RISK PERCEPTION AND AGRICULTURAL INSURANCE DEVELOPMENT STRATEGY FOR CASHEW CROP FARMERS IN THE BRONG-AHAFO REGION OF GHANA

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DECLARATION

I hereby declare that this work has not been submitted in substance for any degree elswere other than the Doctor of Philosophy (PhD) in Agribusiness Management pursued at the Kwame Nkruamah University of Science and Technology. I also declare that this work is the result of my own investigations and it contains no material previously published by any other person, nor material which has been accepted for the award of any other degree of the University, except for reference which have been duly acknowledged in the text.

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DEDICATION

I dedicate this thesis to the Glory of God, who imbued me with inchoate ideas that resulted into this work. It is also dedicated to my father, Rev. Dr. G.K. Mensah and late Mother, Veronica Mensah. It is also dedicated to my late Grand Parents: Abraham Kof i Mensah Edusei and Dora Dede Darko and my brother James Yeboah Mensah and my sisters: Gloria Abena Mensah and Mrs Grace Mensah Cobold.

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ABSTRACT

Although cashew development is imperative to mitigating the effect of climate change in 2030 and beyond when cocoa revenue begins to fall in Ghana, Cashew farmers lack access to credit to expand their production. The study was aimed at assessing risk perception of cashew farmers, financial institutions and insurers in order to develop agricultural insurance to enhance cashew crop farmers' access to credit to foster cashew development. The study covered seven districts and 21 comunities in the Brong Ahafo Region of Ghana. Both quantitative and qualitative techniques were utilized in the study. A a multistage sampling technique was used to select a total of 500 respondents comprising 420 farmers, 30 pool stakeholders from Ghana Agricultural Insurance Pool (GAIP) and 50 credit officers from financial institutions.Primary data were collected by means of focus group discussions, semi-structured questionnaires, in-depth interviews, and choice experiments based on stated preference techniques. Means scores, percentages, frequencies, standard deviations, factor analysis, and Kendall's coefficient of concordance, mix logit, latent class and multinomial logit models were employed in analysing the data. The results indicated that farmers' residual risks and key perils which needed insurance covers were excess rainfall, high temperature, high wind speed and fire. It was found that farmers and financial institutions were willing to pay for agricultural insurance schemes based on index, indemnity and functional synthesis philosophies and GAIP stakeholders were willing to accept. The mix logit model and latent class models results show that the mean willingness to pay for functional synthesis approach was highest, followed by simulation, indemnity, index and benchmarking with mean WTP per acre of GH¢102.38, GH¢93.94, GH¢76.34, GH¢71.34 and ¢67.70, respectively and four latent classes were observed. Feasible distribution channels, insurance companies, banks, marketing champions, while full service model, banccassurance model, partner-agent and agency models were detected as supply models.Cashew crop farmers' perception of insurance companies was positive with an index of 0.22, while a negative perception index of -0.15 was recorded for insurance benefit. Almost all farmers indicated that promotion of agricultural insurance education should be done through local radio and television stations. A value chain financing model in a public-private partnership (PPP) model was seen as an appropriate framework to lend and distribute insurance products to cashew farmers. To overcome the constraints to the development of agricultural insurance to enhance farmers' access to credit for cashew development, a policy aimed at forming cashew development, building capacity for insurers, and legislation on agricultural insurance and value chain financing in Ghana will be useful.

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LIST OF ABBREVIATIONS

ADB	Agricultural Development Bank
ADF	Africa Development Fund
ADVANCE	Agriculture Value Chain Enhancement Program

AYII	Area Yield Index Insurance
BPS	Black Panicle Syndrome
CAADP	Comprehensive Africa Agriculture Development Programme
CASE	Center for Social and Economic Research
CCD	Cloud Top Temperature
CDP	Cashew Development Project
CE	Choice Experiment
CEO	Chief Executive Officer
CIAT	International Centre for Tropical Agriculture
CIE	Center for International Economics
CNSL	Cashew Nut Shell Liquid
CRC	Crop Revenue Coverage
CTT	Cloud Top Temperature
CV	Coefficient of Variation
CVM	Contingent Valuation Method
DII	Drought Index Insurance
EML	Estimated Maximum Loss
ES	Expected Shortfall
EV	Expected Income
EVT	Extreme Value Theory
FAO	Food and Agriculture Organization of United Nations
FBOs	Farm Based Organisations
FIIS	Farm Income Insurance Scheme
FinGAP	Financing Ghana Agricultural Project
FLEXA	Fire, Lighting, Explosion and Aircraft
G NET	Ghana Meteorological Agency
GAIP	Ghana Agricultural Insurance Pool
GAIP	Ghana Agricultural Insurance Pool
GCB	Ghana Commercial Bank
GDP	Gross Domestic Product
GEO	Geostationary Satellites
GEO	Geostationary Satellites
GH¢	Ghana Cedis
GHANA-RE	Ghana insurance company ltd.
GIA	Ghana Insurers Association
GIZ	German Development Corporation
Gmet	Ghana Meteorological Agency
GOES	Geostationary Operational Environmental Satellites
GPS	Global Positioning System
GRIP	Group Risk Income Protection
GRP	Group Rusk Plan
HA	Hectares
HDI	Human Resource Development Index
HLB	Highest Lower Bond
IDFC	Intentional Fertilizer Development Centre
IFAD	International Fund for Agriculture Development
IFPRI	International Food Policy Research Institute
IIPACC	Innovative Insurance Products for Adaptation to Climate Change

IP	Income Protection
IPA	Innovations for Poverty Action
ISSER	Institute of Statistical, social and Economic Research
LDA	Loss Distribution Approach
LEO	Low-earth Orbit
LTAY	Long Term Average Yield
MAV	Multi Attribute Approach
MB	Management Board
MFIs	Micro Finance Institutions
MLA	Meso Level Approach
MM	Millimetres
MOFA	Ministry of Food and Agriculture
MOFEP	Ministry of Finance and Economic Planning
MPCI	Multi Peri Crop Insurance
MPL	Most Probable Loss
MT	Metric Tons
MTS	Modified Taungya System
NGO	Non-governmental Agency
NIC	National Insurance Commission
NIC	National Insurance Commission
NITC	Malta International Training Centre
NPM	Hedonic Pricing Model
NOAA	National Oceanic and Atmospheric Administration
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Square Regression
PMD	Powdery Mildew Disease
PPP	Public Private Partnership
RA	Revenue Assurance
RCBs	Rural and Community Banks
RCN	Raw Cashew Nut
SC	Steering Committee
SDG	Sustainable Development Goals
SCP	Structure Conduct & Performance
SCP	Structure Conduct and Performance
SRID	Statistics and Research Information Directorate
TAMSAT	Tropical Application For Meteorology using Satellite and Ground Data
TC	Technical Committee
TCAI	Technical Committee for Agricultural Insurance
TCM	Travel Cost Method
TMU	Technical Management Unit
TSI	Total Sum Insured
UNDP	United Nations Development Program
USAID	United States Agency for International Development
VAR	Value at Risk
WDI	World Development Indicators
WFP	World Food Programme
WII	Weather Index Insurance

WTP Willingness to Pay

OPERATIONAL DEFINITION OF TERMS

Adverse Selection:- A situation in which an insurer end up insuring only high risk individuals or farmers. Instead of mixture of high, low and in between risk individuals.

An aggregator:- A person who buys from the farmers and sells it to a processor

Basis Risk:- A potential mistrusted between pay outs and the actual loss where farmers receive claims, when they are not suppose to or do not receive claims when they are suppose to.

Business risk: - This may be as a result of income variation as a result of the type of variety of crop the firm is engaged in and also the type of cropping systems, such as mono cropping or mix.

Casualty Risk: - this may include farm/property loss due to fire, flood, draught, theft all of which affect sustainability process especially in production.

Cash crops:- Tree crops with economic value

Credit Rationing:- Circumstances in which farmers who need credit are not given the chance to apply for credit or not offered the required amount they desire.

Crop Cut:- A yearly yield estimate, where MoFA, randomly select fields in a district and cut.

Decad: - 10 days of weather data

Ex-ante:- Action taken before a potential peril occur

Ex-post:- Action(s) developed in reaction to an event

Financial risk: - This may refers to a higher loss under unfavourable business condition when financial leverage is high. Leverage – amount of unity capital relative to equity capital that is Debt/equity.

GAIP's Stakeholders- Technical Management Unit (TMU), made up of manager, underwriter and agrometeologist, Steering Committee of Agricultural Insurance (SC), Technical Committee of Agricultural Insurance (TCAI), and Management Board (MB)

Indemnity:- Compensation, that brings the insured to their pre loss financial position.

Information Asymmetry: A situation in which one party has more information than the other.

Insurable Interest:- The legal right to insure, that is the financial or pecuniary relationship existing between the insured and the subject matter of insurance, in which the insured. Stands to benefit from the safety of the subject matter and may be prejudice by its loss.

Institutional risk: - This refers to government institutions policy options and decisions such as removal fertilizer subsidies or decisions on minimum wage rates, tax policies, tariffs and trade policies.

Legal risk: - This may be rules and laws of the country and more of regulation of agricultural production including increased awareness of food safety.

Labour risk: - This is due to labour mobility or labour shortage at critical times of the season.

Market risk: - This includes deviation from expected price or changes in the market cycles.

Personal risk: - These affect the farmer, it may include, sickness, death are captured in the medical bills the business has to deal with.

Production risk: - These are natural hazards and environmental variation such as rainfall, insect, pests and diseases thaty affect yield or wipe out total production.

Moral Hazards:- Fraudulent behaviour on the part of insured, which leads to staging claim(s).

Morale Hazards:- Carelessness on the part of insured, because of they have purchased insured.

Nucleus farmer:- A farmer who is an opinion leader of many farmers, they can sometimes be input suppliers or aggregators

Payouts:- Insurance claims

Peril:- Event that brings about a loss.

Poverty Trap:- A situation in which one is not able to recover after loss of investment, and pass on the poverty to the next generation.

Premium:- Amount of money paid to transfer risk to insurers by purchasing insurance.

Price risk: - This may include price inflations from the supply side bottlenecks or excess inflations, import substitutes that affect farm income.

Proximate Cause:- The immediate causes

Reputation Risk:- Risk that arise from other operational risks leading to loss of confidence in organisation due to reputation damage e.g. delay in claim payment or non claim payment due to bases risk.

Residual Risk:- These are those risks that remain, once any action has been taken to treat the risks.

Risk Assessment:- Qualitative and quantitative evaluation of risk to determine, the exposure and magnitude.

Risk Management:- Actions taken to reduce or prevent potential loss/or loss events from occurring.

Safety Nets:- Government assistance for the vulnerable or citizens affected by a catastrophe.

Site Production Capacity:- This is given by the total standard biomass produce and you know where to plant and to also determine the yield in a particular site or area.

Social risk: - Stem from social actions which include fire, looting, poison, arson, and accident.

Systematic Risk:- Risk that affect an entire area or all households in a community. Idiosyncratic risk, that is peculiar or unique to individuals or households in a particular community or circumstance.

Technological risk: - Rapid changes in technology which requires farmers to constantly adopt a new technology.

A defined threshold or strike value, in which the maximum or part of the TSI (Total Sum Insured is paid, when the index fall below a limit which is a pre specified value and payouts are based on pre defined parameter such as temperature, rainfall amount windstorm and values serves as best proxy for yields.

Underwriting:- The process of assessing the risk exposure of farmers in order to accept and fix equitable premium or reject the risk.

Utmost good faith: Declaration of all the material facts pertaining to the risk to be insured in order to help the prudent underwriter in fixing the premium.

Warranty:- These are specialised conditions that goes into the heart of insurance contract for the contract insurance is void as initio, even it the loss was not connected to the breach.

Trigger:-

CHAPTER ONE INTRODUCTION

1.1. Background of the Study

Agriculture is critical to the development of Africa and crucial to the achievement of Sustainable Development Goal one which seeks to eradicate extreme poverty and hunger by 2030. Over 70% of Africa's population depends on agriculture (IFDC, 2013). It is in light of this that at a conference held in Maputo in 2003, African leaders endorsed a Comprehensive Africa Agriculture Development Programme (CAADP) as a framework for Africa's agriculture development to banish hunger and poverty in order to fuel economic growth and development in Africa. They set targets of allocating 10% of their national budgets to agriculture by 2008 and also reach a national agricultural growth rate of 6% per annum since, most countries in Africa will have to boost the agricultural sector growth rates through welfare, equity, anti-poverty, efficiency and empowerment approach to transform livelihoods in that sector in order to achieve SDG 1 and 2 (Dugbazah, 2007, CAADP, 2008).

In Ghana, agriculture is paramount to achieving food security, poverty reduction and economic growth. Also, the agricultural sector in Ghana has complex linkages with other sectors of the Ghanaian economy (Sarpong and Al-Hassan, 2014). 22.7% of the Ghana's GDP came from Agriculture in 2011 (ISSER, 2012). Out of the total land area of 23,853,900 hectares (ha), in Ghana, the potential land for agricultural production is 13,628,179 ha representing (57%), but only 7,311,500 ha, representing 54% of agricultural land is cultivated, and only 29,804 ha reflecting (0.2%) are irrigated (IFDC,2013). The rest are largely rain fed (MOFA, 2011; IFDC, 2013; Anning, 2006; CASE, 2009, Zaney, 2011). Agricultural lands in Ghana are used for cultivation of cash crops and food crops. Cocoa is the major cash crop that gets most of the attention in Ghana, and subsequently has become the second highest income earner in Ghana but its production is declining in recent times (ISSER, 2013).

The Cocoa sector recorded 6.9% and -14% decreases in production respectively in 2010 and 2011. Cocoa production decreased from the 1million metric tonnes to 879,300 metric tonnes which equates to negative 14% change (ISSER, 2013). This downward trend in Cocoa production is likely to worsen in 2030 and beyond due to climate change (CIAT, 2011). A study by International Centre for Tropical Agriculture (CIAT) in 2011 brought to the fore that climate change will affect cocoa production in 2030 and beyond. The same study, however, identified cashew as one of the promising perennial crops that have the potential to reverse the downward trend in Agricultural GDP resulting from the fall in Cocoa production in that era. This makes cashew development key, but the sector is also exposed to a myriad of risks including social risks such as fire that tend to erode the financial investment of farmers (Miranda and Farrin, 2012). This makes it difficult for cashew crop farmer to secure loans from financial institutions for expansion of the sector (OseiTutu, 2012).

Over the years, farmers in developing countries, including cashew farmers in Ghana, have been managing and coping with the risk of the weather, pest and disease as well as other social perils, *ex-ante* and *ex- post,* using traditional methods such as farm fragmentation and diversification which are sub-optimal (Ben-Houassa, 2010;Wenner, 2005). However, these traditional methods are not attractive to financial institutions making them enact tighter lending policies in the form of credit rationing (Gine and Yang, 2009; Ben-Houassa, 2010; Awunyo- vitor, 2011). Besides, farmers including cashew crop farmers are constrained by lack of collateral security that is acceptable to lending institutions, since their lands seldom have leases and land title certificate leading to the prevalence of credit rationing (MoFA, 2009; Stutley, 2010). However, in developed economies, protection against financial impacts are normally done through contract farming, forward contracts, hedging in futures markets and the use of agricultural insurance (Ashok *et al.* 2003; Stutley, 2010; Miranda and farrin, 2012). According to Awunyo-Vitor (2011), the prevalence of risk rationing suggests that if farmers had access to risk mitigating facilities in the form of affordable insurance products, they would be able to access formal financial service, and this can be done by assessing the premium level that would be acceptable to both the insurer and the farmer. Consequently, agricultural insurance can serve as collateral for financial institutions to enhance cashew crop farmers' access to credit, as well as a risk mitigating instrument to address cashew crop farmers' residual risk in order to prevent them from falling into the poverty trap (Wenner, 2005). Clearly, if agricultural insurance is not developed for cashew farmers it would have negative impact on their profit maximization and also threaten the welfare of households involved in cashew production. Agricultural Insurance would also protect the incomes of households in farming communities against both idiosyncratic and systemic risk and ultimately positively influence farmers to access credit and other ancillary services from financial institutions (Hellmuth *et al*., 2007; GlobalAgRisk, 2009).

Osei-Tutu (2012) confirms the above assertion that developing agricultural insurance schemes for the cashew sub-sector will encourage investment in the cashew subsector. This will lead to sustainable economic growth and poverty reduction and also propel Ghana to shift towards the positive side of the Human Resource Development index (HDI), particularly in the rural areas to achieve SDGI (MoFA, 2007; World Bank, 2007).

1.2 Research Gaps and Problem Statement

1.2.1 Research Gaps

A thorough review of literature exposes the gaps in agricultural insurance knowledge, particularly in the cashew sub sector, in terms of awareness and willingness to pay, distribution channels, products, supply models, and media for raising awareness to ensure the sustainable development of agricultural insurance system to enhance cashew crop farmers access to credit (Stutley, 2010; Awunyo-Vitor, 2011; Osei-Tutu, 2012; GAIP, 2012; Ben-Houssa, 2010).

Gap 1: Sustainable agricultural Insurance systems are less developed in Africa, except in Mauritius, Sudan, Morocco and South Africa and Africa adds less than 1% to the global agricultural insurance premiums (Stutley, 2010; Iturrioz, 2010; 2010; FAO, 2011). This is similar to observations made by Imhre (2011) and Bonna and Aidoo (2011) that the agricultural insurance market is underdeveloped in Africa and its penetration rate is still low.

Gap II: According to Stutley (2010), there cannot be any viable insurance scheme for the cashew subsector in Ghana, but Osei -Tutu (2012) found out that demand for agricultural insurance exists in the cashew subsector in Ghana and even concluded that financial institutions are reluctant to give loans to the farmers because they have no appropriate insurance policies against adverse environmental hazards especially bush fires. To buttress this, Innovation for Poverty Action (IPA) offered farmers in the Northern region a rainfall index insurance product known as Takayuya and observed 40% of farmers were willing to pay actuarially fair premiums. This controversy presents a gap in literature for investigation.

Gap III: The first ever agricultural insurance product rolled out at an actuarially fair price in Ghana was the Crop Drought Index Insurance which was introduced in three Northern regions in 2011 on a pilot basis by the Technical Management Unit (TMU) of the Ghana Agricultural Insurance Pool (GAIP) to protect the financiers of maize farmers namely: Agricultural Developing Bank(ADB), Bonzali Rural Bank and also protect farmers of an agri-based research institution and NGO, Innovations for Poverty Action (Zaney, 2011; Imhire, 2011; Bonnah and Aidoo, 2011). Nonetheless, there is no insurance for cashew and other cash crops, hence the need to develop innovative and demand-driven agricultural insurance products to protect farmers and their financiers and to increase the agricultural insurance penetration rate in the Ghanaian insurance market.

