35 and 44 and above 65 years represented 25.7%, 23%, 20.4% and 18.6% of the total cocoa farmers respectively. Only 12.4 % of the respondents were aged between 25 and 34 years. On average, the farmers were about 52.76 years old, the minimum age about 29.5 years old and the maximum age about 77.5 years.

A substantial (77%) number of the cocoa farmers have married whiles 23% were unmarried (12.3% were divorced, 8% widowed and 2.7 single). A majority (52.2%) of the cocoa farmers had a household size of between six (6) and 10 whiles 35.4% had a household size of between one (1) and five (5). Only 12.4% of the cocoa farmers had a household size of above 11. A majority (83.2) of the cocoa farmers had received formal education with 42.5% receiving Senior High School or Middle School education, 38.9% attending Basic School or Junior High School, and a lowly (1.8%) receiving tertiary education whiles 16.8% not receiving formal education at all. Table 1 shows that 38.9% have little experience in cocoa farming, having done farming for fewer than 10 years of, while 61.1% of the respondents have been doing cocoa farming for more than 10 years.

Table 1

Cocoa farmers' demographic characteristics

Variable	Description	Percentage (%)
Gender	Male	78.8
	Female	21.2
Age	25-34	12.4
	35-44	20.4
	45-54	23
	55-64	25.7
	Above or equal to 65	18.6
Marital status	Single	2.7
	Married	77
	Widowed	8
	Divorced	12.4
Household size	1-5	35.4
	6-10	52.2
	Above or equal to 11	12.4
Level of education	No education	16.8
	Primary/J.H. S	38.9
	Secondary/Middle school	42.5
	Tertiary	1.8
Years of farming experience in cocoa	Less than 10	38.9
	10-20	38.1
	21-30	12.4
	31-40	6.2
	Above 40	4.4

Source: Data from field survey (2020).

4.3 Major Cocoa Production Risks That Affect Cocoa Farmers

Table 2 shows the production risks recognized and experienced by cocoa farmers in the study area. From Table 2, it was identified that the most production risk that affects cocoa yield in the study area are insect pest and disease (95.6%), drought (88.5%), variation in yield (87.6%), poor access to inputs (73.5%), too high temperature (69%), high prices of farm inputs (66.4%), aging cocoa farmer (50.4%) and excess rain (32.7%).

Table 2

Production risks faced by cocoa farmers from the study

Variable	Percentage (%)
Bush fire	19.5
Drought	88.5
Variation in yield	87.6
Insect pests and diseases	95.6
Poor access to inputs	73.5
High prices of farm inputs	66.4
Excess rain	32.7
Too high temperature	69
Illegal chain saw activities	8
Flood	1.8
Galamsey	0.9
Aging cocoa farmer	50.4

Source: Data from field survey (2020).

The majority of the cocoa farmers identified drought and erratic rainfall as one of the major production risks they face. A possible reason could be climate change effects on agricultural farmlands. The cocoa farmers identified that most of the cocoa crops die during the drought periods, leaving them no option but to replace or replant most of their cocoa crops again when they experience rainfall. Surprisingly, erratic rainfall affects the cocoa pods. The respondents acknowledged that the cocoa pods "absorb" water during erratic rainfall periods and making it difficult for the cocoa beans to mature prematurely. Some of the respondents recalled their unfortunate experiences with bush fires. The unlucky farmers who have been affected by bush fires said that bush fires completely destroy the cocoa farms. This leaves farmers helpless and poor. The respondents associated the cause of bush fires in the study area to game activities. Individuals who hunt for "bush meat" during the drought periods start bush fires by using fire as a hunting tool. On the flip side, 50.4% of the cocoa farmers noted that aging cocoa farmers are a risk to cocoa production.