Gap IV*:* There is a noticeable lack of knowledge by policy makers, advisers and insurers on methods and models for designing and implementing agricultural insurance products for the cashew subsector in Ghana. According to Meuwissen *et al.* (2001):

> *….although much theoretical research on risk in agriculture and its management has been done, useful practical insight for policy makers, advisers, developer and sellers of new risk management strategies is generally limited in the agricultural subsector (Meuwissen et al., 2001:45).*

Gap V: Implementers of Agricultural insurance schemes normally use the product approach from the insurers' perspective instead of the producers' perspective while neglecting the system approach. However, the system approach is vital in product designs, distribution channel development and selection, and building the required institutions for sustainable agricultural insurance development (Herbold, 2012). In order to overcome this:

> *…….it is important to answer questions on how farmers perceive the importance of risk factors influencing their activities and adequacy of the tools and methods of treating such risk, since these factors bear great influence on the risk management strategies applied by producers (Palinkas, 2011:1).*

It is in consonance with this that Awunyo-Vitor (2011) recommends an interdisciplinary approach comprising socio-economists, agronomists, insurers, meteorologists, and farmers to embark on a research aimed at developing a sustainable insurance scheme for farmers and concluded that results from a study of this nature will alleviate the fears of formal financial institutions in order to extend credit to farmers.

1.3 Problem Statement

Climate change will hit Ghana and Cote d'Ivoire in 2030 and 2050 and temperatures will rise by

1.3^{oC} and 2.3^{oC} respectively and total annual rainfall will decline by 9-27% whiles the mean daily temperatures will rise by 2.5^{oc} – 3.2^{oc} in the whole universe by the year 2100 (CIAT, 2011;

Minia, 2004). This would adversely affect Cocoa Production but affect cashew production positively necetating cashew development. However, cashew farmers lack access to credits as financial institutions embark on transaction cost rationing, quantity rationing and risk rationing of credits, with risk rationing being the prevalent when it comes to agricultural lending (OseiTutu, 2012; Awonyo-Vitor, 2011). Their perception is anchored on the notion that the risk enumerated earlier on will affect the cash flow of farmers, which would lead to default risk (Hazell *et al.*, 2010;

Stutley, 2010). Another factor responsible for rationing is the continued reliance of farmers on traditional farming methods of risk management. Traditional *ex-ante* risk managment methods include diversification, farm fragmentation, location choice, asset flexibility, i.e. investing in assets that have multiple use, product flexibility, market flexibility, precautionary savings, offfarm investment (Muewissen and Molnar 2010) while *ex-post* strategies are comprised of removing children from school, and using them as labour, dependency on informal sharing arrangements with neighbours, and remittances (Wenner, 2005; Misra, 1996; skees *et al.*, 1997). Consequently, financial institutions including rural banks, and Agricultural Development Bank whose mandate was to lend 20% of their loan portfolio to agriculture, have consistently reduced their credit even from 16.8% to 4.8% in 2008 (Awunyovitor, 2011; IFAD, 2008; Stutley, 2010). Lack of credits to cashew farmers have the potential to stifle cashew development since cashew crop farmers may need financial services to acquire inputs such as planting materials, seeds, fertilizer and pesticides (Osei-Tutu, 2012). Osei-Tutu (2012) reports that financial institutions restrict access to credit to cashew farmers because of lack of agricultural insurance to cover their residual risk including fire consistent with the observation made by Gine and Yang (2009) who found a correlation between agricultural insurance and access to credits among groundnut farmers in Malawi. In Ghana, the Agricultural sector constitutes a potential market for the insurance industry. However, the current market penetration rate is 1% because access to agricultural insurance is generally limited in developing countries, since insurers mostly concentrate on urban and industrial risks and had previously neglected agricultural risk (World Bank, 2010; National Insurance Commission, 2011). Moreover insurers in Ghana lack knowledge on product development, rating, underwriting, and adjusting agricultural insurance claim for the cashew crop (Stutley, 2010). Empirical literature on agricultural insurance for cashew farmers is scanty and Ghana Agricultural Insurance Pool (GAIP) has confirmed their current lack of knowledge and skills to develop agricultural insurance product for cashew farmers in general. More so, insurers in Ghana lack knowledge on feasible distribution channels for marketing agricultural insurance to cashew farmers as most insurance companies are located in the urban centres and lack rural branch networks for administration and marketing of agricultural insurance (Stutley, 2010). Again, they are also faced with logistic and administration challenges as they have no support from the Government to develop and market insurance products for the cashew subsector as found in USA, Canada and Spain. To overcome this challenge, Hazell *et al.* (2010) opined that initial research is required to build capacity for local insurers and also to develop delivery channels.

Regrettably, there is no known study in Ghana that has sought to identify risk perception in the cashew subsector with the aim of developing sustainable insurance products to enhance their access to financial services, which according to Osei-Tutu (2012), is a major constraint to cashew development. Moreover, almost all the insurance studies done in Ghana relied on single product approach based on a single insurance philosophy or approach. None of these studies used the system approach to examine all the philosophies or approaches such as: index, indemnity, simulation, benchmarking and functional synthesis which has all the elements of the first four approaches to conduct their study. Consequently, results from such studies could be inadequate for decision making. Besides, most agricultural insurance studies done so far in Ghana focus on food crops and cocoa farmers and extant literature on cashew insurance is almost non existent. Furthermore, studies done in agricultural insurance in Ghana till date did not use inter-disciplinary approach comprising agronomists, farmers, insurers, meteorologists, and financial institutions to arrive at premiums that are acceptable to the farmer, insurer, and financial insitutions. It is in this regard that Awunyo-Vitor (2011) stresses that a study of this nature should be interdisciplinary to arrive at premium level that could be acceptable to both insurers and farmers so that the results of a study of this nature would help alleviate the fears of financial institutions so as to provide credit for farmers including cashew crop farmers in the study area.

1.4 Research Questions

Based on the gaps identified in literature, the main research question the study sought to answer was what is the appropriate strategy for developing agricultural insurance for cashew crop farmers in the study area? Specifically this takes into consideration seven grand tour questions with sub questions as suggested by Collis and Hussey (2003).

1. What sources of risk are perceived as important in cashew crop sector in the study area and what are cashew crop farmers' risk management strategies and insurance preferences?

i. What are the farmers' systemic and idiosyncratic risks?

ii. Which of these risks are residual? iii. What risk management strategies are employed by the cashew farmers in the study area?

iv. What is the probability of occurrence of the cashew farmers' residual risk?

v. What is the attitude of cashew crop farmer towards risk? Are they risk averse, risk neutral or risk 'preferers'?

2. Are Cashew farmers willing to pay for agricultural insurance products in the study area?

i. What insurance products are cashew crop farmers aware of?

ii. What are their knowledge, attitude and perception towards insurance and insurance companies in the study area?

iii. What Agricultural insurance products would be appropriate for Cashew Crop Farmers in the study area?

iv. What effects do socio demographic characteristics of the farmer such as household size, education, age, experience, gender, access to public help, perception, and price of insurance have on cashew crop farmers' willingness to pay for Agricultural Insurance?

v. What effects do farm and institutional characteristics such as farm size, farm age, access to agricultural training, and tenure, product type and trust in insurance companies have on the cashew crop farmers' willingness to pay for Agricultural Insurance?

vi. What method of payment is appropriate to the cashew crop farmer?

3. What distribution channels from the cashew crop farmers' perspective would be appropriate for marketing Agricultural Insurance Products in the study area?

i. What supply models would be appropriate for supplying agricultural insurance products in the study area? is it the:

- Provider model?
- Partner –agent model?
- Full service model?
- Community model?
- Agency model?
- Utility based model?
- Banccassurance model?
- or the composite model?

4. What are financial institutions risk perceptions of the cashew crop sector in the study area? And what type of risk do they perceive as critical to their loan recovery in the study area?

i. Would financial institutions be willing to buy the agric insurance to cover their agric loan portfolios or would they want to pass it to the farmer? ii. Would the financial institutions increase their loan to the cashew crop sector if insurance is developed to cover the cashew farmer's residual risk? iii. What model of agri lending is appropriate for the cashew crop sector in the study area?

5. Would Stakeholders (Technical Management Unit, TMU, Tecnical Committee, TC and Steering committee, SC) of Ghana Agricultural Insurance Pool (GAIP) be interested in designing agricultural insurance product for cashew crop farmers in the study area?

i. If so, what products are they willing to design? Is it damage-based or yield-based and on what philosophy or approach: index, indemnity, simulation or benchmarking, or functional synthesis?

ii. On what terms, conditions, warranties, franchise, and deductibles are they willing to accept cashew crop farmer's residual risks?

iii. Which approach will they prefer to market their insurance product, is it the individual or group approach?

iv. How do Stakeholders of GAIP want the Government to support agricultural insurance development for cashew farmers in the study area?

6. What constraints would impede both Insurance and cashew development in the study area?

7. What is the appropriate strategy or framework for providing sustainable agricultural insurance for the cashew sub sector in the study area?

1.5 Objectives of the Study

In pursuance of the search of convincing answers to key research questions enumerated, the main objective of the study was to assess the risk perception of cashew farmers, financial insiturions and insurers with the aim of identifying a strategy for developing agricultural insurance system for cashew farmers to enhance their access to credit to foster cashew development. Seven (7) Specific objectives were generated to focus the study to achieve the overall research goal as follows:

1. To analyze the important sources of risk perceived in cashew production by farmers and insurers as well as their risk management strategies and insurance preferences.

2. To assess cashew farmers level of awareness and willingness to pay and factors that influence their willingness to pay for agricultural insurance in the study area.

3. To identify feasible distribution channel and supply models for marketing agriculture insurance products to cashew crop farmer in the study area.

4. To investigate financial institutions risk perception, preference, mode of purchase of agricultural insurance and lending model to cashew farmer in study area.

5. To evaluate stakeholders of GAIP's interest in developing agriculture insurance for cashew farmers and to ascertain the support need from government to supply the products.

6. To determine the key constraints that would impede both insurance and cashew development in the study area.

7. To develop the appropriate strategy for underwriting and implementing agricultural insurance systems for cashew crop farmers in the study area.

1.6 Justification for the Study

The cocoa sector for many years has been one of the main export crops for Ghana and has been the country's second foreign exchange earner for the nation. However with changes in climatic conditions of the world and it attendant impact on Ghana, the cocoa crop will be affected and may no longer continue to thrive in the advent of climate change in the next 15 years and beyond (CIAT, 2011).

Consequently, plants that can withstand the change need to be produced to allow the country to diversify its income source to mitigate the possible reduction of revenue from cocoa need to be promoted. One of such crops is cashew but the sub-sector which is currently under developed need agricultural insurance to enhance cashew farmers' access to credit and to also protect their investiments (Awunyo-Vitor, 2011, Osei -Tutu, 2012).

This undoubtedly would help foster cashew development to mitigate the effect of climate change in 2030 and beyond when government revenue from cocoa starts falling,as recent trends show that there is an ever growing demand for cashew in countries with high per capita income including France, Germany, Italy, United States, Canada and Spain (Vieira *et al.*, 2005). Additionally in the face of several risk faced by farmers in Ghana, the issue of agricultural insurance in mitigating risk has dominated policy discourse for some time now and any emipircal study that seeks to come out with an insurance system that takes into account perceptions and views of key stakeholders is a bold beginning in the country's effort at addressing risk faced by plantation crop producers particularly cashew farmers through market options.

Consequently, a study of this nature would not only add to the existing canon of knowledge in agricultural insurance literature but also would provide ministry of Food and Agriculture information on the needs of this sector and assist with the development of the cashew subsector. In addition, insurance companies would be able to develop agricultural insuance products tailormade towards the needs of financial institutions and the farmers in the sector. National Insurance Commission would also be able to formulate and implement regulatory policies aimed at providing technical guidance to insurers and farmers to mitigate risk and enhance the development of the cashew subsector in Ghana. The Technical Management Unit (TMU) of Ghana agricultural insurance pool (GAIP) consultants and other stakeholders will also gain insights and reshape their insurance thinking, particularly on the models for developing , rating and designing agricultural insurance for cashew crop farmers in the study area. This study will undoubtedly help the insurance market in Ghana to increase agricultural insurance penetration rate and also add to the global agricultural insurance premium where Africa's position continues to remain in a sorry state.

1.7. Scope of the Study

The study assessed risk perception from the farmers, financial institutions and insurers' perspective with the aim of identifying a strategy for developing agricultural insurance to cover cashew farmers' residual risk. This study was limited to 21 communities in 7 districts in the BrongAhafo Region of Ghana.

1.8 Organisation of the Study

Following chapter one which has just been discussed, chapter two presents the theoretical framework, literature review and empirical framework of the study. Research methodology is described in chapter three, followed by chapter four which is risk perception, agromomic and meteorological analysis. Chapter five focused on the presentation and discussion of results of choice experiment and insurance development survey, while chapter six was devoted to the summary of findings, conclusion sand recommendations.

1.9 Chapter Summary

In this chapter, a case was made for the use of agriculture insurance as machinery to transform the cashew subsector to foster economic growth in 2030 and beyond. It also threw light on the exploration of the potential for the use of agricultural insurance product to boost cashew farmers confident to invest in the subsector by gaining to gain access to credits from financial institutions and also protecting their investments. The next chapter looks at the literature review which encapsulates the theoretical, empirical and conceptual framework for the study.

CHAPTER TWO LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK OF THE STUDY

2.0 Introduction

This chapter looks at the theoretical, empirical and conceptual frame work of the study. It also attempts to discuss the theoretical underpinnings of risk perception and agricultural insurance development philosophies. The chapter also reviews literature on factors that influence the willingness to pay for agricultural insurance.

2.1. Concept of Risk

Risk and uncertainties are part and parcel of agriculture including cashew production and exist whenever the future is not known with certainty (Anafo, 2011). Knight (1921), in his seminal work, distinguished between risk and uncertainty and defined risk as chance of loss to which probabilities can be assigned. He argued that if probabilities cannot be assigned, then the situation reflects that of uncertainty. Ellsberg (2001) on his part explained risk to reflect a situation where objective or subjective probabilities can be assigned to states of nature. Here, both Knight (1921) and Ellsberg (2001) seem to support the probability theory which can be determined by using various mathematical models including the relative frequency approach or ratios to determine the probabilities. However, Knight’s definition of risk is viewed by Atkins and Bates (2007) as emphasising the down side of risk since it only connotes negative outcomes; yet, positive outcomes reflect the upside of risk. MITC (2008) views risk as potentially negative outcome of decisions or events. These definitions are inadequate, since they connote pure risk, where there are no possibilities of gain, but only a chance of loss or break even; thus neglecting speculative risk where gains can also be made (Atkins and Bates, 2007).

Ellsberg (1961) and Chevas (2004) revealed a critical nuance between risk, uncertainty, ambiguity and fuzzy set theory. To them, uncertainty and ambiguity relate to information and also stress the amount, type, unanimity and reliability of the information. Ellsberg (1961) reinforced Knight’s position on uncertainty by stressing that where there is not enough information to estimate the probability, it reflects a situation of uncertainty; while ambiguity can be perceived as a situation in which the decision maker behaves as if no well-defined objective or subjective belief distribution exists (ibid). Fuzzy set theory posits that individuals may not be able to distinguish precisely between alternative prospects (Chavas, 2004). Apparently, a person's risk perception depends on his or her orientation. For instance, a medical doctor looks at risk in terms of dietary habit, lifestyle and health whiles a police man looks at risk in terms of crime (MITC, 2008). Todaro (1981) maintains that economists perceive risk as any situation in which the probabilities of obtaining some outcome is not precisely known while sociologists view it as the unintended consequences of rational actions (Evers and Mehmet, 1994).

From the agricultural sector, a policy forum held in Damascus in 2007 perceived risk as anything that leads to the reduction of consumption below sufficient levels (Nehme, 2007). Hardaker *et al.* (1997) on the other side of the global risk discourse defined risk as imperfect knowledge where probabilities are not known thus reinforcing the perspective of Knight's on the concept of uncertainty. Dorfman (2008), on his part, postulated that risk is the variability in the outcome of events or decisions. MITC (2008) argues that the outcome of a risky event or decision may either be negative, positive or uncertain. However, in most cases, agricultural risk is associated with negative outcomes of events such as unpredictable biological or climatic outcomes, and price variability which causes financial loss, though the prospect of financial gain is also possible. Seasonality in rain-fed agriculture may force farmers to embark on risky decisions. However, due to imperfect knowledge, the outcomes of their decisions manifest months or years later (Tangermann, 2011). This necessitates the service of experts who are good at managing agricultural risk, with tools such as agricultural insurance.

Mathematically, operating under the assumption that the decision makers which in this case are cashew crop farmers are risk averse and would like to transfer their residual risk to insurers who operate on the principles of large numbers, then, following the central limit theorem, the probability distribution p_i of a decision under risk approaches a normal distribution.

If X_i is a random variable (the loss for one participant in a pooling arrangement), where $i = 1.........,N$ (where N equals the number of cashew crop farmers. If the expected value of $X_i = \mu$ and that the standard deviation of $X_i = \sigma$ for all i, each cashew crop farmer has the same expected loss and standard deviation (Harrington and Niehaus, 2004). Then, for any small number $\varepsilon > 0$ as shown in the equation (2.1)

$$\text{Prob}\left(\left| \frac{\sum_{i=1}^{N} X_i}{N} - \mu \right| > \varepsilon \right) \to 0 \ \text{as} \ N \to \infty \qquad (2.1)$$

The quantity within the parenthesis is the absolute value of the average loss for the insurance pool minus the expected loss for each farmer (Harrington and Niehaus, 2004). The explanation for this is that the probability that the average outcome or the loss of each cashew farmer in the pooling arrangement differs from the expected value by more than a small number as N approaches infinity based on the central limit theorem. Simply stated, as N gets large, the average outcome is likely to assume a normal distribution and also reduce the variance (Harrington and Niehaus, 2004).

According to the central limit theorem the distribution of the average outcome approaches a normal distribution with mean μ and standard deviation $\frac{\sigma}{\sqrt{N}}$ as N gets very large.

Mathematically, the variance and standard deviation show precisely the probabilities of the different outcomes and the deviation of each outcome of cashew crop farmers' residual risk and abosute measure of risk which are expressed mathematically as:

$$\text{Variance} = \sum_{j=1}^{N} P_i \left(x_i - \mu \right)^2 \qquad (2.2)$$

And

$$\text{Standard deviation} = \sqrt{\sum_{i=1}^{N} p_i \left(x_i - \mu \right)^2} \qquad (2.3)$$

Equation (2.1) and (2.2) are variance and standard deviation respectively, which form the rudiments for risk detection and basis for risk reduction through pooling arrangements such as insurance. The decision rule is that the lower the variance or standard deviation, the lower the risk. From theory and practice when non-correlated risk, which are risk with different probabilities are pooled together, the variance is lowered and consequently results in low risk (Harrington and Niehaus, 2004). This principle underlines the concept of indeminity approach to insurance. However, correlated risk or covariate risk have the same probability of occurance and must be treated with indicies in an index insurance contract. To this end, the probability assigned to an outcome of a risky event remains critical in risk management decisions for the cashew crop farmer from falling into poverty traps as there is a correlation between risk exposure and poverty (Bird *et al.*, 2002).

Besides, the probability of an event or a decision can be estimated based on the observations of the random variable in the sample, such as changes in rainfall pattern over a period (Chevas, 2004). Insurers make use of this concept to build their insurance portfolios, where risk is independently or randomly distributed among the insured but in agricultural insurance portfolios, risk may be systematic or covariate which is correlated and widespread and may not be randomly distributed. For instance, good or bad weather, which is covariate or systematic, may affect the entire population in a farming community (Raju and Chand, 2008). Consequently, the type of risk a cashew crop farmer faces would determine its distribution (Harrington and Niehaus, 2004), as well as the type of insurance approach and products required to mitigate the effect of that risk. Risk indicators such as coefficient of variation which is a dimentionless measure and relative measure of risk can help in analysing risk to determine its treatment.

Other risk indicators identified by Tripp *et al.* (2004) and Anafo (2011) are classified into three categories namely **exposure-related** indicators, **Loss-related indicators** and **Cause-related indicators.** According to the authors**, Exposure-related indicators** are quantitative indicators that typically measure the potential for production failure, as production risk is multidimensional, and requires such indicators which may come in the number of chains from an insurer's perspective. **Loss-related indicators** measure the number of events associated with production losses outcomes as well as lagging indicators; however, they are insufficient on their own while **Causerelated indicators** measure drivers of production loss such as labour turnover and are therefore leading indicators.

Undoubtedly, these indicators have a link with the cashew crop farmers' risk management decisions, when it comes to residual risks.

2.2 Theoretical Frameworks for Risk Management

The choice of a risk management strategy is determined by the risk attitude of the decision maker (Stutley, 2010). Risk management involves risk mitigation, retention, avoidance, control and transfer to third parties by hedging in futures markets, contract agreements, outsourcing to third parties, foward contracts and insurance. Various risk management theories such as loss distribution approach (LDA) thrive on the frequency and severity of losses. (Carla *et. al.*, 2007), Value at Risk (VAR), Expected Shortfall (ES), are also used for determining risk capital necessary to cover insurers operational risk, while Extreme Value Theory (EVT) is used for measuring severity of loss distribution and have a viable fit with the **Measurement theory** which hinges on quantitative applications of risk in terms of ordering options based on their probability distributions. Theories such as **Combs theory,** which posits that individuals have ideal or preferred level of risk they choose from when faced with situations which explains how and why individuals form judgments about risk in a social context, were also reviewed. Cultural theory developed by Mary Douglas (1982) provides normative emphasis on processes by which decisions under risk are made through understanding of their sources. It gives insight as to why some risks are constructed, and selected, or politicized and emphasized and is a good theory in explaining risk culture of a group. Other theoretical frameworks on risk reviewed were:

Protection motivation theory which relates to risk perception and risk tolerance. According to this theory, individuals are more likely to protect themselves against anticipated negative consequence and subsequently have the desire to avoid them by taking preventive measures, and this is the reason for which this theory is used for safety campaigns (Back and Maiman, 1975). **Risk compensation theory** also known as **Risk Homeostatic theory** explains why individuals take risk. The theory states that people take risk when they have a greater sense of security, meaning people risk taking behaviour is dependent on safety measures in place, consequently, expansion of cashew farmers production will be based on provision of agricultural insurance, while financial institutions will take risk by extending their loan portfolios to the agricultural sector.

Situational Rationality theory is rooted in the argument that it is erroneous to assume that safe behaviours are inherently rational and high-risk behaviour are irrational, meaning there is a rational justification for why people take risk (Choudry and Fang, 2008). Similarly, there is a justification for cashew farmers taking risk in expanding their farms to mitigate the effect of climate change in 2030 and beyond (CIAT, 2011).

Habituated Action theory argues that engaging in high-risk behaviour many times without a negative outcome often decreases the perceived risk associated with behaviour, necessitating the use of farming experiences to mitigate risk in cashew production (Weyman and Kelly,1999), **Social Action theory** states that people take risk because of peer pressure or general community perception that an activity is low risk. Consequently, farmers may go into cashew production if its production is being encouraged in a community.

Social control theory introduced by Hirshi (1969) states that being connected to organizations promotes conformity which can decrease the probability of high risk behaviour. This theory throws light on the usefulness of a cashew farmer, belonging to an FBO, or a block farming activity in order to conform to harmonized agronomic practices to mitigate risk through extension contact. Other theories are extentions of consumer behaviour theory which was formulated by Bernouth in (1738) and axiomatized by Von Neumann and Morgenstern (1944) known as the **expected utility theory** in which cashew farmers behave as if they have a utility function and make choices to maximize it. Another theorem views risk as the probability that the farmers' income will fall below predetermined threshold known as **safety first approach** (Korir, 2011). .

In this study, protection motivation theory, measurement theory, social control theory and expected utility theories served as a theoretical framework in gauging the risk perception of farmers, financial institution and insurers in order to develop agricultural insurance system that is acceptable to financial institutions and cashew crop farmers in the study areas with the aim of enhancing their access to credit for expansion in order to mitigate the negative externality effect of climate change that will affect cocoa revenue in 2030 and beyond.

2.3. Risk Classification in Agriculture

Risk in the Ghanaian Agriculture varies in terms of types, frequency and impact, the agro ecological zone involved, farming system, and policy frameworks of a locality (Hess and Pispoli, 2010). Stutley (2010) identifies risks that agriculture as a combination of factors from: climatic risk, such as erratic rainfall, subsidence, and ground heaves landslide, flood, hurricane, droughts, storms, earthquakes, subterranean fires, volcanoes and biological risks such as pest and disease. He argues that risk can be manmade or natural and concluded that natural risk is uncontrollable, making it the subject of insurance. Perhaps it is also pertinent to consider MITC (2008) risk perception which are social risks such as fire and theft; chemical risk such as explosion, spontaneous combustion and fermentation; and miscellaneous risks which cover events such as escape of water, Aerial device dropped from air /space craft, impact by road among others which are all insurable risks (ibid). Wenner (2005), on his part in assessing the risk factors affecting agricultural yields in the Caribbean and Latin America, seems to have the same classification with Stutley (2010), with the exception of geological risk which includes tsunamis. Another important classification of risk in agriculture which the writer views as pertinent to the cashew crop sector is that of Roberts (2005) who in his assessment of crop insurance schemes in developing countries categorises risk into production risk, natural resource risk, financial risks, marketing and price risk. His typology of production risk includes: adverse climate conditions, drought, excess rain, flood, windstorm, lightening, pest and disease attacks, frost, hail, sunburn. Natural resource risk included adverse soil conditions such as salinity, erosion of top soil, loss of soil nutrient, deterioration in water quality due to pollution of the water table as well as lack of water from irrigation source.

Roberts (2003) added that these risks can be market-related risk and non- market related risks. Market –related risk, he argued, pertains to transactions which include availability and price of inputs, price of farm produce, availability of markets for farm produce, slump price and gross margin of agricultural enterprises. Roberts (2005) explained market related risk by iterating that:

> *With regards to prices, it is particularly the short-term volatility in prices for both input and output, which is of most concern to the average farmer, as he is rarely in a position to make quick changes to his farm enterprise mix or to his farming system. The possibility of being denied market access for products when there evidence of a serious disease or a contamination situation leading to health risk apply to both domestic and export markets, and also creation of trade barrier for political reasons(.Roberts, 2005:9and 10).*

Non-Market related risk, Roberts (2003) argued, is man- made and involves human interventions directly or indirectly. According to Roberts (2005), identifying areas of risk common to a particular crop predisposes it to the choice of risk management strategy including agricultural insurance. Adding to this, Arias, and Covarrubias (2006) argued that some production and price (or market) risks may be beyond the management of the farmer. It is against this backdrop that Roberts (2005) contended that production risks and price risks can be mitigated through crop– revenue insurance under normal supply/demand conditions. Leaning on Muewissen and Molnar's (2010) assessment of Australian agricultural insurance markets, risk was classified into genetic factors, environmental factors, crop management factors, biological factors as well as social factors which involve market collapse, government ruling, input shortages, market disruption, rising input cost, product losses, farm family accidents and illness. The World Bank (2000) as well as Holzmann and Jogensen's (2001) view risk classification in terms of Micro or Idiosyncratic risk, that affect individual farmers; Meso which connotes risk affecting the whole community, and Macro or systemic risk affecting the whole region or country. According to Skees *et al*. (1997) and Ibara (2003), idiosyncratic risk affects areas, sectors or individuals heterogeneously, meaning that individuals are affected differently. They posit that systemic, also referred to as systematic, covariate contangion or undiversifiable risks affect an area, sectors or aggregate group of people homogeneously. Hardwood *et al.* (1999) concludes that idiosyncratic risk affects households' welfare, than systemic risk since personal hazards such as illness of a household head or a farm operator may have adverse effect on a particular farm. They, however, concluded that the frequency and scale of risk may change as a result of broader consequence of broader long run changes in the farming environment, such as desertification, deforestation, climate change, and agricultural trade liberalization among others.

Ben- Houassa (2010) in his study of the cocoa subsector in Cote D'Ivoire establishes that risks in the cocoa sector are of two types: namely business risk which is income variations and financial risk which to him are technical, market and social risks which may results from variation in yield due to bad weather, disease or climatological events, derived from expected price, in addition to social factors such as strikes, sudden death, accidents, war etc. He found a negative relationship between risk factors and profitability, adding that enterprise profitability depends on yield, price of output and price of inputs. Similarly, in the Cashew subsector, Osei-Tutu (2012) also observed high incidence of pest infestations, bush fires, difficulties in accessing farm inputs and lack of good planting materials which are biological, social and institutional risk factors in the Brong Ahafo Region of Ghana. According to GIZ (2010) as cited by Osei-Tutu, the financial institutions are reluctant to give loans to the cashew crop farmer because of the risk associated with pest and diseases, drought, bushfires and lack of pricing policy for cashew nuts. Though various models such as pure micro cedit services such as small initial loans, which is increased after successful payment, joint liability loans have been used in most countries, the default in payment and lack of collaterals is making financiers in African countries such as Ethiopia, Kenya and Uganda applying the value chain financing model as a risk mitigation measure (EAFF, 2013; Onumah, 2011). Moschini and Henessy's (2000) framework for classification was in terms of government policies such as taxes, exchange rates and interest rates variability as risk that affect agricultural investments. Their perspective connotes institutional, and financial risk.

Wenner (2005), analyzing the Caribbean and Latin America agricultural subsector, contended that risk in agriculture can result in a catastrophe which can wipe away the entire investment of the farmer. However, Atkins and Bates (2010) perceived risk to be static or dynamic, their perspective of risk classification has also been supported by Wenner and Aris (2003) who also viewed risk as widespread or localised. However, Wenner (2005) on his part views risk to be either correlated or independent. It must be noted however that for risk to result in a catastrophe, it depends on its frequency and severity (MITC, 2008; Dorfman 2006).

MITC (2008) classified risk into pure risk and speculative risk. The institution stresses that pure risk has no chance of gain but a chance of breakeven as well as an element of loss. Speculative risk, it opined, has an element of gain, a chance of loss and a chance of break even, making speculative risk a subject of investment, and pure risk a subject of insurance. Based on literature including the works of Bracea and Cristea (2008); Kay *et al*., (2008)) and Anthony (2010) and the report of the working group on risk management in agriculture for the Indian Planning Commission, risk in cashew production may include but is not restricted to: Production risk, price risk, casualty risk, technological risk, personal risk, institutional risk, labour risk, market risk, legal and social risks.

Other studies on agricultural risk have identified health risk as one of the important risk attributes (Harrington and Niehaus, 2004). It is worth noting that identification of risk sources in cashew production is a precursor to risk management decisions (Stutley, 2010). To mitigate the effect of these risks in cashew production and marketing would require the blending of financial and technical decisions for both manmade and even non manmade risk which may be systematic and non-diversifiable requiring the use of agricultural insurance to address non manmade risk.

2.4. Risk Management in Agriculture

Farmers' risk attitude informs the choice of the risk management strategy. In general, there are three types of risk attitudes exhibited by producers including those in the cashew enterprise, as identified by Akins and Bates (2010), MITC (2008); Harrington and Niehaus (2004). These are the risk lovers, risk neutral and the risk-averse. Stutley (2010) maintained that the extent to which agricultural producers are risk-averse plays a key role in their management decisions, although most economic models and theories assume that these farmers are risk-averse. According to Mahaul and Stutley (2010), it is common to mitigate risk through technical risk management approaches such as coping and financial risk management approaches such as insurance. However, Binswanger (1980) noted in his study that wealthier, better educated and more progressive farmers tend to be less risk-averse. Goodwin (2001) conducted a survey of 593 US farmers and reported that the farmers were either risk neutral or even risk-preferring.

It appears Arrow-Pratt (1969) view risk preferers as having a higher risk appetite, while risk averters will either embark on risk control or risk transfer resulting in the purchase of agricultural insurance, while risk neutral cashew farmers will avoid their risk.

Ben-Houassa (2010) identified two types of risk management techniques applicable to agriculture in Cote d'Ivoire as traditional methods and modern methods. Meuwissen and Molnar (2010) distinguished between two types of traditional methods in Australia as on-farm and offfarm methods. They posited that on-farm methods include mixed cropping, location choice, farm fragmentation, choice of crops, and product flexibility. They further contended that product flexibility is planting products that have multiple uses. Asset flexibility is done by purchasing farm assets that have multiple usage and market flexibility is by planting crops that can be sold on different markets. They added crop diversification and mulching as other on-farm traditional methods of risk management. Key *et al.* (2008) added diversification and share lease as an onfarm risk management method in addition to stable enterprise techniques such as irrigation.

With regard to the off- farm risk and non-farm risk management methods, these farmers embark on off-farm investment, off-farm employment, precautionary savings, mutual funds contributions and social networks, embarking on asset flexibility by purchasing assets that have multiple use, market flexibility and coast flexibility among others (Muewissen and Molnar; 2010, Ben Houssa, 2010). Key *et al.* (2008) proposed safety precautions, contract sales, spreading sales, hedging, and the use of credit and liquid resources, in addition to the utilization of self-liquidating loans to manage off farm risks.

In Ghana, however, traditional risk management methods are well-utilised by cashew crop farmers who currently have no agricultural insurance schemes and other modern methods of risk management. Though these methods of self-insurance do not present a measure of poverty alleviation, they reinforce them (Ben-Houassa, 2010).

Wenner (2005) observed that lack of modern methods like agricultural insurance products can cause a rural small-holder to fall into a poverty trap, a phenomenon in Caribbean and Latin America whereby a small-holder loses his/her investment through catastrophe and is not able to recover from the income shocks and therefore passes on the poverty on to his/her generations. He contended that lack of modern risk methods in agriculture has micro, meso and macro effects on the small-holder farmer which comes in the reduction of food intake by their households, and may also liquidate their asset, share foodstuff with other households, they may also remove their children from school and give up farming (IFAD, 2010; Wenner, 2005).

Wenner (2005) concludes that the meso effect comes in the form of debt forgiveness by financial institutions which shrink their capital base and come out with tight monetary policies on the agricultural enterprise. He identified the macro-effects as adhoc-government programmes on disaster management which have adverse impact on government expenditure and planned activities. To Perline (2013), the choice of a risk management technique depends on its probability of occurrence as well as its impact which can be captured in a risk management matrix as shown in Table 2.1.

Table 2.1 Risk Management Matrix

Probabilities

Impact	High	Moderate	Low
Total Loss	Avoid	Avoid	Manage/Transfer
Moderate Loss	Avoid	Manage/ Transfer	Manage/Transfer
Minor Loss	Transfer /Manage	Manage/ Transfer	Accept

Source: Perline, 2013

He maintains that if the probability of occurrence is high and would lead to a total loss, then the farmer should avoid that risk by not investing, however, if the probability of the farmer losing his or her investment is low, moderate or minor losses, then he or she can accept, manage or transfer the risk. From these strategies, the concept of risk transfer fall within the purview of insurance and other related modern risk management techniques.

Rutten and Youssef (2007), on the other side of the debate, identified modern risk management tools as hedging, options, forward contracts, contract farming while Nehme (2007: 9); Wenner and Arias (2003) added catastrophic bonds and insurance. They, however, noted that the usage of modern methods including agricultural insurance as a means of managing risk is higher in the developed countries and the computed usage of some countries in percentages is shown as:
USA46%, CANADA-55%, SPAIN -43% and Japan 79%.

2.5 The Concept of Agricultural Insurance

Agricultural Insurance started in France when livestock farmers formed mutual livestock insurance companies and Europeans also formed crop hail mutual insurance companies and migrants transferred this concept of insurance to USA, Canada and Argentina in the late 19th century (Stutley, 2010). Agricultural insurance plays a role of indemnification of risk-averse farmers who might be adversely affected by natural probabilistic phenomenon. According to Agricultural Insurance Company of India (2008), agricultural Insurance is a means of protecting the agriculturist against income shocks due to uncertainties that may arise from a named peril or all unforeseen perils beyond their control. Raju and Chand (2008), maintain that agricultural insurance is an important mechanism to effectively address production and income risks resulting from various natural and man-made events. The weakness in this definition is the cover for manmade risk which insurers normally term as wilful act of the insured. Mahul and Stutley (2010) on their part contend that agricultural insurance is part of a comprehensive risk management framework that can contribute to the modernization of agriculture. Their definition highlights the importance of agric insurance as one of the risk management tools. To Livate (2009), Agricultural insurance offers financial protection or cover for agricultural producers and others in the agricultural value chain against loss of their crops due to natural disasters or from climatic related perils such as drought, flood, excess rainfall or the loss of revenue due to decline in prices of agricultural commodities. Leaning on these concepts, it can be deduced that agricultural insurance is one of the morden risk management tools that can mitigate the effects of extreme income shocks in the agricultural sector. It is, therefore, a financial tool that can stabilize their farm income and investment, guard against losses due to natural hazards when they initiate risky production activities.

It is in the light of this that Roberts (2005) succinctly opined that agricultural insurance should cover losses arising out from perils beyond the control of farmers- a phenomenon Wenner (2005) referred to as residual risk. From the demand side, it offers a risk-averse farmer a mechanism to transfer risk by paying premiums in the good state of nature and also receive money in the bad state of nature (Agyire Tettey, 2010; Baidoo and Buss, 2011). From the foregoing, it can be noted that the availability and accessibility of insurance products will positively influence demand. In analysing the philosophical underpinnings of the development and promotion of agricultural insurance from a supplier's perspective, Ahsan *et al.* (1982) reports that the philosophy of insurance market is based on the law of large numbers where risks are pooled and this affords individual farmers or farming households the possibility of shifting or sharing their risks with others so as to engage in risky farming activities which they would not undertake without insurance.

Wenner (2005) reinforced this assertion of this law when he opined that agricultural insurance is the actual model to calculate coverage, underwrite risk and determine risk premium based on the premise that: the more uncorrelated risks are added to a portfolio, the lower the variance of the outcome for the entire portfolio. Similarly, agricultural insurance for cashew crop farmers would also be a risk transfer mechanism for indemnifying risk averse cashew crop farmers and also offer them the possibility of shifting risk to enable them engage in risky investment regarding their objective and production functions (Ansan *et al.*, 1982). In view of the aforesaid, it stands to reason that the overall idea behind agricultural insurance is risk pooling which involves the transfer of risk faced by many a large number of farmer to contribute their premiums to a common fund for covering and financing individual farmer's losses when they occur (Bielza *et.al*, 2011).