Climatic changes affect production yields in the study area. The United Nations Framework Convention on Climate Change (UNFCCC) year defined climate change as when human activities change the structure of atmospheric conditions (Protocol, 1997).. This change causes inconsistencies in climate over some time periods (Protocol, 1997). With cocoa production adding value to the Ghanaian economy through the creation of employment and foreign exchange, natural climate variability would affect cocoa output levels. The spatial and intermittent variations in rainfall patterns which are evidenced by frequent droughts and erratic rainfall are among the most damaging factors affecting the cocoa output (IPCC, 2014 & Laux et al., 2010).

There was drastic reduction in total cocoa production from 5000kg to 2000kg in 2003 due to effects of climatic change on cocoa farmlands (Codjoe et al., 2013). Nature provides the natural resources needed to effectively manage cocoa (Codjoe et al., 2013).

Particular important resources needed are water, conditions of the soil, moisture, crop land, sunshine and humidity (Codjoe et al., 2013). Temperature, rainfall and the energy provided by the sun directly affects agricultural farmlands, which affects production yield and the physical structure of plants (Mollaee et al., 2020; Codjoe et al., 2013).

The respondents in the study area complained of how no or little rainfall and erratic rainfall patterns reduce cocoa yield. It is not surprising to see from Table 2 that Variation in yield 87.6% of the respondents experienced the risk of variation in yield. Longe and Oyekale (2013) asserted that farmers complained of serious drought and inconsistent rainfall affecting the growth of seedlings and reduction in crop yields.

During the cocoa seed development stage, an insufficient supply of soil water results in increased seed mortality (Anim Kwapong & Frimpong, 2004). The authors also found that the cocoa bean size is greatly affected when there is not enough soil water, and hence affecting the quality of cocoa beans. Wessel and Quist-Wessel (2015) found that heavy rains that fall between August and October do not allow the cocoa trees to produce enough flowers and also the cocoa pods absorb water during the pod filling stage. The cocoa beans harvested are affected. This reduces farmers' revenue from the farm.This affects the quality of the cocoa beans produced by farmers, and consequently cuts their income.

Codjoe et al. (2013) established that climate change affects how pest and pathogen grow, changes the physical properties of the host plant by weakening host resistance. A possible effect is that hosts and pathogens will modify to be survive in different geographical locations, which will increase crop losses and reduce crop yield (Codjoe et al., 2013). Codjoe et al. (2013) determined that such pest and pathogen modifications would likely disturb the livelihood of the farmer, revenue and decision making on managing the farm.

In most cocoa-growing communities in Ghana, majority of farmers are not able to afford the cost of farm inputs or do not get access to purchase farm inputs that will enable them increase crop yield (Onumah et al., 2014). Wegner (2012) emphasized that improving cocoa farmers' access to basic cocoa production inputs such as fertilizers, spraying machines, wellington boots, pruners, rakes and insecticides/pesticides is key to enabling farmers to grow quality and high yielding crops every year. Wegner (2012) asserts that the most concern of smallholder cocoa farmers is to get access to credit facilities and farm inputs. Cocoa activities are seasonal. It therefore relies on easy access to farm resources to be able to guard against pest, disease and rotting of cocoa beans that cause low yields (Onumah et al., 2014). Output or yield could be increased for farmers if they have access to credit facilities to enable them buy inputs such as fertilizers, insecticides/pesticides, employ labor, fuel, spraying machines among others. However, Grossman and Tarazi (2014) determined that smallholder farmers in developing cocoa-producing countries find it difficult to get access to loan facilities. With cocoa being a seasonal crop, many cocoa farmers tend to borrow to help them purchase inputs and cater for their families before harvest (Lundstedt & Parssinen, 2009). Lundstedt and Parssinen (2009) determined that the access to loan facility challenge makes farmers borrow up to about 60 percent of their harvest income. A 2012 World Bank report indicated that access to financial credit is limited in developing countries. The report likened the cause to majority of farmers in developing countries being subsistent farmers which limit their financial capability to purchase farm inputs and household needs (World Bank, 2012).

Due to this extreme financial problems farmers face, farmers do not get the required finance needed to buy the necessary inputs to increase output levels and quality cocoa beans, as well as adopt new and better technologies. Table 2 showed 66.4 percent of farmers to have grumbled about high input prices.

Generally, input suppliers only sell cocoa inputs to farmers who have "ready cash" to make purchases (Onumah et al., 2014). This is because the input suppliers regard cocoa farmers as a big risk because their income source is seasonal (Onumah et al., 2014). Only a few Cocoa farmers get access to inputs as the vast majority are priced off. Although the private sector dominates the sale and distribution of cocoa farm inputs, COCOBOD extremely subsidizes the price of fertilizer, insecticide and pesticide distribution to increase output levels (World Bank, 2011; Onumah et al., 2014).). World Bank (2011) further observed that the Cocoa Disease and Pest Control (CODAPEC) unit of the COCOBOD through the Mass Spraying Exercise initiative distributes agrochemicals to cocoa farmers. However, to increase output levels, cocoa farmers were allowed to use as much quantities of agrochemicals they wish to use. Although COCOBOD greatly subsidizes the distribution of farm inputs, cocoa farmers still make significant contributions to the cost of production **(**Onumah et al., 2014.

From table 2, 73.5 percent of the respondents complained of having poor access to farm input. A lot of the farmers said that the cocoa Mass Spraying Exercise was not enough as they often insect pest and disease again. Some also reported that the last time they received supplies from the CODAPEC dates back to 2016. 80.3% of the farmers mentioned that they receive most of their agrochemicals and other farm inputs from a private supplier called *Cocoa Life* Ghana. Launched in 2012, the company gives farmers training, cocoa management skills and a promise for a bright future for the next generation of cocoa (Cocoa Life Ghana, n.d). A study by Hainmueller et al. (2011) supported this report from the farmers in the study area when they found that there provision of inputs for cocoa farmers in Ghana is not enough and are distributed late. Hainmueller et al. (2011) further reveal that a lowly 14 percent of cocoa farmers in Ghana get farm inputs when need it.

The International Cocoa Organization (2007) reports that the world's cocoa yield have generally increased. Baah and Anchirinah (2011) asserted that the upward trend was a result of higher production prices, support programs from government, fertilizer credits, allowing private suppliers to supply inputs, liberalizing the internal market, stabilizing prices and management of pest and disease. However, insect pests and diseases are prevalent in cocoa-growing areas which affect output levels.

One of the causes of the reduction of yield levels is the prevalence of insect pest and disease because of poor management (Dormon et al., 2004). The Ghanaian cocoa sector is plagued by one major group of insect pests and two major plant diseases **(**Baah & Anchirinah, 2011**).** An example of insect pest of cocoa is the mirid that attack a growing cocoa tree. The two prevalent diseases are Cocoa Swollen Shoot Virus Disease (CSSVD) and the black pod disease which attack the growth and ripening of cocoa pods (Asante, 1995)**.** It is estimated that insect pest and disease cause 30% loss in global output every year and a loss between 10% and 80% of individual farm (Duguma et al., 1998; Lass, 2004; Dormon et al., 2007).

From table 2, 95.6% of admitted facing incidence of insect pest and disease. Economically, farmers' cocoa farm income levels reduce due to the prevalence of mirids.

Mirids is the insect pest that affects cocoa farmers a lot in terms of economic losses in Ghana (Antwi-Agyakwa, 2013).

The livelihood of cocoa farmers is threatened by the production risks (pre and post-harvest) as these risks increase unemployment and worsen poverty rates in smallholder cocoa-growing communities. This also decreases Ghana's foreign income earnngs.

Smallholder cocoa farmers do not have adequate access to the support systems that could enable them to incresase crop yield (Onumah et al., 2014). A UNDP (2010) scoping paper reported that cocoa production requires a lot of labor-intensive efforts because a lot of modernized technology is not suited to cocoa production. Therefore, the source of labor used by a cocoa farmer could increase or decrease their output levels on the farm to some extent. Heshmati and Mulugata (1996) found that both family source of labor and hired labor (popularly called "part-day" in Ghana) also increases productivity. Onumah et al., (2010), however, found that both family source of labor and hired labor provided similar levels of productivity in the Ghanaian fish farming industry. The majority of the respondents were old and aging with 23% aged between 45 and 54 years, 25.7% aged between 55 and 64 years and 18.6% are more than 64 years old (Table 2). Consequently, the level of output in the sector will reduce in the future as old cocoa farmers will not have the strength and energy to work on the farm.