It must also be noted that insurance does cover wilful act of the insured but can only mitigate the effect of risk and perils that are beyond the control of the insured which in this case is the cashew crop farmer. From the foregoing, agricultural insurance has a strong potential to address income shock arising out of accidental and unforeseen losses due to key perils such as fire, high temperature, excess rainfall , uncontrollable pest and diseases to prevent farmers from falling into what Wenner (2005); Hazell *et. al*, (2010) and Global Ag Risk (2010) describe as the povertytrap.

It is worth stressing that up to 2011, Ghana had no formal agricultural insurance schemes that offered actuarially fair insurance products to protect farmers' investments against their residual risks.

It was in 2010 that German International Cooperation (GIZ) project known as "*Innovative Insurance Products for the Adaptation to Climate Change*" (IIPACC) in collaboration with Ghana Insurers Association established the Ghana Agricultural Insurance Pool to underwrite agricultural risk. Currently, the pool has index insurance products for maize and also front indemnity based products such a Multiperil Crop Insurance (MPCI) and aggregate loss of investment for largescale farmers with good management techniques, with time series data on annual production history and sales data to Swiss Re, but do not currently have insurance products for Cashew subsector.

2.6. Theoretical Frame work for Agricultural Insurance Development

Agricultural insurance development hinges on theoretical frameworks based on behavioural models and capital formation models (Nyman, 2001; Schneider; 2004; Ashok *et. al*, 2003). Among them is the **Human Capital theory** which is anchored on farm and production characteristics in which Nelson *et al.*, (1966) used level of education as a proxy for human capital indicator to reflect a farmer's ability to adopt innovative risk management strategies such as the use of agricultural insurance. The human capital theory was used in this study to examine the effect of education on the choice of modelled hypothetical agricultural insurance product options, based on various agricultural insurance philosophies. **Consumer theory,** on the other hand, postulates that if consumers have information, they will maximize their utility in their consumption of various products, given their relative prices and income which will influence the quantity of products they will purchase. This theory is good at explaining insurance penetration through sensitization and awerenss creation. Consequently, this theory was utilized in this by presenting various hypothetical products with different level of attributes and prices to provide information to respondents in order to make informed choices.

Another theory reviewed was the **State Dependent Utility theory** which indicates that consumers' utility levels and tastes are influenced by their state, which is determined by their socio-economic characteristics, making consumers have different risk attitudes and this could influence their preference for insurance products and also influence their purchase decision in terms of coverage depending on the expected pay offs. This theory was utilized by Manning and Marguis (1996) to study how individuals select products from hypothetical insurance products options offered at different rates with different pay offs. This study also made use of this theory to assess how sociodemographic characteristics influence cashew crop farmers' willingness to pay as well as their heterogeneous preference for hypothetical agricultural insurance product options under different philosophies in a stated preference choice experiment situation.

Prospect theory assumes that choice is about prospects and gains or losses, and does not tolerate uncertainty. In this regard, individuals are assumed to have thresholds or benchmarks for every expected gain or loss dubbed their risk appetite. Therefore the perception of gain which an individual envisages influences his/her choice of risk management strategy including the purchase of agricultural insurance. This theory which views individuals as risk preferers was also utilized in assessing cashew crop farmers' risk attitude and their insurance preference. The theory views cashew farmers as rationalizers who will first assess their wealth and eventually deviate from it in relation to the insurance premium they are supposed to pay (Kanemanann and Tversky, 1979).

Cumulative prospect theory, on the other hand, combines prospect theory with state dependent theory to suggest that individuals assign weights to probability of occurrence of an event, and then make choice between prospects by weighing the probabilities of losses and gains. (Kahnemann and Tversky, 1979) – here, individuals insure because of the higher weight assigned to their insured events. **The endowment effect theory** also assumes that decisionmaking is affected by individual risk aversion particularly about innovations. It describes how individuals perceive greater cost in giving up something to acquire benefits which come with something new.The theory assumes that individuals would rather stay with their old technologies if they do not know the benefits of new technologies. Under this theory, farmers or individuals who are poor will only insure if the perceived benefits of insurance are higher.

The status quo bias theory is similar to the endowment effect theory which suggests that consumers prefer the status quo they are familiar with instead of adopting new risk management techniques such as agricultural insurance to manage risk. The theory assumes that individuals consider new approaches or technologies as detrimental and old techniques as beneficial. Consequently, they tend to stay with the status quo if there are more alternatives to choose from. This theory was not utilized in this study because it is in stark contrast to agricultural insurance development and its adoption. It also defied the choice experiment approach this study utilized in gauging out the heterogeneous preference of agricultural insurance products. Though this theory was not utilized in this study, it highlighted the importance of information in consumer behaviour towards the purchase of agricultural insurance products (Kahnemann *et. al*, 1991).

Regret and disappointment theory is based on assumption that individuals are risk averse and conservative in their preferences. The theory suggests that they try to avoid regret and disappointment and do not just consider the eventual outcome, as suggested by the expected utility theory. Here, individuals factor their feeling of regret in case their decision goes wrong and the outcome does not meet their expectations. Consequently, they may prefer to remain uninsured, because they might regret, if they do not benefit from insurance contracts.

The expected utility theory posits that demand for insurance reflects individual risk aversion and that demand for insurance is a choice between an uncertain loss that occurs with a probability like paying a premium. However, the theory is silent about the impact of income on insurance decisions, making **the random utility theory** developed by Lancaster (1966) which views individuals as rationalizers choosing from product options that maximize their utilities subject to their income constraints more appropriate theoretical framework for this study. This is discussed in detail with empirical review of factors influencing farmers' willingness to pay for agricultural insurance products.

Another theoretical model reviewed and seen as pertinent to this study was the **traditional insurance theory** which stipulates that risk-averse cashew farmers will purchase insurance when offered at actuarially fair premiums (Brau, Merrill and Stalling (nd). To them, demand for agric insurance schemes would be influenced by transaction cost which should be made reasonable to cover residual risks, which are stochastic, while unpredictable and insurers must be of certain minimum solvency requirement, capital adequacy, technical quality, and insurance contracts must be enforceable. They maintained that insurers should charge a loading cost that will cover all costs, including marketing and distribution expense, administration cost, general overheads for building technical reserves and also load the premium for profit, making sure that in spite of these loadings, the premiums are actuarially fair as well as affordable in order for the policy to be attractive. This theory was utilized in this study to estimate insurance premium and also assumed that cashew farmers are risk averse and will purchase insurance to cover their residual risk when the risk premium is actuarially fair (Arrow Pratt, 1970; Korrir, 2011).

2.7. Agricultural Insurance Development Frameworks

According to Clark (2012), agricultural insurance should be linked to the developmental needs of a country, and should be placed in a broader context and priority areas like development of road networks to farming communities, improvement in irrigation systems and must viewed as a macroeconomic policy to ensure price stability and other interventions that would enable farmers to stay and not exit because of lack of equity. It is also critical that the various paradigms of the implementation process need to be assessed for sustainability of agricultural insurance schemes. Some approaches identified in literature include what Herbold (2012) termed as system approach and the product approach which are discussed below:

2.7.1 The System Approach

The system approach refers to erecting the necessary structures, in terms of appropriate products, channel, supply models, instructional framework, legal requirement and enforcement and monitoring system for implementation of agricultural schemes; whereas product approach looks at product development only. In making a case for the systems approach, Herbold (2012) was lyrical in these words:

> *It is misleading to look for the solution at the product level: the problems of appropriate risk management tools in agriculture cannot be solved with an insurance product alone and this is why none of the proposals of index cover has resolved the problem in developing countries. The problem has not got to do with the type but lack of implementing the adequate framework that any insurance product needs (Herbold 2012:15*)

He identified the elements of a system approach as follows: Institutional framework in the form of public –private partnership (PPP) made up of the government, the farmers, the insurance and reinsurance industry and the financial sector with the state setting up the legal framework and cofinancing of premiums, catastrophic losses and efficient marketing channels in order to market the insurance in a cost effective manner to achieve a reasonable outreach where production credit is linked with agricultural insurance.

2.7.2 The Product Approach

In the product approach, the marketing philosophy is based on the product concept in which organisations spend more time on product development (Kotler and Keller, 2011).The product approach focuses much on product development at micro, meso and macro levels by only seeking to develop appropriate insurance products that the insurers consider as appropriate to individuals risk management solution. McCord (2012) noted that a product that is successful in one market may not be successful in another hence insurance products should be developed taking into consideration the production characteristics and needs of the clients in the agricultural sector of that country, more especially the financiers of the production process (Herbold, 2012). This is why the author is positive that providers of agricultural insurance must understand the farmers' production cycle, farmer turnover, immutable dynamics in the production area, while looking at production-based solutions in developing products to cover their residual risks. They must look at the storage based and post-harvest loss based solution in order to reduce hunger and poverty as well as the collection of premium since it has been proven that while some farmers can pay in cash, others prefer to pay in kind and others both depending on their income and wealth and their attitude towards risk.McCord (2012) added that insurance products aimed at targeting rural households should be S.U.A.V.E. which means it should be Simple, Understood, Appropriate, Valuable and Efficient and must be pilot tested before it is rolled out.

It is in this regard that McCord (2012) came out with a more holistic approach that addresses issues both from the demand and supply sides and takes into consideration institutional assessment and market research as well as continuous review of products. He makes it explicit that there is the need for institutions to address the short comings and also undertake their commitment to product development by embarking on market research that encapsulate demand, supply, delivery channels, regulations and educational level of potential clients in tandem with the human capital theory , in order to develop a successful product. Again the author thinks assessment should be made at the micro which deals with the farmers, meso which looks at aggregators and macro whick looks at government or institutional level. In Ghana, stakeholders of GAIP with the support of GIA and NIC are developing agricultural insurance system based on Public-Private Partnership (PPP) approach.

2.8. Agricultural Insurance Development Philosophies and strategies

Agricultural insurance products take their origin from the sources of risk which have been dealt with earlier on. After the review of the works of Meuwissen and Molnar (2010); Mahul and Stutley, (2010) in addition to an MPCI seminar held in Ghana with Lovemore Forichi of SwissRe in July, 2013, four main strategies and philosophies were identified for developing agricultural insurance schemes namely: parametric/ index approach, Traditional or conventional known as the indemnity approach ,the simulation approach which is a combination of the indemnity and parametric or index approach as well as benchmarking approach, in which benchmark farms are selected from farming communities with homogeneous characteristics and whatever happens to the benchmark farm is deemed to have happened to the rest of the farms.

While each philosophy or strategy is applicable to particular sources of insurable risk which Nickel *et al*.(1997) and Bittel *et al*.(1989) argued must not be fundamental of doing business, and the potential loss must be measurable and purely accidental, researchers and insurance practitioners are united in their thinking that systemic risk is normally dealt with by index and benchmarking insurance products; while an idiosyncratic risk should be dealt with through indeminity named peril and multiperil insurance, whereas yield and price risk are taken care of by revenue insurance (Roberts, 2003; Swiss-Re, 2013). Systemic and idiosyncratic risk occurring together should be handled by simulation insurance. According to Meuwissen and Molnar (2010), each approach or methods of designing agricultural insurance products have their pros and cons. These approaches are discussed as follows:

2.8.1 Index or Parametric Approach

Index insurance should be seen as a derivative and not a traditional insurance (Clark, 2012). According to Herbold (2012), Index or parametric approaches are of two folds: the weather index and the area yield index. He added that the indices are based on an agreed threshold of meteorological indices such as rainfall or precipitation, temperature, humidity or wind speed measured from weather stations or satellite stations.In index approach, product design, payouts are based on a pre-determined index or triggers rather than farm-level losses (World Bank, 2007), which are easy to identify and measure. This approach uses indices such as Temperature, Wind speed, Rainfall, Sunshine, Humidity as proxy for yields to determine whether a farmer has experienced a loss in yield or not; here, the basic assumption is that there is a correlation between the chosen index and expected yield, if the right agronomic and silviculture practises are ensured by the farmer.

Jones *et al*. (2010) provides a framework for the estimation using crop water balance which in rainfall/weather index programmes based on water use or evapotranspiration using the FAO, 1977 computation as:

$$ET = P - (R + D) - \Delta S \qquad (2.4)$$

Where ET is the evapotranspiration, P is rainfall, $R + D$ is runoff and drainage and ΔS is soil water storage. The quantity $P - (R + D)$ is called the effective rainfall which correlates better with crop yields than total rainfall alone.

He added that for accurate prediction of weather effects on crop yields the full water balance, evapotranspiration must be calculated, and this requires knowledge of soil texture, soil depth, water holding capacity, environmental temperature, among others since rainfall less than 2.5mm will evaporate before being used by a plant (GAIP, 2012). He stresses that the potential monthly evapotranspiration or water demand can be determined following Thornthwaite (1948) and the crop yield-water response of Doorenbos and Kasam (1979) to estimate actual yields and yield loss:

$$\frac{Y_m - Y_a}{Y_m} = K_y\left(1 - \frac{ET_a}{ET_p}\right) \qquad (2.5)$$

□ □ □□□ □ ____ □□□□ □

Where Y_m and Y_a are the maximum (potential) and actual yields respectively (t/ha), and ET_p and ET_a are the potential and actual evapotranspiration, respectively and k_y is the yield response factor. He concluded that rainfall in excess of the soils water holding capacity will be assumed to runoff or drain below the root zone to recharge the underground water.

Two main forms of index products are available at Ghana Agricultural Insurance Pool (GAIP). The first one is weather index which uses rainfall estimates measured by the Ghana Meteorological Agency (G.Met) at selected weather stations or satellite stations as the basis for determining payout due to drought or excess rainfall for an insured farm.Ghana Meteorological Agency (G.Met) operates 277 weather stations from synoptic stations to simple rainfall stations but quite a number of them are not suitable for the insurance product designs and rating and most of them are concentrated in the southern part of the country but most of Ghana's weather stations are not automated (Mathias, 2012).

Table 2.2 shows G.Met's selected weather stations for pricing index insurance products in Ghana.

Table 2.2: G.Met Selected weather stations for Index insurance

	Northern	**Upper East Region**	**Upper West**	**Brong-Ahafo**	**Ashanti**	**Eastern Region Region Region region Region**
Towns for selected weather stations	Tamale Pong Tamale Walewale	Navorongo Bolgatanga Bawku	Wa Funsi Tumu	Sunyani Asunafo West Atebubu	Ejura Ashanti Mampong Effiduase	Forifori Donkorkrom Kwahu-Tafo
	Yendi	Garu	Babile	Techiman	-	Asesewa
	Damongo	Zuarungu	-	Kintampo	-	Asaman Kese
	Bole	Vea	-	Nkoranza	-	Kede
-	-	-		Jaman North	-	Akim Oda
-	-	-		Dormaa	-	
				Ahenkro		Agogo
-	-	-		Wenchi	-	-

	-	-	-	Prang	-	-
Total	6	6	4	10	4	8

Source: Technical Management Unit of GAIP, 2012

IFAD (2011) submits that a selected weather station for setting triggers for pricing index insurance products must have twenty (20) years historical data with less than 3% data gaps, though these gaps if minimal can be filled by interpolation. In Ghana, however, GAIP's basis for selecting a weather station for an index insurance contract is for the station to have a thirty (30) years historical data with less than 5% data gaps [1]. It is important to note that the Brong -Ahafo Region has the highest number of selected weather stations in the country, making it a suitable region for developing index insurance schemes.

To participate in GAIP's index insurance, a farmer's field needs to be within 20 km radius of a GAIP's selected weather station since the technical Management Unit of GAIP is strict on data integrity of weather station and rainfall recording procedure in order to minimize the possibility of data tampering at the weather stations. The mode of transmission of weather is as shown in Figure 2.1

[1] GAIP selected weather station is the one with 30 years historic data and less than 5% gap

Figure 2.1 Transmission Process of Rainfall Data

Source: GAIP, 2013

The second is the Area Yield Index (AYII) product which insures farms and triggers are set based on yield estimates from district average yield, estimated from crop-cut exercise of Statistics and Research Information Directorate (SRID) of Minisry of Food and Agriculture (MoFA). This product is available for farms with similar characteristics and being piloted in districts in the Upper

West region of Ghana (GAIP, 2013). Initially the crop cut exercise in Ghana was based on five plots, and there was a possibility of compromising the integrity of data through selectivity bias which will adversely affect MoFA food security planning as well as insurance payouts (GAIP, 2012). This was the impetus for which IPACC-GIZ empowered SRID to increase the fields for crop cut exercise from 5 to 32[1].

This was done to ensure data integrity, since most farmers do not keep records of their operations. In the developed countries, yield index triggers are set based on both crop cuts and farmers time series data between 4-10 years data from a farmer's Annual Production History (APH). Other information required according toTMU(2012) are information on crop varieties, planting periods, management practises, risk profiles and historical recollection of the impact of perils as well as the most sensitive phases in crop life are essential in designing weather index contracts. They succinctly opined that index contracts must be hinged on the relationship between the variables and the losses. Consequently, insurers must select indices that are most effective in providing payouts. Most index products normally have three to four phases depending on the crop to be insured, however, a three phase product is sold to the maize, sorghum and soya farmers in Ghana. The number of phases for the Drought Index Insurance product (DII) covers the Germination, Growth and flowering phases.

In the index products, dry day triggers assigned to each phase of the crop are based on research conducted on the variety of crops and their water requirement, the type of soils in an area, their water holding capacities in addition to the agronomic practises of farmers in a particular locality. For instance, in a particular area, the trigger may be 13 consecutive days for both the germination and growth phase and less than 125mm of rainfall during the flowering phase whilst in other areas; the triggers may be 17consecutive dry days for the germination and growth phase. According to Herbold (2012); Muewissen and Molnar(2010), the merits of an index product stems from the fact that it is good at addressing covariate or systemic risk and it also has an added advantage of addressing the problem of adverse selection, information asymmetry and moral hazards. It is good at fostering trust through transparency (utmost good faith) for both the insurer and insured, since pay-out is based on the index which is measured by an external agency as part of their regular duties and both the insured and the insurer cannot tamper with the data derived from the index (Miranda and Farrin, 2012). There is also reduction in both operational and transaction cost, through limited individual underwriting and claims settlement costs which are relatively lower since no field loss adjustors and on call assessors are required (IFAD, 2011). It must be noted that index insurance claims or pay-outs are not reported but triggered (Ibid). Table 2.3 below shows prototype for designing index insurance contracts, including the pay-out parameters developed by IFAD (2011). **Table2.3: Parameters for designing index insurance contracts**

Contract parameter	Options

[1] The author and his team audited SRID's crop-cut exercise in the Jirapa, Sisale west and Wa districts, recommend that farmers be insured for yield below 70% of the area yield.

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 which was pilot-tested by the TMU of GAIP in Ghana and was found to be problematic as it was not economically sustainable.
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: adapted from IFAD, 2011 with slight modification by the author.

2.8.1.1 Operational and Technical Challenges of the Index or Parametric Approach Though the problem of adverse selection, moral hazards and information asymmetry comprise the main challenge of indemnity contracts, and literature supports the idea that index insurance are affordable, Herbold (2012) and Hazell *et al.* (2010) have a contrary view. To them, a closer look at index insurance programme reveals that the development costs are rather high, as the product design process is complex and the availability and reliability of data is limited and very expensive to launch which compels international donor agencies to fund the research and purchase weather stations for product designs. Another challenge associated with index insurance is the issue of correlation as to whether there exists some degree of correlation between the data gathered and the agreed triggers with yields. In most cases, the correlation is around 60% which may lead to product basis risk that can negatively impact the success of the program (Skees, 2008).

2.8.1.2 Basis Risk as an Operational Challenge in Index Approach

Basis risk is the potential mismatch between the loss experienced by the farmer and the payout triggered by the insurer in index insurance contracts (GIZ, 2011; World Bank, 2010). Basis risk is further explained in these words:

> *It could result in farmer experiencing yield loss, but not receiving payout or a payout being triggered without any loss being experienced. Hence index insurance works best where losses are homogeneous and the defined perils are highly correlated with the indexed peril* (IFAD, 2011:20)

Basis risk poses a threat to insurance marketing, as there is a possibility of the insurer experiencing reputation risk. Basis risk is influenced by the degree of covariate risk in a geographical area and it is lower where there are no micro climates, or different management practices or crop varieties to distort the impact of climatic risks (World Bank, 2010). Following the works of IFAD (2011) as well as Miranda and Vendnov (2001), basis risk can be categorised as follows:

1. **Product basis risk:** a situation where there is no clear-cut relationship between loss and the index peril because triggers may be set for the same species but are different varieties with different water requirements and are planted on soils with different water holding capacities.

2. **Temporal basis risk:** it is an inter-annual variation in seasonal crop phases, meaning that the insurance phases are not temporally aligned with the intended crop growth stages as a result of lack of technical expertise for new products in agro-metrology (IFAD, 2011).

3. **Crop-specific basis risk:** reflects variations in factors such as opportune planting times, the length of the growing season, and the sensitivity to temperature and moisture across different crops, thus affecting production (Miranda and Vedenov 2001).

4. **Spatial basis risk** is a situation where there is location variation in the peril occurrence, for example, rainfall deficit or dry spells, within the area surrounding the weather stations. Depending on the climatology as well as the topography of an area, spatial basis risk may occur and may not be captured by the weather station (Hellmuth*et al*., 2009). Basis risk was also experienced in Ghana in October, 2012 and October 2013 when the TMU of GAIP embarked on a claims notification exercise; farmers in Yinduri in the Upper East region. Farmers experienced floods instead of drought and wished they had excess rainfall index insurance instead of drought index insurance. Moreover, their farm management techniques were inadequate since the drought index requires that they have a sowing window or a start date when they can sow their crops. However, they experienced delays since there were not enough tractors to plough their field for them before getting to their sowing window period. Also in some communities, the weather stations were found outside the farm area, rather they were found in the towns causing farmers to experience spatial basis risk in the Manga Bawku district;

> *In Azum Sapeliga, a community 7 miles away from the Manga Bawku weather station, farmers recorded 17 days of dry spell at the crop germination phase but this was not captured by the weather station. Floods were a problem both at the germination and flowering phases of the crop on some farms thus resulting in yield loss. Aside these two, farmers received fertilizers for the crop late. Some planted two seed varieties of which one variety was good and the other bad by their estimation, (GAIP, 2012).*

This affirms the fact that that spatial and product basis risk is a challenge experienced by most index programmes and many attempt have been made to reduce basis risk by different researchers, notable among them is Carter (2012) and Mathias (2012).

To overcome this difficulty, the Pool has the alternative to price weather index insurance product with satellite based data for weather measurements, but this also results in challenges in terms of complexity and transparency, making it difficult to explain the product to the ordinary farmer during the product marketing and sensitization sessions (Burke *et al.*, 2010).

Satellite data cannot be seen by the farmer, unlike the weather station, referred to as truth tellers by farmers in Kenya (Sygenta, 2012). To resolve this, Carter (2012) argued that area yield index insurance offer comprehensive coverage and would be very useful in reducing basis risk. To deal with the challenge of basis risk requires a well- designed contract to reduce basis risk (Carter, 2012). A presentation by micro insurance catastrophic risk organisation held in Tanzania in (2012) brought to the fore that the index approach can be designed to allow policy holders to buy back basis risk as extensions. But the author also thinks that there should be distinctions in the extensions which may permit clients to buy extensions like dry options cover and extra dry options, wet options as well as product basis risk options.

Carter (2012) also proposed that village-level area yield index may help reduce basis risk in index insurance contract in semi-arid environments in West Africa; however, Mathias (2012) proposed the use of satellite methodology and good agronomic practises to reduce product and spatial basis risk. This was re-echoed by Herbold (2012) who amplified the application of site specific and sustainable production methods and techniques to minimize production risk. According to Mathias (2012), selected weather stations are not enough, hence farming communities that needed to access loans may not participate in the index insurance program. In this regard, TMU of GAIP (2012) and Carter (2012) proposed the use of high-density weather stations which in their view provide useful benchmarks for comparison between satellite data; nonetheless it is not economically feasible in practise even though the technical Management Unit (TMU) of GAIP suggest that the twenty kilometre radius distance of G.Met Weather stations should be shrunk to 15 km.

2.8.1.3. Responding to Basis Risk through Satellite Methodology

Satellite methodology is an option to overcome spatial basis risk.This involves the application of remote sensing technique to acquire satellite data either from a Geostationary Satellites (GEO) or Low-earth orbit satellite (LEO), where satellites supply raw data on pixel by pixel basis. Satellite methodology requires the coordinates of the participating community in the index insurance contract. Mathias (2012) examined the suitability of various satellite data in order to determine its suitability for designing and pricing index insurance products in order to eliminate spatial and product basis risk in the Kpong Tamale district of Northern Ghana.

Mathias (2012) reported that particular attention should be paid to agronomic practices like the date of planting, the usage of fertilizer, weed control and pesticide application. He recommended that insurers should consider the following:

- Insure farmers with similar management and agronomic practices.

He contended that GAIP should:

> *……..Homogenize the farming practices of the policyholders (use of fertilizer, seeds, weed control) in order to avoid losses related to other factors than rainfall. This can be achieved by insuring farmer unions or commercial farmers only who manage their plots in a similar way. Alternatively, certain farming commitments (e.g. minimum amount of fertilizer) for all policyholders have to be set up. But this approach would certainly be difficult to keep track of.* (Mathias, 2012:10)

- Secondly, implement a flexible contract period adjusted to the date of planting

> *….. Implementation of a flexible start date is essential. A fixed period for planting is, subject to the seasonal rainfall development, counterproductive because the start of the rainy season is shifting from year to year, especially in the course of the enduring climate change. Moreover, farmers are in many cases not able to start planting on all their plots in the given time span, (Mathias, 2012:10).*

However, the author thinks a flexible start date could breach the contra-profrentem rule in insurance contracts. Consequently the TMU should align their products with the thresholds to the plants water requirements. They may have dynamic sowing windows for contract inception.

2.8.2. The Conventional Indemnity Approach

This insurance philosophy, according to the World Bank (2007), has been the first agricultural insurance approach offered in many countries while index contracts which are derivatives are used for managing correlated, covariate or systemic risk. Indemnity approach is good for providing cover for a farmer's idiosyncratic risk that is peculiar to individual households or farms. In this approach, farmers' important sources of risk that are residual and unique to an individual household form the basis of the contract (Wenner, 2005). Indemnity insurance product has some advantages over the index product in that there is an on-farm measurement which can establish actual losses on the farm leading to a compensation of the farmer in accordance with the actual loss experienced. Livate (2009) maintains the conventional method offers financial protection for agricultural producers and their allies in the agricultural value chain against losses due to natural perils such as fire, wind, storms, ground heave and landslides and other social perils like theft, riots and malicious damage. Traditional indemnity insurance involving Multiperil Crop Insurance (MPCI) will however require

an estimate of the yield potential of crops to be insured after emergence. Sufficient emergence to meet long-term average yield expectations is required for insurance to incept (Swiss-Re, 2013, Stuley, 2010). This type of insurance can cover windstorm and other measureable perils such as rainfall, fire, uncontrollable pest and high temperatures for crops such as Cashew. Therefore, no basis- risk can occur in indemnity contracts, however premium estimates may on some occasions be higher than that of the index insurance due to loss adjustment cost which normally is passed on to the farmer in the form of increased premiums. In a paper delivered by Clark (2012) at the 8th international microinsurance conference in Tanzania, it was argued that the drawback of the indemnity approach is the issue of trust resulting from exclusions and also the challenge of moral hazards, where the insured intentionally stage claims because they have insurance.
Muewissen and Molnar (2010) submit that the actual indemnity or payment of claims in this approach depends on the evidence and measurement of the loss confirmed by an agronomist after contacting the insured field. Also, conventional or indemnity insurance contracts are based on the traditional approach to underwriting and claims management philosophies. This type of approach will help risk averse farmers to choose insurance options that reflect their expected loss, that maximize their utilities subject to their budget constraint and insurer has to provide individual cover, not a blanket cover found in the index insurance which covers covariate or systemic risks. It is worthy to note that indemnity insurance contracts start with risk mapping in order to determine the Estimated Maximum Loss (EML) or the most probable loss (MPL) which is the basis of indemnity (Atkins and Bates, 2010; Stutley; 2010 and MITC, 2008).

However, the determination of the MPL or EML starts with risk analysis which is a precursor to insurance contracts (Stutley, 2010) and this involves risk Identification, measurement and quantification of risk factors (MITC, 2008). In the conventional or indemnity approach risk classification and EML or MPL is also done to enable the insurer identify their risk exposure from the frequencies or probabilities of occurrence of perils as well as their impact (Atkins and Bates, 2010).

Moreover, while the principle of insurable interest which according to MITC (2008) is the legal right to insure, and is the financial relationship between the insured and the subject matter of insurance in which the insured stand to benefit from the safety of the subject matter but may be prejudice by its loss, is also a pre-requisite and cannot be over looked particularly for groups in contracts. Regarding the principles of insurable interest according to MITC (2008), life insurance contract is only needed at the inception of the policy since it can be assigned to third parties but in contract of indemnities, the insurable interest should run throughout the policy and cannot be assigned. The author’s position is that conventional approach to insuring properties like farms and livestock should follow the principle of insurable interest in life insurance contracts, where the policy can be assigned to financial institutions, input dealers, and agro processors, even though they can be loss payee on the policy, in order to access funds.

According to Atkins and Bates (2010), indemnity insurance contracts must also be anchored on the principle of subrogation and contribution which are corollaries of the indemnity clause which ensure that no insured profit from insurance contracts but receive compensations that brings them back to their pre loss financial position after any loss or damage.

Again, the principle of utmost good faith where the farmer would have a positive duty to disclose all the material facts that will influence the judgement of the prudent underwriter in fixing the premiums is strictly adhered to in indemnity insurance contract and breach may constitute concealment or misrepresentation of facts, which may be negligent, fraudulent or innocent misrepresentation, and may allow the insurer to repudiate claims, or void the contract ab-initio, just as if warranties imposed by the insurer are breached (MITC, 2009).

Additionally, it is worth noting that the conventional approach is adjusted on damage bases or yield base Multiperil Crop Insurance (MPCI) and aggregate loss of investment; however if the contract was fixed on damage base then, only the damage portion of the subject matter of the insured farm or property would be indemnified after adjusting the claim.
However, the main drawback of the indemnity approach is the problem of adverse selection, information asymmetry, moral hazards, high transaction costs, in addition to loss adjustment or assessment cost that renders the premiums to be very expensive relative to the index insurance and less affordable for farmers unless there is some form of subsidy (Mapfumo, 2007; Coleman and Rispoli, 2007).

2.8.3 Simulation Approach

Simulation Insurance approach combines both index and indemnity approaches. Meuwissen and Molnar (2010) identified this type of product under the name yield shield insurance, in their study of the Australian agricultural insurance system.They brought to the fore that this approach reflects the amalgamation of both index and indemnity approaches in which hail, fire and water stress are bundled together in a single insurance contract normally known as combined policies. Another Insurance product which is anchored on simulation approach is the greenhouse insurance which uses Index approach to insure crops in the greenhouse and also use conventional indemnity approach to insure the green house equipment in Asia (Iturrioz, 2010). This approach is particularly suited for households in farming communities faced with both systemic and idiosyncratic risks.

Under this circumstance, farmer idiosyncratic risks are taken care of by the conventional indemnity portion of the policy while the systemic or covariate risk is taken care of by the index portion of the contract. The author is positive that this approach can also be one of the panaceas for eliminating basis risk. According to Meuwissen and Molnar (2010), this approach addresses the problem of adverse selection, moral hazards and possibly information asymmetry inherent in the indemnity approach of providing agricultural insurance solutions among farmers in Australia.

2.8.4 Benchmarking Approach

The benchmarking approach is well suited for small scale agriculture where farm sizes tend not to exceed 5.0 ha, and loss assessment on individual farms would be resource- intensive and time consuming when compared to indemnity insurance contract (Swiss-re, 2012).

The benchmarking approach is ideally suited to perils that are systematic in nature, that affect a wide area or community (Swiss-re, 2013), and not suitable for localised or idiosyncratic risks. According to Swiss-Re (2012) and Lovemore (2012), benchmarking is suitable for: Organised communities e.g. Co-operatives, Small scale producers located in an area with homogeneous soil and climate, outgrowers, harmonious communities with little chances of conflict where extension services are present. It is instructive to note that in this approach, more than one benchmark farm or site can be selected per sub-region and all farmers in the sub-region should agree with the selected benchmark site as shown in figure 2.2. Moreover, benchmark farm or sites are monitored regularly throughout the period of insurance by a qualified person. The potential yield of the benchmark farm or site is recorded. This yield potential is assumed to be that of the sub-region it represents (Swiss –Re, 2013).

Benchmark farms are selected that are representative of a sub-region (assumes a certain level of homogeneity). According to Lovemore (2013), an MPCI expert revealed that in the benchmarking approach, farmers intending to use the same variety of seeds, fertilizer and other inputs, coupled with good agronomic practises; farmers who are trustworthy and noted for adhering to good agronomic practise are chosen and their farms are chosen as benchmark for the other farmers in the group.

In this approach, whatever happens to the farms chosen as benchmarks would be presumed to happen to all the farms under benchmark insurance contract. Hence, pay-out would be triggered as a result of agreed events specified in the insurance contract occurring on the benchmark farms. The selection of the benchmark farm or site must be such that it is fully representative of the natural resources (soil and climate) of the sub-region it represents. Besides, the agronomic practices on the benchmark farm or site must reflect best practices and current trends prescribed by local extension services (Swiss-re, 2012). In the event of loss, the extent of damage in terms of yield loss is determined on the benchmark site or farm only. All farmers in the same subregion will have equal pay-outs or claims.

Figure 2.2 Illustration of selection of benchmark farms in a homogenous area

Sub- region 1 Sub - region 2 Sub - region 3

Farm 1 Farm 2 Farm 3 Farm 4 Farm 5

Benchmark Farm 1 Farm 7

Farm 8

Benchmark Farm 2A BenchmarkBenchmark Farm 10

Farm 11 Farm 12 Farm 13 Farm 14 Farm 3

Farm 16 Farm 2B Farm 15Farm 15

Farm 18

Benchmark Farm 19

Farm 20

Source: Swiss - re, 2013

According to Lovemore (2012), the administrative burden for the direct insurer is reduced as only selected farms or fields have to be monitored and assessed, and verified for emergence of crops to determine the long term average yield (LTAY) on each farm. Conclusively literature synthesis have revealed that various insurance philosophies or strategies notably the index, indemnity, benchmarking and simulation approaches are used for developing agricultural insurance systems, however, the author is also proposing a functional synthesis approach – an approach or philosophy that has elements of all the approaches enunciated to model agricultural hypothetical agricultural insurance products as a new philosophy that insurers should consider for underwriting agricultural risk in order to give room for flexibility and selectivity. This would be tested among cashew crop farmers using the stated preference techniques in choice modeling based on the random utility theory developed by Lancaster, (1966).

2.9. Types of Agricultural Insurance Products

A skim through the works of authors like Roberts (2003); Roberts (2005); Muewissen and Molnar (2010); Swiss-Re, (2010) and Stutley (2010), revealed various agricultural insurance products for named perils as single peril or damage-based named peril or yield-based multi-peril insurance product for indeminity contracts, yield and whole farm-insurance products, Group Risk Plan (GRP), Crop Revenue Coverage (CRC) and Income Protection (IP) for revenue insurance contracts. For index or parametric insurance contracts, area yield index, crop weather index, area revenue index assurance, satellite vegetation index and mortality rates for livestock and contract farming index are some of the products in the advance economies. Simulation insurance products have been developed under the name yield shield in Australia and Greenhouse insurance in Asia. (Muewissen and Molnar, 2010, Iturrioz, 2010). Mahul and Wright (2003) submit that in 2002 crop year, 41.98% of U.S. crop insurance premiums were spent on the MPCI programme, 29.36% on the Crop Revenue Coverage (CRC) contract, 18.57% on Revenue Assurance (RA) contract, 1.10% on Group Risk Plan (GRP) contract, 0.48% on the Group Risk Income Protection (GRIP) contract and 0.31% on the Income Protection (IP) contract.

In Ghana, however, the Ghana Agricultural insurance pool is underwriting drought index insurance (DI) which is a parametric type of crop insurance, and also front aggregate loss of investment for some farms and Flexa (Fire, Lighting, Explosion, and Air craft damage) plus windstorm damage for rubber plantations to Forest-Re in London. Currently, GAIP has no expertise to design agricultural insurance products for cashew crop farmers in Ghana. Table 2.5 is a summary of the various philosophies, products and strategies for proving agricultural insurance and their basis for insurance contract and claims settlements.