The cocoa output levels are more likely to reduce at areas across where the study was conducted is nothing is done to change the demographic distribution in area of the research. This trend is consistent with the Government of Ghana's generation gap" fear, that threatens yield of cocoa and productivity in Ghana (Onumah et al., 2014). From table

2, Only 12.4 % of the farmers are youthful (aged between 25 and 34 years). Cocoa production is labor-intensive (Onumah et al., 2014). The study area is just about eight (8) miles from the industrial city of Accra, the capital city of Ghana. The youth could as well avoid the labor-intensive nature of cocoa production and rather migrate to Accra in search of non-existing jobs. Okoffo et al. (2016) found that the level of apathy shown by Ghanaian youth to participate in farming activities is a structural problem that needs to be looked at until it greatly affects cocoa output in Ghana.

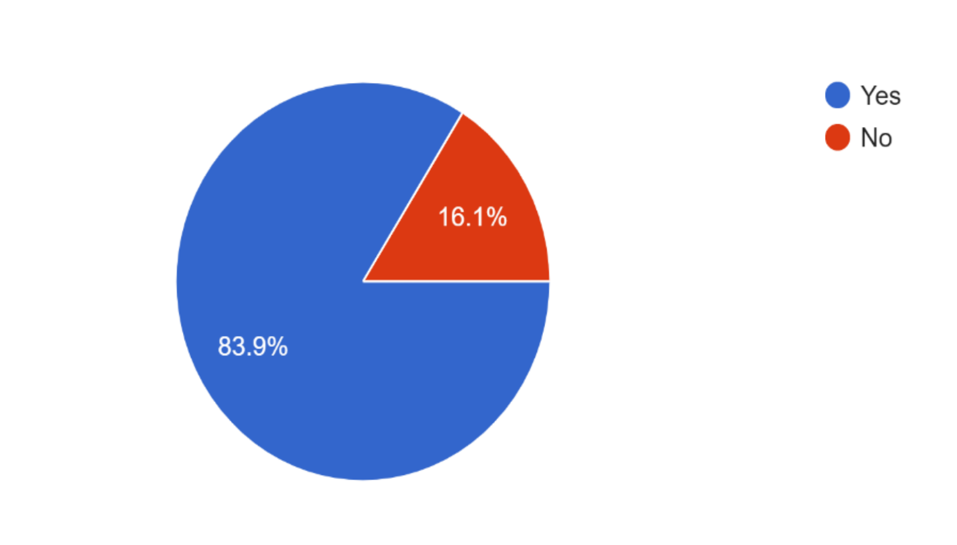
The cocoa sector in Ghana faces a lot of production risks that affect productivity levels. Salimonu and Falusi (2009) found factors such as pest and disease, erratic rainfall and dry seasons as the most prevalent and important production risks faced by cocoa farmers. Le and Cheong (2009) also found production risk as one of the most important risks farmers experience. Production risks that result in low yields threaten the survival of smallholder cocoa farmers. With low yields, unemployment levels will increase, poverty levels increase and income from foreign exports decrease consequently. Cocoa farmers depend heavily on the monetary returns they earn to cover their expenses such as paying for medical bills, providing good nutrition for their households, paying school fees and general living expenses. Crop losse cause the children of smallholder farmers to quit school, are not able to buy enough food, becomes undernourished and poor health of the household (Okoffo et al. (2016).