Table 2.5: Summary of types of insurance phiolosophies, products and their basis of claims payment

Type of crop insurance product	Basis of insurance contracts & Claims settlements
Conventional/ indemnity insurance	
1. Single peril (e.g. fire, wind)	% damage
2. Named peril (e.g. fire, excess rain, wind)	% damage
3. Multiple peril crop insurance (MPCI)	Loss of yield
4. Revenue insurance	Loss of yield and price
Index insurance /parametric Insurance	
5. Aggregate yield shortfall insurance	Loss of aggregate yield

6. Area-yield index insurance (e.g. India, USA)	Area-yield index
7. Crop weather index insurance (WII):	Weather index (e.g. rainfall)
7.1. Micro-CWII (individual farmers) (e.g. Malawi)	Weather index (e.g. rainfall)
7.2. Meso-CWII (financial institutions, input suppliers)	Weather index (e.g. rainfall)
7.3. Macro-CWII (government) (e.g. Malawi, Ethiopia)	Weather index
8. Remote sensing indexes (e.g. NDVI / drought pasture indexes for livestock, satellite imagery or synthetic aperture radar, SAR, for flood)	Remote sensing index (e.g. NDVI pasture index)
Simulation Insurance	
9.Yield Shield(Weather index and Indemnity 10. Green House Insurance (Area/weather Index and indemnity.	% damage and Weather index for yield shield and % damage and Weather /Area index for Greenhouse insurance
Benchmarking	
1 Named Perils damaged base 2 Multi peril yield base **Functional Synthesis Approach**- has elements of index, indeminity, simulation and benchmarking, approaches, Claim payment is based on on farm inspection, monitoring of benchmarks, to dectect % loss from an insured peril, and triggers from weather and satellite stations.	Whatever happens to the benchmark farms is deemed to have happen to all farmers in the selected area. Indemnity or payouts are based on agreed occurrences' on the selected farms

Source: (Adapted from IIPACC Crop Insurance Feasibility Study 2010 with some modifications by the author based on the works of Miranda and Molnar, 2010; FAO, 2011 by Asia and the Pacific Bangkok, 2011; Swiss-Re's Presentations to GAIP, 2013**).**

2.10. Modules for Supplying Agricultural Insurance Products

Musing over supply models for agricultural insurance products, McCord (2006) and Cohen (2005) examine the supply models of micro insurance schemes that were also adapted by Stutley (2010) and utilized as models for supplying Agricultural insurance products. These models are known as the partner-agent model in Uganda, community model in Tanzania, Full service model in India, the provider model in Cambodia, voluntary model in Turkey, and Agency model in the USA. Cohen and McCord (2003) explained the first four supply models as follows: under the full service model, the public or commercial providers assume the full responsibilities for all insurance functions including education and marketing either through their sales agent or commission brokers while the insurer assume responsibility for product development, through distribution to absorbing risk. Premiums are collected by the company from the insured and claims notification and settlement are managed directly by the insurer. However in the agency model, an agency designs crop insurance schemes and administer them on behalf of insurance companies, while in

Turkey, these farmers are trained to voluntarily participate in crop insurance schemes. With the partner- agent- model, public insurers together with microfinance institutions or non-governmental and other organisations collaboratively develop the product. The insurer absorbs the risk and the agent markets the products through their established distribution network and channels, but claims are paid by the insurer, while the agents receive commission for their services. With the community – based model they argued that local communities, MFIs, NGOs and cooperatives develop and distribute the product, manage the risk pool and absorb the risks. Concluding with the provider model they maintained, that it involves banks and other financial service providers including microfinance can directly offer the required agricultural insurance contract. These are usually bundled with credit for examples to insure against the risk of default.

McCord and Osinde (2005) maintained that for the management, governance, operations, accounting and marketing involving the use of these models, there is the need to harness the relationship into sustainable profits. McCord (2007) concluded that each model has its strengths and weaknesses and therefore implementing agricultural insurance schemes should be based on lessons from each model. In this regard, the author is of the view that the best approach is to piggy baggy on existing models in the country and either enhance or introduce innovations through modifications or adjustments in order to bring them to the context that provide a fit between the cashew crop farmer environment as well as agricultural insurance sales.

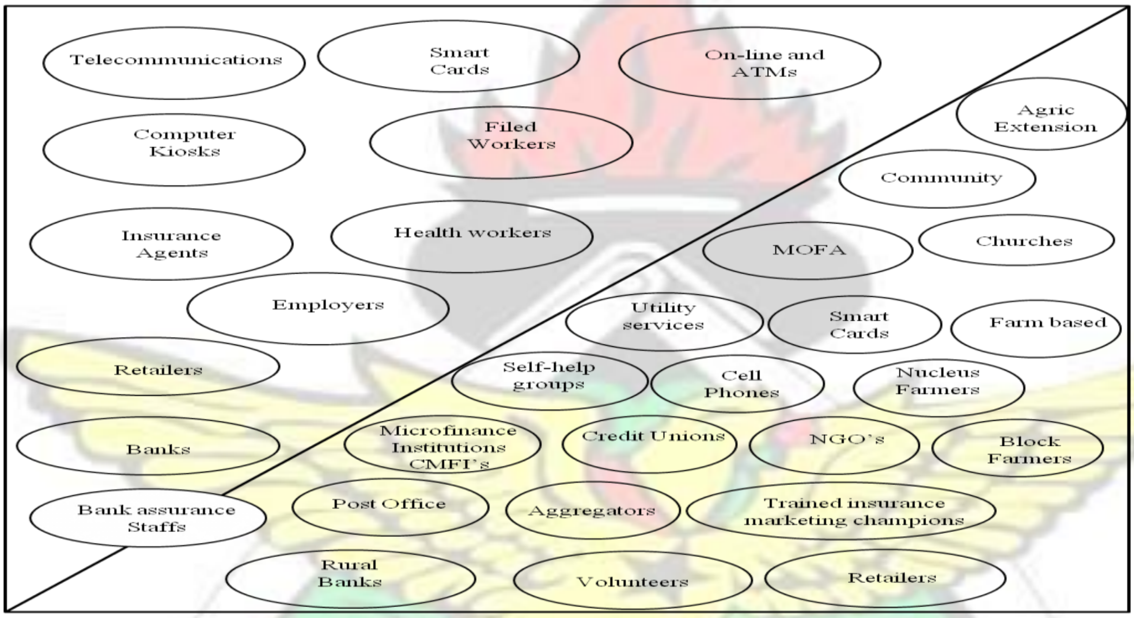
2.11. Distribution Channels for Marketing Agricultural Insurance

At the core of marketing agricultural insurance schemes is channel selection, which is a major decision for firms (Omar, 1999; Oppong Mensah, 2008). Marketing channels link individual or organisations to products or services to consumers at the right place, quantity, quality and price (Brassington and Pettitt, 2000). Harrison-Walker (1995) argues that the target audience literacy level influences the channel selection strategy. Moreso, analysis of landscape of theories and literature on distribution channel selection strategy continue to illuminate the fact that it is based on the type of client, product or the intermediary involved as well as marketing strategy adopted be it push or pull strategy. Most empirical literature shows that there are various approaches to agricultural marketing include the functional approach, the institutional approach, the commodity approach, or combination which is termed as joint market approach by Herbold (2012). While the functional approach looks at the exchange function, physical functions and facilitating functions, the commodity approach looks at the sources and conditions of commodities, where as the institutional approach looks at firms in the supply chain, with the behavioural approach looking at a firm’s ability to adapt to changes in the market. Additionally, the managerial approach pays particular attention to the marketing mix variables, also known as the controllable elements of marketing including: product management, price, place, promotion, people, process, physical evidence, positioning and partnerships (McCord, 2005; Mari, 2009; Crawford, FAO, 1997). While the author believes these approaches are also applicable to agricultural insurance marketing, the key issues in agricultural insurance marketing would be best explained by Ansoff growth matrix, which are: market development, product development, market penetration and diversification so as to develop demand driven and market oriented product in order to cover farmers' residual risks. It is peharps educative to analyze channels identified by Mari (2009), which in his analysis of agricultural markets in India and Pakistan, observed that marketing systems vary from farmer markets, cooperative markets, and corporate markets to contract markets and identified channels as co-operative societies, traders, brokers, markets, assemblies, wholesalers, retailers and processors. Following this, Clark (2012) in his presentation in 8th Micro Insurance conference in Dar-es Salaam, Tanzania, amplified the need for successful implementation of agricultural insurance marketing systems through coordination instead of competition. This phenomenon is termed by Herbold (2012) as a joint market approach which ensures that all providers of insurance and risk carriers form coinsurance pool, thus creating a better platform for the pooling of agricultural risk. This approach ensures that agricultural insurance marketing systems are organised and financed through public private -partnerships between government, farmers, insurance industry, rural banks, microfinance institutions, and other stake holders like input dealers, agro-processors, cooperatives, extension officers and farm based organisation. To him, this approach will bring about market wide and uniform insurance terms and conditions, which are technically, sound to guarantee sustainability of agricultural insurance markets. However, if banks and MFIs are to be used as channels for marketing, there is an urgent need for them to reduce their interest rates; similarly, these unique channels under the partner-agent model also can act as a distribution channel for selling agricultural insurance products. Since interest is a function of risk and insurance absorbs part of the risk inherent in the bankers' agricultural loan portfolio. Part of the bankers' administrative cost can also be borne by the commissions they will receive if they rather act as commissions agents. Skees *et al.* (2002) posit that the advantage with this model is that due to the fact that insurers can partner with financial service providers that function in rural areas and have greater knowledge about the client pool.

Also, careful analysis of the agricultural insurance implementation programme from insurers' perspective has revealed that the Joint Market Approach in the form of one company Model is used in providing agricultural insurance scheme since 17 non-life insurance companies have come together as a pool in a joint market approach. This has resulted in the formation of marketing champions which involves the use of the staff and agents of insurance pool member companies as marketing champions to provide education and sales to their existing clients .A survey conducted by the researcher in the three northern regions of Ghana in (2012) also revealed that nucleus farmers, NGO, Processors, and all other types of aggregators can be used as marketing channels (Mari, 2009). However, it is pertinent to do a background check in order to ensure that there is accessibility, integrity and sustainability that will not cause deterioration in the companies' value and agricultural insurance marketing should be done in a timely manner and not at a time farmers may be thinking about production inputs and not at the season of other domestic commitment like payment of school fees (GAIP, 2013). Admitting this fact, a recent study by

NIC (2009) reports that bancassurance is becoming increasingly successful in Ghana. Other channels in Ghana include: Marketing Staff of Insurance companies, Agency force of Insurance companies, Insurance Brokerage firms, tel-assurance (partnership/insurers and telecom companies. Further review in relation to marketing channels show that insurance brokers are good channels for corporate or meso level clients, while agents are good at targeting retail clients at the micro level. However, both brokers and staff are good at lobbying for businesses at the macro level. Also Strategic alliance and banc assurance channels are good channels for retail clients with good premiums. Notwithstanding the advantages of bancassurance, Slangen (2002) maintains that each channel has its disadvantages too. Mahaul and Stutley (2010) amplified the need for delivery channels to cost less for marketing and administering agricultural insurance and advocate the need for insurance companies to use varieties of distribution channels for marketing agriculture insurance. In order to choose the appropriate channel, there is an urgent need to solve the chicken and egg problem of which farmers, which type of products, which weather stations meet the requirements, where can the weather stations be found and which crops time series data correlates with climatic data from these weather stations to set triggers for index insurance? Are farmers interested in satellite based insurance products or indemnity products, also find out which farmers have the required data for MPCI or aggregate loss of investment products. It is worth pointing that the strength of each channel usage depends on the company's marketing philosophies. The salesoriented insurance companies rely solely on their agents to sell their products while the marketing oriented companies depend largely on their staff as well as brokers as distribution channels. No company restricts itself to one marketing channel but each has a dominat channel based on their marketing philosophy and strategy. It is also imperative to analyse the channels for payment in order to mobilize premiums, either through direct payment to the insurer or usage channels such as: mobile phones, taking into consideration the strengths and weaknesses of each payment mode or channel (GAIP,2012;IPACC-GIZ,2012).

Figure 2.3: Distribution channels for agricultural insurance marketing



***Source*: Adapted and Modified from the work of Bernhardt, Steinmann and McCord, 201I)**

Smith *et al.* (2012); Stein and McCord (2012) also identified utility and telecommunication companies as well as third party bill payment providers in addition to cash base and credit based retailers as channels for marketing micro insurance which the author thinks can also be used for marketing agricultural insurance

2.12 Theoretical Framework for Farmers Preferences and Willingness to Pay

The theory of farmers' preferences and willingness to pay for agricultural insurance products hinges on microeconomic theory and Lancaster's characteristics methodology (Lancaster, 1991; Nicholson, 2001). Lancastrian consumer theory and random utility theory forms the basis of attribute-based and discrete choice theory called choice set involving all alternatives (Jaffry *et al.*, 2004; Train, 2003). Lancastrian consumer theory proposed that the utility derived from a product

Figure 2.3 presents some channels that can be used to distribute agricultural insurance to farmers in developing countries.

is actually equal to the combined utilities the farmer derives from the attributes of the product (Loureiro and Umberger, 2006; Lusk *et al*., 2003).

Additionally, neoclassical economic theory assumes that the utility function of an individual enables him to rank different product alternatives in a consistent manner and to select the option providing him with the highest utility (Anderson *et al.*, 1992). Under such an assumption, the individual's preferences are presumed to be reflexive, complete, transitive, continuous and strongly monotonic (Anderson *et al*., 1992). The neoclassic postulations also suggest that individuals have the competence to make discriminating rankings and the capability to process information flawlessly (Tiffin *et al*., 2006). Random utility theory is based on the assumption that rational individuals select the options that yields them the highest utility given their budget constraints (Loureiro and Umberger, 2006). Based on these theories, the cashew farmers' choice between two or more agricultural insurance products respectively described by their attributes reveals their relative preferences. Consequently the utility the cashew farmer derives from insurance products by divided into a deterministic and a random component as follows:

$$\square_{ni} \square \square \square V_{ni} \square \square \square_{ni} X_{ni} \square_{ni} \qquad (2.6)$$

Where V_{ni}, is the utility that individual n obtains from good I and V_{ni} is the deterministic and observable part of this utility, which is related to the attributes of the insurance product. The term $_{ni}$ is the error term, or the random part of the utility, that is unobservable to the researcher

(Bateman *et al*., 2002). This may be as a result of measurement errors, misspecification of the utility function, missing attributes, and inattentiveness or fatigue of the respondent during the survey. The deterministic component, $_{ni}$ of function (1) is further characterized as the vector, X_{ni}, of the exogenous attributes' times the vector of the coefficients for the attributes, and is assumed to be linear in parameters (Bateman *et al*., 2002).

This leads to the perceiving of utility as a random variable and to perform a probabilistic choice analysis where the individual makes a choice between insurance product, i and j depending on the resulting utility levels (Bateman *et al*., 2002). The cashew crop farmer choose agricultural insurance product *i* provided that the condition *i j* fulfilled. The conditional probability that a cashew farmer *n* prefers agricultural insurance product with attributes i over j in a different choice set is:

$$P_{in} = P_r\left[(V_{ni} + \varepsilon_{ni}) > (V_{nj} + \varepsilon_{nj})\right] = P_r\left[(V_{ni} - V_{nj}) > (\varepsilon_{nj} - \varepsilon_{ni})\right], \forall\, i \neq j \qquad (2.7)$$

2.13.1 Empirical Review of Factors influencing willingness to pay for Agricultural Insurance and other Insurance Products

Though Agricultural insurance has an element of public good and normally receives public support, demand is not often as high as could be expected and reasons for its low demand may be accounted for by analysing either its supply or demand conditions. From the supply side, most challenges envisaged by the supplier is the issue of adverse selection, information asymmetry as well as moral hazards, which is made manifested in the wilful act of the insured in that a claim should occur once an insurance cover is bought (Mahul, 1999; Bourgeon and Chambers, 2003). On the demand side, farmers are not able to identify the benefits of agricultural insurances particularly in regions where they use traditional methods to take care of their risk and have not experienced extreme climatic perils which could not be handled by traditional methods normally trigger low demand(Garrido and Zilberman, 2008).

This is in conformity with the Habituated Action theory which assumes that those who embark on risky decisions many times without negative outcome may decrease the risk perception associated with it.

A better understanding of the parameters affecting the willingness to pay (WTP) can help practitioners and policy makers to design insurance products for target population. (Dror and Koren 2012), WTP can be estimated through revealed preference techniques (RP) which is a predictive modelling approach to WTP or alternatively through stated preference technique (SP). Moreover, WTP is mediated by ability to pay as well as individual cultural or Institutional factors as well as product characteristics that influence one's perceived benefit (Ibid).

In line with the state dependent utility theory, various studies have tried to estimate how socioeconomic factors have influenced farmers' willingness to pay for agricultural insurance. In most willingness to pay literature, these socio-economic factors have been seen to include, age, gender, income , household size, education,farming system, farm size, farming experience, land tenure, public help in disaster times and perception about insurance companies and farm location among others (Sherrick *et al.,* 2003, Ben-Houasa 2010,Sherrick *et al.*,2004 and Fraser, 1992; Dror and Kaner,2012). Sherrick *et al.* (2003) determined farmers' preferences for crop insurance attributes using conjoint analysis. The authors found out that the most important crop insurance attributes was the extent of cover provided as well as acreage flexibility. Aktera and Brouwer (2007) examined the demand as well as commercial viability of crop insurance in disaster prone areas in Bangladesh using double bond dichotomous choice elicitation method and found out that demand for crop insurance were positively correlated with household head's primary occupation, land ownership, size of agricultural farmlands. Their studies also revealed that their willingness to pay to reduce cost associated with damage crops vary across households.

The empirical literature covering these variables are explained blow:

2.13.1.1 Age

Previous studies have found mixed results in terms of the effect of age on risk management strategy adoption (Mishra and El-Osta, 2002). Black and Dorfman(2000) observed that age had a negative coefficient and farming experience had a positive coefficient in their study, suggesting that the older a farmer is, the less likely he is to purchase crop insurance; but the longer he has been farming, the more likely he is to purchase. Jehu-Appiah (2011) found that the greater an individual's age, the more likely his/her insurance enrolment.

2.13.1.2 Income

Several authors including Bierer and Eling (2012) report that high premium is a major impediment to micro insurance uptake. Brouwer *et al.,* (2006) reveal a positive relation between willingness to pay (WTP) for flood protection through the construction of an embankment and average annual household income, which suggests that higher income households are willing to spend more money (i.e. pay a higher flood protection premium) to protect themselves against flood damage risk in Bangladesh.But Ifft (2001) revealed that the demand for drought insurance was found to decrease in households with higher overall incomes or more self-insurance. Akter and Brouwer (2007) found out that the two most common reasons for not buying an insurance scheme in principle are 'limited financial income and 'disliking of terms and conditions of proposed flood insurance scheme. Jehu-Appiah *et al*. (2011) also found out that richer household preferences for health insurance are high in Ghana.

2.13.1.3 Education

Based on the human capital theory which uses education a proxy,several studies have established a correlation between education and insurance uptake, for instance Chankova *et al.*(2008) reports of positive correlation between health insurance uptake and education of the household head. Brugiavani and Pace (2011) found literacy to be a determinant of health insurance enrolment. According to Raju and Chand (2008), level of education, did not show any significant influence on insurance uptake in India. Sherrick *et al.* (2004) reported that insurance users in general, and revenue insurance users in particular, are expected to be more experienced and better educated, indicating a greater responsiveness of insurance use to modern, more sophisticated approaches to risk management. Such attributes may lead to greater precision in risk assessments and to possible changes in risk attitudes that complement improved riskcarrying capacities.The lack of skill can increase their fear of the risks inherent in agricultural production and consequently their needs to resort to risk management strategies (Ben-Houassa, 2010). Furthermore, it is generally hypothesized that producers with higher education tend to adopt more sophisticated risk management tools.

2.13.1.4 Household size

According to Raju and Chand (2008), family size and livestock ownership did not show any significant difference between insurers and non-insurers in India.Ben-Houassa (2010) found a large household size to be positively related to the use of precautionary savings to deal with risk in the cocoa subsector in Cote d'Ivoire. An increase in family size means more people to feed, to care and then increases the level of vulnerability of the household. Hence, taking into account the amount of uncertainty regarding the future, it is reasonable for large households to smoothen their present consumption (by making saving) in order to secure their future welfare.

2.13.1.5 Perception, awareness and Knowledge of Insurance

Gine *et al.* (2008) strikingly show that the most frequently cited reason amongst non-purchasers is that the consumer does not understand the insurance product, representing 25% of weighted responses. The results suggest a significant proportion of households who purchase insurance do so on the advice of trusted farmers or village leaders; conversely 25% of explanations for nonpurchase cite a lack of understanding of the product. Atim and Sock (2000), identify community perception as the cause of the low uptake of health insurance. Jehu-Appiah *et al.* (2000) conducted a study to investigate households' perceptions of NHIS and found out that perception of price and benefits influences the enrolment of NHIS in Ghana, Coydon and Molitor (2011), however, found out that lack of insurance awareness normally hampers demand for micro insurance product.

2.13.1.6 Public Help

Also, a study conducted by Sherrek *et al.*, (2003); Year and Fraser (1992) public help in times of disaster and perception as well as other factors as influencing farmers' preferences and willingness to pay for farm insurance.

Brunette *et al.* (2009) observed that cognitive factors public help, risk context and farmer characteristic influence insurance choice of forest owners. They brought to the fore that government public contingent compensation decreased the owners' willingness to pay for insurance as compared to a situation where there is no public help. Dracea and Christie (2008) also noticed a crowding out effect by government disaster payments as an impediment to developing agricultural insurance products.

2.13.1.7 Farm Size

In general, larger sizes reflect greater managerial capacities and perhaps economies of scale and scope in the utilization of various risk management practices.

Farm size and crop income, were significantly higher for insurers household as compared to noninsurers.Insurance users are expected to operate larger acreages and to have intentions for further acreage expansions (Sherrick *et al.*, 2004). Enjolras *et al.* (2011) noted that insurance is positively linked to the size of the farm, whether agricultural (cultivated area) or financial (total assets), which is in line with literature. Black and Dorfman (2000) found out that farmers were more willing to purchase insurance if they had larger than average farm. Farm size was not a significant variable in a study by Smith and Baquat (1996). This finding agrees with Smith and Goodwin (1996). Smith and Baquet (1996) postulated that relatively large farms with greater diversity could lead to a better insight into factor influencing crop insurance purchase decisions. Akter and Brouwer (2007) found in their studies that respondents who were willing to purchase crop insurance scheme had larger farm land areas than those who did not want to buy crop insurance.

2.13.1.8 Farming system and diversification

Farming systems have an influence on the purchase of agricultural insurance. Farmers who have knowledge of other risk management instrument such as diversification, credit, financial markets have a negative correlation with demand for agricultural insurance (Wright and Hewitt,1994). Also diversification can either constitute a substitute or a complement to insurance (Enjolras *et al.*, 2011). In France for instance, they act as complements to insurance. In Italy, the negative sign associated to cultivated crops indicates that diversification is a substitute to insurance. They indicated that diversification and usage of modern techniques such as testing the number of cultural crops per hectare, and irrigation. have positive effect on insurance in France. In this context, they act as complements to insurance. In Italy, the negative sign associated to cultivated crops indicates that diversification is a substitute to insurance. Surprisingly, the variables correlating with degree of diversification had negative signs in Black and Dorfman (2000) who speculated that it demonstrated farmers' ability to self insure.

2.13.1.9 Tenure

Ownership and leasing of farmland often reflects greater wealth positions of farmers and greater stability of land control. Other studies have shown that the greater wealth and less tenure risk also reflect stronger risk bearing capacities and greater reliance on self-insurance relative to commercial insurance. Hence a high ratio of owned acres to total acres operated normally reflect non use of insurance and a greater preference for specificity in type of insurance product (Sherrick, *et al.* 2004). Akter and Brouwer(2007)noted that crop insurance demand varies significantly across agricultural land ownership in Bangladesh.They noted that Landowners are significantly more willing to buy crop insurance scheme than landless farmers. Furthermore, they found out that the demand for crop insurance varies significantly across the size of farmlands. The estimated coefficient of TENURE arrangement variable (RENT) was negative in Black and Dorfman (2000) which is contradictory to previous studies. They suggested that one reason for the contradiction was that some farmers have non-contiguous rented land and have tracts on different soil types. They stressed that geographic diversification may lower the perceived production risk and therefore the demand for agric insurance.

2.13.1.10 Distance to Insurance Company

Jehu *et al.* (2011a) found out that convenience of NHIS correlates with enrolments. While Asenso Okyere *et al.* (1997) also found out that distance to health facility was an insignificant determinant for the willingness to pay for health micro insurance. Dror *et al.* (2007) found a negative correlation between distance to a preferred hospital, but not a primary health facility.

2.13.1.11 Gender

Most studies show that female individuals and households headed by females are more likely to become members of insurance schemes, since women are in most cases are exposed to the consequence of health shocks (Jehn-appiah and, Owusu *et al.*, 2012).While Wan(2014) also found a significant relationship between gender and and breeding sow insurance uptake in China, DansoAbbeam *et al*.,(2014), did not observe any statistically significan realationship between gender and cocoa insurance uptake in Ghana.

2.13.1.12 Marital Status

Also' being married and having a large household may associated with insure demand as marriage couple tend to be risk averse and may remand insurance to protect their children (NketialAmponsah(2009) and Chankora *et el.*, 2008). Gine *et al.* (2008) and Budak *et al.* (2010) noted that marital status influence farmers willingness to pay for index insurance. In a similar study in the cocoa subsector in Ghana, Danso-Abbeam et al, did not find any significant relationship between marital status and insurance uptake.

2.1.13.13 Payment Method

Chankora *et al.* (2008) noted that a yearly payment schedule is not suitable for low-income clients. Coydon and Molitor (2011) observed that membership and payment through CBOs such as churches; government, NGO and corporation have a positive influence on micro insurance distribution.

2.14. Underwriting Agricultural Risks

Risk analysis is a crucial step in underwriting insurable risks (MITC, 2008). Moreover risk analysis helps insurers who are assured to be risk neutral (Mahul and Writght, 2008) to design and underwrite agricultural risks in order to come out with actuarially fair premiums, since there is nothing like actuarially correct premiums(Clark,2012). Underwriting is a procedure of assessing and quantifying risk to determine the premium that should be paid by a risk averse farmer to cover his or her residual risk and to decide whether or not the risk should be accepted or rejected by an insurer (MITC, 2008) and on what terms and conditions or warranties the insurance companies should accept the risk. In this regard, a farmer seeking insurance should declare all material facts that will influence the judgement of the prudent underwriter in fixing the premiums and failure to do so may constitute concealment, non disclosure or misrepresentation of facts (MITC, 2008). At the time of claims, investigations may be conducted to detect whether or not the misrepresentation was an innocent misrepresentation, negligent misrepresentation or fraudulent misrepresentation. The insurer may pay claims on ex-gratia for innocent misrepresentation but may repudiate claims for negligent misrepresentation and void the contract ab initio for fraudulent misrepresentation since insurance contracts do not support illegalities or contracts that are contrary to public policies (MITC, 2008).

To this end, the key elements in underwriting involve collection of information on farmer's management capabilities, production and marketing history to geographical specifics of farmer's exposure which could have an impact on the risk experienced by the farmers in an area, in addition to information on their agronomic practices such as types of seeds used, technical coefficient of production, sources of water whether rain fed or irrigation, fertilizer use, times for weed control, crop varieties, cropping systems, and other farming techniques, the yield potential, of the crops, the area of planting particularly the types of soil. Furthermore the cropping calendar of that crop taking into consideration, planting and harvesting times and the GIS coordinates of the field in order to determine the cadastral plans of the farm which can be verified in times of loss, and also to assess their risk reduction technique so as to make a decision to accept or decline their residual risk (GAIP, 2012). With index-based products, there is a need to analyse the soil water holding capacity through soil analysis for the area, in addition to site production capacity, soil types, and other edaphic factors such as salinity , acidity and alkalinity of the soils which are abiotic factors in order to know the yield per hectare and also determine the crop water requirement, normally determined by conducting a greenhouse experiment and subjecting the various crop varieties to water stress experiments to determine their permanent wilting points at the various phases such as the germination, growth, flowering, fruiting and probably harvesting phases in the crop life cycle.

These analyses become paramount in providing index insurance because of their usefulness in calibrating or setting the triggers for payouts (ibid).This enables the insurer to make prudent reinsurance decisions, whether to use quota share treaty or facultative reinsurance arrangements based on the risk tolerance, appetite and risk capacity which is dictated by the resources of the insurance company in question. It must be noted that to estimate premium is not an exact science. According to Clark (2012), no rating methodology is perfect and a technically sound methodology uses a combination of data, statistical analysis and expert judgment to determine and monitor premium rates and in this sense data becomes the life blood of pricing. While there are no one fits all model for estimation insurance premium,

Nodling *et al.* (2010) developed a model for underwriting health insurance which in the author's view is also applicable to agricultural insurance ratings which given by

$$Pt = P_o C + A \qquad (2.17)$$

Where P_t is the total premium comprising the pure loss cost and administrative expense loadings and P_o is the probability of the insured event occuring and C is the cost of cover for the loss normally known as pure loss cost and A is the administrative cost.

However, Clark (2012) underwriting model for rating at an actuarially fair rate is given by:

$$\textit{Commercial Premium} = \textit{Expected claim payment} + \textit{Costof capitalexpense loading x Discount factor} \qquad (2.18)$$

To Hazell, the condition for viability and sustainability of insurance contract is given by

$$\frac{(A + I)}{P} < 1 \qquad (2.19)$$

Where A is the average administrative cost per contract, I is the average indemnity paid and P is the premiums paid taking into consideration financial and environmental risk faced by the insurer as well as the financial constraint faced by the insured. The model is used to calculate the expenseover-revenue ratio normally called Hazell ratio which is calculated by taking the proportion of indemnities paid I plus administrative costs ( )A (I+A) over the premiums collected P .

The decision rule is that if the Hazell ratio is more than 1, then the scheme is not is not financially sustainable on its own and needs external support such as government support.

A Hazell ratio of more than 2 also reflects weak justification for such instruments in terms of economic efficiency, since such programs become simply an additional channel through which to provide resources to farmers (Aries and Covarrubias, 2005).

Comparing equation (2.17) and (2.18), they all try to estimate administrative premium by first determining the technical premium, which is the pure loss cost after which administrative cost is added to determine the administrative premium that will ensure sustainability of the scheme. Consistent with the traditional theory of insurance, there are usually some loadings for administrative expenses such as: communication expenses, financial transaction fees, additional cost of obtaining data, as well as miscellaneous expenses (GAIP, 2011). From the foregoing analysis, the premium can be estimated as:

$$Premium = Expected\ loss + Risk\ Margin + Administrative\ Cost \quad (2.20)$$

In a situation where there is data, statistical models can be developed to estimate the pure loss cost but where there are data gaps, the premium is loaded for data uncertainty, and the impact may assume a catastrophe, catastrophic loadings. Also, the loss distributions inherent in past portfolios are analyzed- a phenomenon known as historic burn analysis, to determine the burning cost of an insurance portfolio (MITC, 2008). However, in a situation where an underwriter lacks historic data for burn analysis for a particular country or context, experiences may be drawn from data from other countries or other contexts.

Additionally, in order to ensure product adequacy as well as the existence of insurable interest, farmer's activities must be understood to ensure that the insurance will be appropriate for them, and also to ensure that the necessary terms, conditions and warranties, precedent to liability within the policy period are imposed.

In the situation where the proposer (prospect for insurance) is a meso level client such as financial institutions, processers, aggregators, Nucleus farmer or other value chain actor, then further analysis should be made to justify the design of tailor made insurance products, such as aggregate loss of investment insurance to meet their risk management requirements.

> *Also prior to final approval of quote, product specification and policy conditions, the underwriter, should ensure that this new policies do not increase the financial risk borne by the portfolio in excess of what the pool has agreed to retain for a specific region, that is to say there is no risk aggregation in the pools portfolio, hence the underwriter must accept the new businesses on condition that there is no risk aggregation* (GAIP, 2011).

Also, the underwriter should verify the accuracy of the information, including the premium, and also making sure that the policy falls within the cropping season (Stutley, 2010). In some situations, an endorsement may be made after the policy has been issued[4]; hence, the modifications that may or may not require a new policy wording or cover that reflects the new risk [5], requiring the notification of the reinsurer [6].

In a situation where the underwriter refuses the endorsement, there can be an outright cancellation of the policy (ibid).

3.Have a look at UN(2007)Sustainable Development Briefs, Issue 2 on Developing Index based Insurance for Agriculture in developing countries, Administrative charges include: operational cost, data cost, taxes, reinsurance and commissions.

4. Endorsement is changes in the policy terms which changes the cover initially requested by the client.

5. Changes such as spellings and other topographical errors do not constitute endorsement, but important aspects such as payout triggers or perils constitute endorsement and must be treated as such.

6. Reinsurance agreements must be noted and during endorsement, and their consent may be sought if the policy terms warrants the permission of the reinsurer.

2.15. Constraints to development of Agricultural Insurance Scheme.

Agricultural insurance markets face constraints worldwide and the situation in Ghana may not be different. However, empirical literature on the constraints faced by Ghana Agricultural Insurance Pool (GAIP) is scanty. Several empirical literature have illuminated the types of constraints faced by agricultural insurance schemes from both insurer and farmers perspectives. A skim through a related study done by Qingshui and Xuewei (2010) identified a range of constraints to the development of insurance which include: high loss ratio, fewer source of income and subsequently weakening farmers purchasing power of insurance products, inadequate promotion of agricultural insurance knowledge leading to vague evaluation of farmers, lack of policies supporting agricultural insurance development and lack of agricultural legislation.

Tsikirayi *et al*. (nd) amplified these constraints in a similar study of Zimbabwe's agricultural insurance sector from both the farmers and insurers' perspective. They identified factors such as limited knowledge, negative perceptions about insurance in general, poor service quality delivery, low agricultural production, remoteness of insurance companies, while insurers viewed the constraints to agricultural insurance uptake as : lack of affordability , distance of the service provider from the farming enterprises, and negative effect of location affected both parties. They viewed insurance as unnecessary expense rather than an investment to curtail future risk, since some insurance companies premiums are too high.

Empirical studies done by Abdulmalik, *et al*. (2012), in their analysis of Nigerian agricultural insurance industry, amplified some of the constraints encountered by the farmers under Agricultural insurance scheme as inadequate and delayed claims payment which in turn bring about negative perception of Agricultural insurance benefits, administrative constraints as a result of bureaucracy which has the tendency of influencing farmers to withdraw from insurance schemes. Others are cumbersome claim settlement procedures which include delays, difficulty in accessing insurance personnel and inadequate information dissemination. In the Zimbabwean Insurance Industry, Yusufu (2010) documented some constraints as: low penetration of the scheme, scarcity of data for actuarial determination of important underwriting, high moral hazard, lack of qualified personnel in the area of agricultural insurance, low participation of commercial banks in agricultural finance, inadequate agricultural infrastructure. Similarly, Mahul and Stutley (2010) identified low penetration in government sponsored programs, inappropriate pricing, poor financial performance with claims cost and administration cost exceeding premium and uncontrollable moral hazards.

In the Caribbean and Latin America, Wenner (2005) assessed the constraints to development of agricultural insurance and observed lack of statistical independence, asymmetric information, high administrative costs, mismatch between farm preference and capacity to pay. Inadequate legal and regulatory frameworks, distorted government incentives and reluctance of reinsurer to enter the market were the developmental constraints facing agricultural insurance markets were prevalent. Other constraints include poor regulatory framework, low awareness, small size of market, financial literacy, high marketing cost, lack of knowledge about product development and marketing channels (Stutley, 2010), lack of government involvement in agricultural insurance, data unavailability, basis risk, while Cross (2012) leaning on Finmark (2010) also noted that prospective clients microfinance have no idea of the processes involved in purchasing insurance. Arguably, apart from information asymmetry and lack of data, it can be concluded that the constraints to the development of most agricultural insurance schemes are financial, administrative, institutional and marketing constraints.

2.16. Government Support for Agricultural Insurance

Agricultural insurance in countries such as us, Canada, India, China, Spain and some countries in Asia and pacific have received some form of government support which comes in the form of subsidization provision of policy guidelines, creation of legislative environment, provision of catastrophic insurance or government acting as a stop loss re- insurer (Wenner, 2005; Stutley, 2010; Mahul and Stutley, 2010; FAO, 2011, IFAD, 2011). According to IFAD (2011), government subsidizes crop insurance programmes in China and India. Wenner (2005) opines that government support agricultural insurance in Latin America and Caribbean by providing subsidies for reinsurance contracts. He contended that provision of subsidies for agricultural insurance premiums regrettably comes with implementation challenges such as identification, sustainability, targeting challenges and argues that it would lead to adverse selection. He advises that instead of subsidizing premiums, operational and administrative cost should rather be subsidized. Che RonBang (2009) in analyzing the Chinese agricultural insurance system opined that government should rather grant agricultural insurance companies tax exemptions. Mahul and Stutley (2010) opine that government should create agricultural and weather data base that would provide insurers in developing countries with reliable data and tools that would aid them in designing actuarially fair agricultural insurance product. They also argued that premium subsidies would help increase agricultural insurance penetration rate. FAO (2011) justified the need for government to support agricultural insurance market because of poorly developed agricultural insurance market, stemming from the fact that commercial insurers are faced with financial constraints because of the prohibited high startup cost of setting up agricultural insurance system. This makes premiums unaffordable for small holder farmers in Asia and the Pacific. Consequently, government support for countries in Asia and pacific depending on the country are in the form of insurance legislation, premium subsidies, subsidies for administrative and operation cost, loss assessment subsidies, public sector reinsurance and other support such as Research and Development training. However, documents from Jamaica (2009) identify support needed by agricultural insurance system as market development, through capacity building for insurers, provision of weather and agricultural data and infrastructure regulator to facilitate the design of agricultural insurance products. The author thinks government should also provide policy guidelines by inculcating agricultural insurance programmes into the nation's agricultural development policy.