4.4 Distribution Of Respondents' Awareness Of Insurance Schemes And Type Of Insurance Used.

Figures 2 and 3 illustrate farmers' general awareness levels on general insurance products and the type of insurance schemes they use. It was found that no cocoa farmer in the study area has ever bought a crop insurance product. Out of the 113 farmers samples, 83.9% already know that there is general insurance policies in Ghana whiles 16.1% have no idea what an insurance scheme is. 54.86% of farmers have registered on the Ghana National Health Insurance Scheme (NHIS), followed by life policy (2.65%) and Tigo (telecommunication network in Ghana) insurance (2.65%) and no farmer using automobile insurance. The farmers who used any of the insurance products said that being insured helped them to reduce their medical costs should they fall sick.

Figure 2

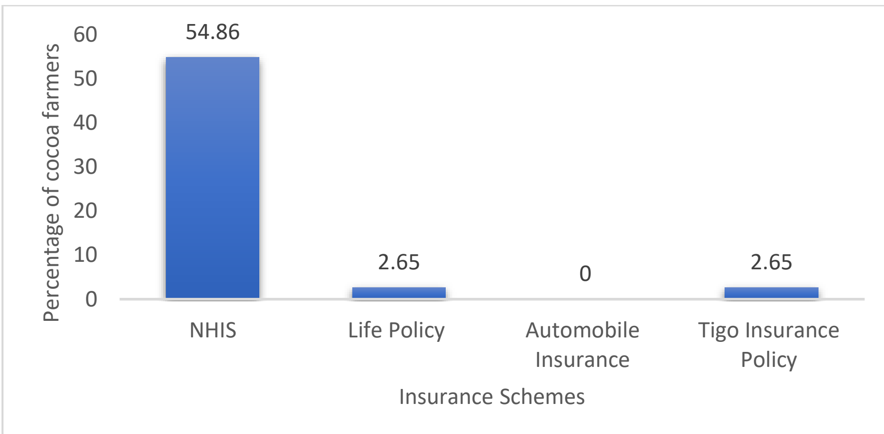
Percentage of cocoa farmers' awareness of insurance schemes in the study area.



Source: Data from field survey (2020).

Figure 3

Type of insurance schemes used by cocoa farmers in the study area.



Source: Data from field survey (2020).

4.5 Cocoa Farmers' Awareness, Sources Of Information And Willingness To Take Crop Insurance Schemes

Table 3 shows farmers' knowledge of crop insurance, where and how they get information on crop insurance and their willingness to adopt crop insurance or not. About 15% of the farmers strongly had knowledge about crop insurance, 12.4% partially aware, 11.5% fairly aware whiles a many (61.1%) had no prior knowledge about crop insurance at all. Overall, 38.9% of the farmers had prior knowledge about crop insurance. The cocoa farmers received information about crop insurance through Farm Based

Organization (FBO) (61.4%), Media (45.5%) and Agricultural Extension Agents (AEA) (81.8%).

Table 3

Distribution of cocoa farmers according to their awareness, sources of information and willingness to take crop insurance.

Item	Number of Respondents	Percentage
Level of awareness about crop insurance		
Strongly aware	17	15
Partially aware	14	12.4
Fairly aware	13	11.5
Not aware	69	61.1
Sources of Information on crop insurance	27	61.4
Farm Based Organizations	20	45.5
Media	36	81.8
Agricultural Extension Agents		
Willingness to take crop insurance	106	93.8
Willing	7	6.2
Not Willing		

Source: Data from field survey (2020).

Despite the majority (61.1%) of the farmers having no knowedge about ccrop insurance, a majority (93.8%) of the farmers agreed to use crop insurance. This shows that cocoa farmers highly appreciate the benefits of crop insurance. Most of the farmers believed that with crop insurance, they could be protected against production risks. Only 6.2% of the farmers were not willing to use crop insurance. The farmers indicated financial constraint (85.7%) and culture of sticking to primitive ways of farming (85.7%) as the major reasons for not adopting crop insurance.

4.6 Farmers' Distribution Of Prices They Are Willing To Take Crop Insurance And The Amount To Pay To Use Crop Insurance.

Table 4

Cocoa Farmers' Distribution of Prices Willing to Take Agricultural Insurance and the amount to pay to use crop insurance.

Variable	Description	Percentage (%)
Percentage (%) of total production cost/acre/annum farmers are willing to pay as insurance premium	<10	91.6
	10	8.4
	20	0
	30	0
	40	0
	>40	0
Price farmer is willing pay as insurance premium per acre/per annum (GHS)	30-40	58.9
	41-50	24.3
	51-100	14
	>100	2.8
Maximum premium farmers are willing to pay/acre/annum	GHS150.00	
Minimum premium farmers are willing to pay/acre/annum	GHS35.00	
Average amount farmers are willing to pay/acre/annum	GHS44.29	

Source: Data from field survey (2020).

Cocoa farmers' distribution of prices per annum they are willing to adopt crop insurance are showed in Table 4. A lot (91.6%) of farmers could afford to use crop insurance by using less than 10 percent of their production expenses, while only 8.4 percent were willing to pay insurance premiums from 10 percent of their production cost. Farmers were willing to pay GH¢150.00 as the highest amount of premium and GH¢35.00 as the least amount as premium. On average, farmers were willing to pay GH¢44.29 to use crop insurance. Those who were indecisive refered to a lack of capital and awareness on crop insurance.

4.7 Determinants of Cocoa Farmer's Willingness to Take Agricultural Insurance

Columns 1 and 2 report the coefficients from both the logistic and probit regression. However, the coefficients cannot be interpreted as a linear model because the dependent variable (willingness) in this study has a binary outcome (willing 1, otherwise 0). Therefore, the magnitude of the coefficients cannot be interpreted because the logit and probit coefficients differ by a scale factor (Katchova, 2016). Unlike the coefficients which are different for logit and probit, the marginal effects are almost identical in the logistic and probit models reported in columns 3 and 4 in Table 5 (Greene, 1999; Katchova, 2016). However, the signs of the marginal effects and coefficients are similar for probit and logistic models 5 (Greene, 1999; Katchova, 2016).

From Table 5, Columns 3 and 4 are the marginal effects on the binary outcome of the logistic and probit regression respectively. The marginal effects were calculated using the chain rule and modeled using STATA and R statistical software For the logistic regression, the inverse of the logit function was modeled to change the linear predictions into probabilities. The estimated coefficients were then multiplied by the probability density function of the linked distribution (also the derivative of the cumulative density function). Per Kleiber and Zeileis' (2008) proposal, this paper used the sample marginal effect to calculate the probit and logistic marginal effects.

Table 5

Summary of binary probit and logistic coefficients estimates and marginal effects of cocoa farmers' willingness to use crop insurance.

Independent Variable	(1)	(2)	(3)	(4)
	Logit	Probit	Logit Marginal Effect	Probit Marginal Effect
Age	-0.061	-0.074	-0.003	-0.003
	(0.0354)	(0.0166)*	(0.0017)	(0.0017)
Gender	0.052	0.0737	0.007	0.007
	(1.3094)	(0.6371)	(0.0625)	(0.0625)
Marital Status	0.584	0.312	0.031	0.031
	(1.1920)	(0.5877)	(0.0579)	(0.0579)
Educational Level	0.776	0.323	0.032	0.032
	(1.1148)	(0.5529)	(0.0543)	(0.0543)
Cocoa Income	-0.0002	-0.028	0.0000	0.0000
	(0.0003)	(0.0002)	(0.0000)	(0.0000)
Other Income	-0.002	-0.001	-0.0001	-0.0001
	(0.0010)	(0.0005) *	(0.0001)	(0.0001)
Household Size	0.04736	0.023	0.002	0.002
	(0.1296)	(0.0624)	(0.0061)	(0.0061)

Source: Data from field suvey (2020).

Note: Number of observations: 113

McFadden Pseudo R-Squared : 0.2135

Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05

A probit and logistic model was used to evaluate the determinants influencing the willingness of cocoa farmers in the Upper West Akyem District in the Eastern Region of Ghana. The explanatory variables were gender, marital status, age, educational level, household size, size of crop area, income, and other income sources. From Table 5, the probit and logistic regression results and the marginal effects show age and other income sources of farmers as the statistically significant factors that influence cocoa farmers' willingness to adopt crop insurance.

From Table 5, columns 3 and 4 show age to be statistically significant at 5%. This negatively affected the willingness of cocoa farmers to use crop insurance. Based on the marginal effect of age, it means that since age is a continuous variable**,** for each additional age, cocoa farmers are 0.17% less likely to adopt crop insurance. The finding is consistent with the prior expectation that older farmers tend to be less likely to use crop insurance. The results from Table 5 indicated that as farmers grow older, their level of participation in using crop insurance decreases. The finding is akin to existing findings by Baidu-Forson (1999) and Aidoo et al. (2014) who found that older farmers tend to use their experience and highly committed to primitive strategies to farming. Older farmers are less likely to accept innovative technology in farming (Baido-Forson, 1999; Aidoo et al., 2014). Mulugetta (2005) maintained that all things being equal, older farmers lack interest in innovative technology. Older farmers have a lot of experience in managing production risks in cocoa production than younger farmers, which makes older farmers less likely to use crop insurance due to their risk-loving aptitude (Baidu-Forson, 1999).

Farmers' income from other sources was statistically significant at 5%, and negatively influenced cocoa farmer's willingness to adopt crop insurance. The marginal effect from Table 5 indicates that for each additional other income earned by a cocoa farmer, cocoa farmers are 0.01% less likely to adopt crop insurance. This means that as farmers receive additional income to complement the income earned from cocoa, they tend to feel protected against production losses. The reason could be that they have a diversified portfolio of income sources.

Similarly, the study hypothesized income from cocoa to influence farmers' willingness to use crop insurance but the results were different. The result could mean that as farmers earn higher incomes from cocoa production, they may consider using other risk management strategies even at a high cost than those who earn lower incomes. The negative influence or significance may explain this reasoning.

The level of education positively influenced the willingness to use crop insurance but was not statistically significant. This finding is not consistent with the prior expectation that farmers with a level of education are more likely to adopt crop insurance. The finding is inconsistent with the finding of Annan (2015) that cocoa farmers with formal education are more likely to adopt crop insurance. A possible reason could be that farmers with formal education tend to apply the necessary production procedures to avoid the risk of losing crops.

One would expect married farmers to adopt crop insurance to protect their families when there is production loss. However, marital status inconsistent with prior expectations. It was insignificant but positively influenced willingness to use crop insurance. The possibility could be that the number of labor increases when a farmer marries and procreates. This increases the productivity on the farm to be able to face the challenges of production risks. This finding is uneven with the finding of Danso-Abbeam et al., (2014) that married farmers are more likely to adopt crop insurance to be able to survive unexpected production risks.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

This paper evaluated the factors that influence the willingness of cocoa farmers to adopt crop insurance in the Upper West Akim District of the Eastern Region of Ghana. The objective of the study was to look at how cocoa farmers could hedge against production risks. It can be inferred from the paper that the majority (83.9%) of the respondents are aware of insurance in general. Although majority of the farmers have knowledge about insurance in general, only 38.9% were aware of crop insurance. Majority (61.1%) of the farmers had no prior knowledge that crop insurance can help them hedge against production risks. The no-adoption of crop insurance is as a result of a lack of provision for a crop insurance scheme. This clearly reveals that cocoa farmers are not familiar with crop insurance schemes that will help them mitigate and manage production risks.

A whopping 94% of the farmers are keen on using crop insurance. On average, farmers are willing to pay an amount of GHS44.29 as crop insurance premium. It was found that although farmers are willing to use crop insurance, many of them cannot afford to pay higher premiums as the highest premium they were willing to pay was GHS150.00.

The major production risks that affects cocoa farmers are pest and disease (95.6%), drought (88.5%), variations in yield (87.6%), poor access to inputs (66.4%), high temperatures (69%) and high input prices (66.4%).

The probit and logistic regressions showed age and other income sources of farmers as the statistically significant factors influencing farmer's willingness to use crop insurance or not.

Based on the findings from the study, it is recommended that the younger people should be motivated to get involved in cocoa farming. This is because, on average, majority of the farmers were aged. The youth engaging in cocoa farming would help increase Ghana's cocoa yield. The government, COCOBOD and private stakeholders should actively sensitize and educate cocoa farmers on the benefits of adopting crop insurance. It is also recommended that the government, COCOBOD and other private firms should make farm inputs accessible and cheap to smallholder cocoa farmers in Ghana. This could help farmers avoid huge production lossess due to pest and disease attack.

Appendix

Table 6

Logit regression reporting marginal effects

Variable	AME	SE	z	p	lower	upper
EducationalLevel	0.0317	0.0543	0.5842	0.5591	-0.0746	0.1380
Householdsize	0.0022	0.0061	0.3610	0.7181	-0.0098	0.0142
Gender	0.0072	0.0625	0.1156	0.9080	-0.1154	0.1298
Age	-0.0027	0.0017	-1.6171	0.1059	-0.0060	0.0006
Income	0.0000	0.0000	0.5502	0.5822	-0.0000	0.0000
Otherincome	-0.0001	0.0001	-1.9241	0.0543	-0.0002	0.0000
Maritalstatus	0.0306	0.0579	0.5283	0.5973	-0.0829	0.1440

Source: Data from field survey(2020)

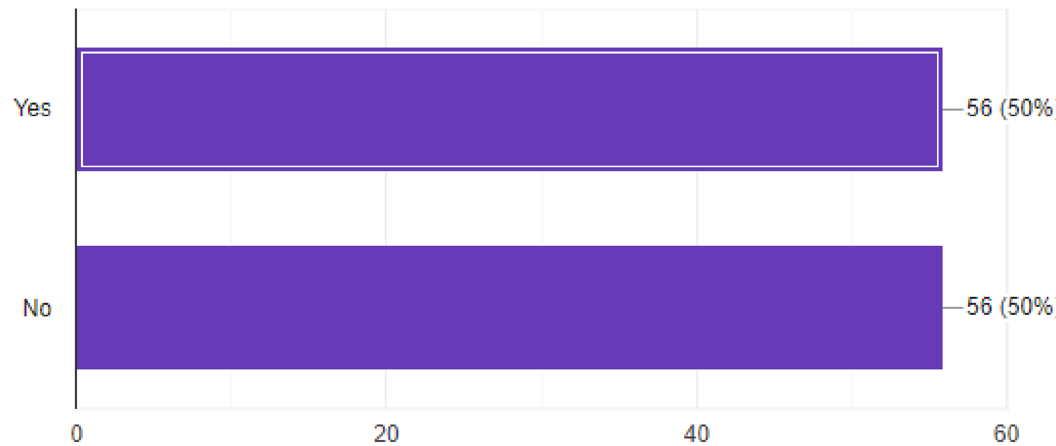
Table 7

Probit regression reporting marginal effects

Variable	AME	SE	z	p	lower	upper
Educationallevel	0.0317	0.0543	0.5842	0.5591	-0.0746	0.1380
Householdsize	0.0022	0.0061	0.3610	0.7181	-0.0098	0.0142
Gender	0.0072	0.0625	0.1156	0.9080	-0.1154	0.1298
Age	-0.0027	0.0017	-1.6171	0.1059	-0.0060	0.0006
Income	0.0000	0.0000	0.5502	0.5822	-0.0000	0.0000
Otherincome	-0.0001	0.0001	-1.9241	0.0543	-0.0002	0.0000
Maritalstatus	0.0306	0.0579	0.5283	0.5973	-0.0829	0.1440

Source: Data from field survey(2020)

Figure 4.
Cocoa farmers' access to cocoa extension services



Source: Data from field survey (2020)

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