2.17. Framework for Developing Agricultural Insurance Scheme

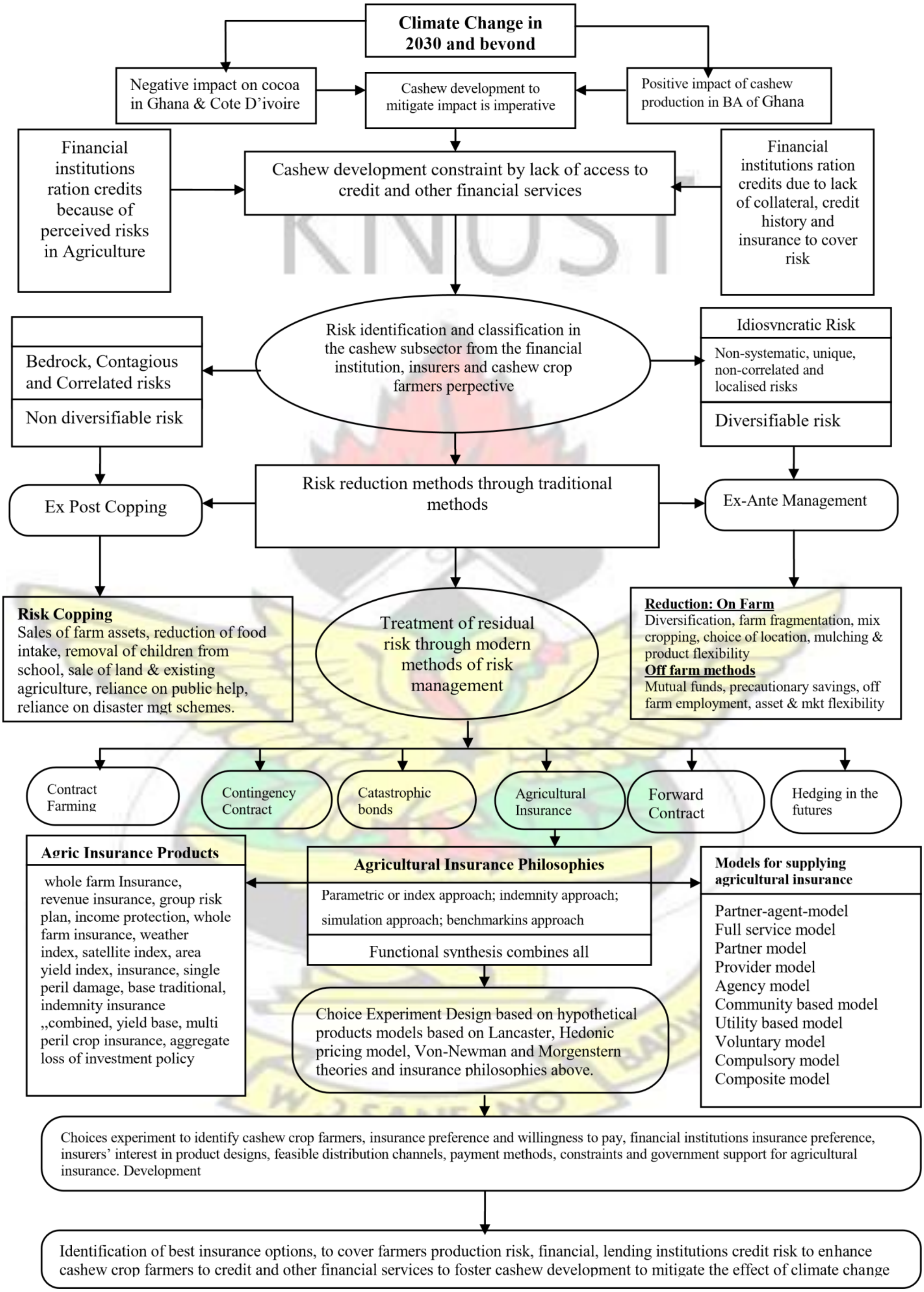
Based on the critical review, it is obvious that agricultural insurance development is not only technical but also entails scientific approach meshed with business sense. It is not surprising to observe that the various literatures reviewed unexpectedly showcase approaches which are either descriptive or prescriptive with less emphasis on diagnostic approach. However, the conceptual framework developed from the theoretical frameworks and empirical review, for the study agrees with the framework developed by Grobal Agrisk (2009) and UN (2007).This conceptualizes agricultural insurance development strategy as captured in Figure 2.4 and following the steps enumerated below:

1. Based on system approaches identifies a potential area and assess farmers risk perception, agronomic and meteorological knowledge to establish their residual risk, accurate proxies or triggers for the development their preferred insurance products.
2. Design hypothetical agricultural insurance products based on insurance philosopies and approaches.
3. Conduct choice experiment to ascertain client's willingness to pay.
4. Identify delivery channels and supply models for distributing agricultural insuance products, payment modes

5. Determine the constraints and government support for agricultural insurance development.

6. Formulate a strategy for developing agricultural insurance system for the farmer involved as shown in figure 2.4

Figure 2.4. Problem Summary and Framework for Devloping Agricultural Insurance Systems for Cashew Farmers


Climate Change in 2030 and beyond
Negative impact on cocoa in Ghana & Cote D'ivoire
Cashew development to mitigate impact is imperative
Positive impact of cashew production in BA of Ghana
Financial institutions ration credits because of perceived risks in Agriculture
Cashew development constraint by lack of access to credit and other financial services
Financial institutions ration credits due to lack of collateral, credit history and insurance to cover risk
Bedrock, Contagious and Correlated risks
Non diversifiable risk
Risk identification and classification in the cashew subsector from the financial institution, insurers and cashew crop farmers perpective
Idiosyncratic Risk
Non-systematic, unique, non-correlated and localised risks
Diversifiable risk
Ex Post Copping
Risk reduction methods through traditional methods
Ex-Ante Management
Risk Copping
Sales of farm assets, reduction of food intake, removal of children from school, sale of land & existing agriculture, reliance on public help, reliance on disaster mgt schemes.
Treatment of residual risk through modern methods of risk management
Reduction: On Farm
Diversification, farm fragmentation, mix cropping, choice of location, mulching & product flexibility
Off farm methods
Mutual funds, precautionary savings, off farm employment, asset & mkt flexibility
Contract Farming
Contingency Contract
Catastrophic bonds
Agricultural Insurance
Forward Contract
Hedging in the futures
Agric Insurance Products
whole farm Insurance, revenue insurance, group risk plan, income protection, whole farm insurance, weather index, satellite index, area yield index, insurance, single peril damage, base traditional, indemnity insurance ,,combined, yield base, multi peril crop insurance, aggregate loss of investment policy
Agricultural Insurance Philosophies
Parametric or index approach; indemnity approach; simulation approach; benchmarkins approach
Functional synthesis combines all
Models for supplying agricultural insurance
Partner-agent-model
Full service model
Partner model
Provider model
Agency model
Community based model
Utility based model
Voluntary model
Compulsory model
Composite model
Choice Experiment Design based on hypothetical products models based on Lancaster, Hedonic pricing model, Von-Newman and Morgenstern theories and insurance philosophies above.
Choices experiment to identify cashew crop farmers, insurance preference and willingness to pay, financial institutions insurance preference, insurers' interest in product designs, feasible distribution channels, payment methods, constraints and government support for agricultural insurance. Development
Identification of best insurance options, to cover farmers production risk, financial, lending institutions credit risk to enhance cashew crop farmers to credit and other financial services to foster cashew development to mitigate the effect of climate change

Source: Framed by the Author, 2011

2.18 Conceptual Framework for the Study

Identification of a strategy for development of agriculture insurance system for cashew crop farmers is hinged on multiplicity of factors which are based on both demand and supply side factors. The demand side factors include farmers' characteristics, farm characteristics, product characteristics and institutional factors.

On the supply side insurers have to identity a system, product development philosophy, agriculture insurance supply models and distribution channel(s)

Based on the state dependent theory factors affecting demand for agriculture insurance include farmers socioeconomic characteristics such as : age, gender, household, and education, marital status, receiving agriculture training, awareness, farmers perception of agriculture insurance, and being a household head. Farm characteristics such as farm size, age of farm and product characteristics such as: type of insurance approach / philosophy type of peril covered, basis of loss adjustment price or premium attached to the product.

Institutional factors such as: access to credit, help in terms of disaster and, loan creditor, and help in times of disaster and existence of marketing channel influence demand for agricultural insurance.

According Parkin *et al.*, (2002), these factors are not considered in isolation but are all evaluated by farmers and influence their demand for agriculture insurance.

Supply side factors, however, take into consideration such as strategies based on product or system approach, product development philosophies base on index, indemnity, simulation, benchmarking or functional Synthesis approaches.

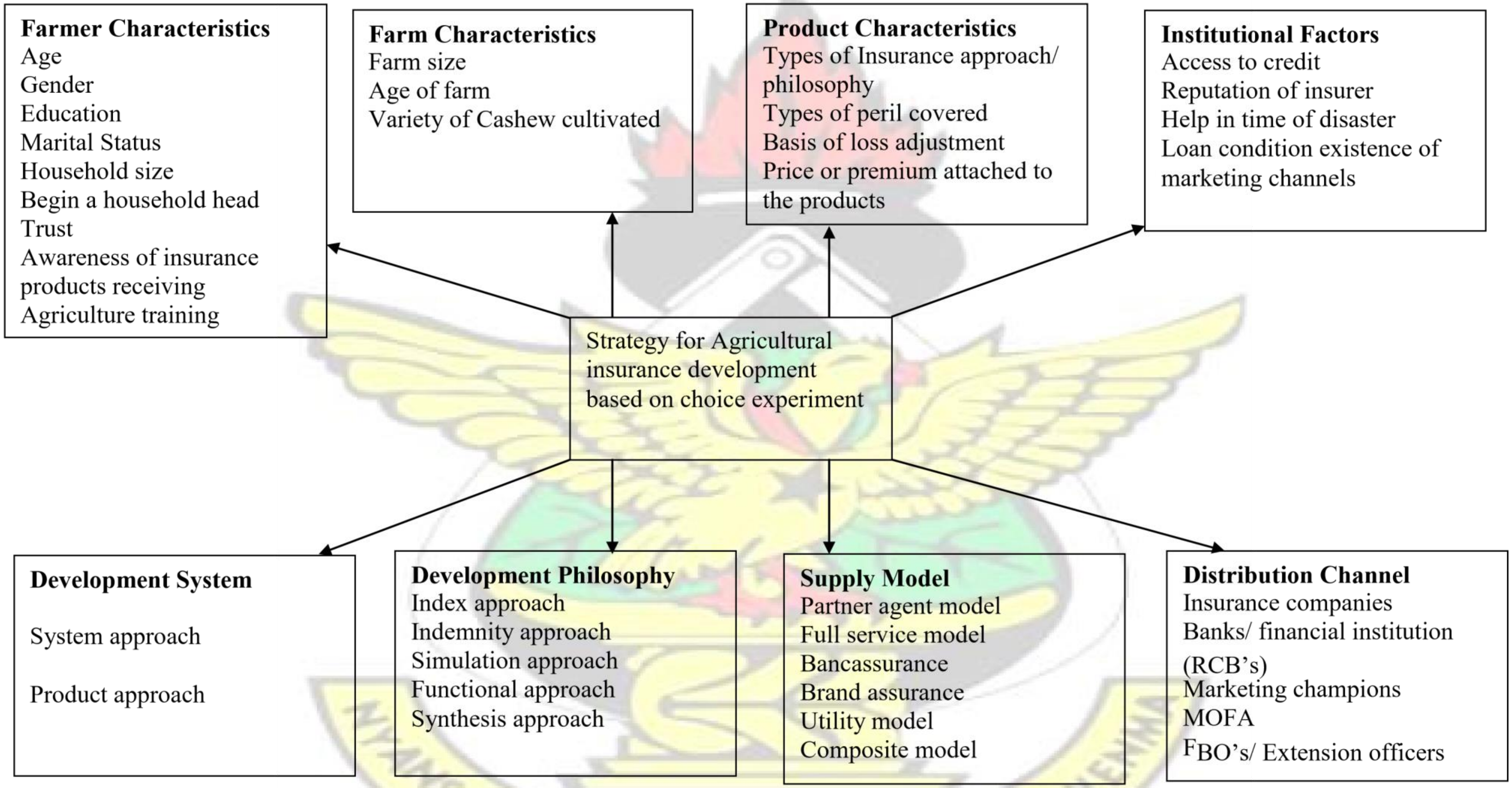
It also includes supply models such as: partner-agent model, full service model, agency model banccassurance, brand assurance, and utility based models.

Moreover, distribution channel also is key for supplying the products; consequently it is impertinent to identify the channel from the suppliers' perspective, which may be insurance companies themselves, financial institutions, farm based organization, marketing champions, extension officers and ministry of food and Agriculture.

Determing appropriate factors will influence agricultural insurance demand and supply that would offer Ghana Agriculture insurance pool stakeholders made up of the technical management unit, (TMU), technical committee of Agriculture insurance (TCAI) and Steering committee of Agriculture insurance (SC) and the pool management Board (MB) the opportunity to come out with a development strategy for cashew crop farmers in the study area, based on traditional insurance theory and random utility theory following Lancaster (1996).

Figure 2.5 Conceptual Framework for the Study

Demand Side Factors



Source: Author's Construct, 2011 **Supply Side Factors**

2.19 Overview of the Ghanaian Cashew Industry

Cashew (*Anacardium occidentaleL*) is a perennial crop believed to originate from a short growing ecotype (Hanedm *et al*., 2008). It belongs to the family *Anacardiaceae* and comprises 74 genera with about 600 species (Barros *et al.,* 2002). It is a hard crop that grows well on marginal lands and can be used for soil conservation and afforestation in savannah areas (ADF, 2000; Chakravorthy, 2007). Cashew grows widely across the tropics and is cultivated under a range of conditions from managed plantations, small holding plots; semiwild or found in wild populations (Paiva *et. al.,* 2003).

Cashew crops found in nature are of two types: the common type and the dwarf type, with the common type being taller and widespread with a height varying from 8 to 15m and a crown that can reach 20m (Paiva *et al*., 2003). The productive capacity of the common type ranges from 3 to 33g and the weight of their peduncle also vary from 20 to 500g (Barros *et al.,* 2002). The Cashew fruits of all the species are kidney shaped and grow at the end of a pedicel known as cashew apple (Akinkunle *et al.,* 2012).

In Ghana, cashew is produced in four agro-ecologies namely: the interior or savannah, forest savannah, transition and coastal savannah, with the forest savannahand transition being the most suitable for cashew production (Dodzoe *et al.,* 2000). It is grown as a cash crop in all the ten regions in Ghana (ADF, 2000). As at 2006, estimated area under cultivation was about 59,000 ha with annual production of about 16,000 metric tons of raw cashew nuts. Recently, the prospect for increased production of cashew crop for both local consumption and export is on the increase (Ashietey and Nicely, 2012). However, CPD (2008) reports that Ghana has enough land size of about 100,000 ha to develop new plantations by 2020; meaning there are prospects for increased cashew production for local consumption and exports. In Ghana, Cashew nut is an important source of income for small holder farmers (FAO, 2009), and about eight thousand people in Brong-Ahafo Region are into cashew production and its allied activities including farm labouring (ADF, 2000).

Until recently, cashew cultivation had been the preserve of small holders farmers in rural communities but current trends have shown that the sector employs over fifty (50) commercial farmers and thirty thousand small holders with farm size ranging from 0.8 – 2.5 ha for small holders in Ghana (Stutley, 2010). Ghana earned US$42,998.09 for exporting 139, 440.72 tonnes of cashew between 2006 and 2008 (CDP, 2008) and US$379m from exporting 280,834

M.T of Raw nuts with only 2% being processed into raw cashew kernels which are roasted and sold domestically (Osei-Tutu, 2012). In Ghana, trade in the cashew industry involves processing cashew into raw nuts and kernels, though cashew shell and cashew apples present some marketing opportunity (Ashitey and Nicely, 2012).

2.20 Cashew Agronomy

Cashew agronomy is imperative for insurance development. Nathaniel (1994) also in a similar study in Mozambique reports of altitude above 1200m having negative impact on yields. The cashew tree grows well under dry farming conditions and its cultivation is concentrated in inter-tropical regions that normally have low soil fertility, sometimes high salinity, high temperatures and irregular precipitation, explaining why only 1% of the nearly 3.4 million hectares used for cultivating cashew in the world are irrigated (FAO, 2007). Since high rainfall at fruiting stage will cause fruit rot from fungal damage before ripping (Opeke, 1982). Annual rainfall requirement is between 1000 – 1500mm per year (Dedzoe *et al.,* 2001). According to Mole (2000), excess moisture during the wet season exposes the cashew crop to helopeltis (Cashew mosquito) attack and fruit rot. It is for this reason that Ashitey and Nicely (2012) maintain that cashew is not grown in areas of Western Region, where rainfalls are higher, because cashew yields drop after heavy rains at the harvesting stage and it can cause the nut to rot or germinate while heavy rainfall during the flowering stage damage the flowers as they become infected with disease like anthracnose and powdered mildew disease (PMD). Although cashew can withstand higher temperatures, lack of water also reduces yield below average rainfall cause cashew crop to shed its leaves with a fall in production to about 40% (Opeke, 1982). According to Dedzo *et al.* (2001), the cashew crop does well under a temperature range of 15-35^{0} C with the optimum ranging from 24 – $30^{0c.}$ and also requires a period of 4 – 6 months drought (ibid).

It has been reported by research scientists working on the cashew crop that water deficits and salinity associated with supra optimal temperatures are the most limiting environmental factors that affect production. Water deficit reduces extraction of nutrients from the soil, limiting the solubility of nutrients in the root environment and also alters the morphology of the root systems (Kramer and Boyer, 1995). Salinity at the germination stage inhibits water absorption at that stage. Consequently, germination in the dwarf type is affected by very high levels of salinity as it reduces the activity of enzymes responsible for nitrate reduction (Viejas *et al.,* 2004).The survival rate at the nursery stage is between 4 and 8 weeks in order to have high plant stand during transplanting. Field trials by Akinkule *et al.* (2012) using four nursery

periods of 3, 4, 8 and 12 weeks field trials in Ibadan, Nigeria for optimum growth and survival rate revealed that 4 – 8 weeks gives the best results.
In analysing the climate suitable for cashew growth, Dedzoe *et al* .(2001) maintained that it can grow in arears with luvisols, lixisols and acrisols soils; where there are seasonally wet and dry tropical climates and yield satisfactorily on well-drained light texture soils (ibid). This indicates that cashew has a very good adaptability to differences in a wide range of ecological climates. The preferred soils should have organic matter at a level of 1.4 – 30% or more with carbon content of 0.8 – 1.5% and a PH that ranges from 4.5 – 8.5% with the optimum PH value within 5.2 – 7.2 (Dedzoe *et al*, 2001). There should also be availability of elements such as nitrogen, phosphorus and potassium. With regard to planting density, Tapley (1966) recommended that the closing space should be 20ft x 20ft in order to improve yields. Thus reinforcing the reasons for which Mole (2000) also recommended that that spacing and selective thinning, labour, pest and disease controls, rehabilation of old important trees and improved cashew nut collection are crucial for improving cashew yields.

About the crop life cycle analysis, Ashitey and Nicely (2012) posited that it can reach 50 to 60 with its peak during the first 15 to 20 years after which the yields start to drop. They succinctly opined that a young cashew tree starts fruiting in the third to fourth year after planting and yields are normally at 90 – 100 kg/ha and increase to 800 – 1200kg/ha in the 10^{th} to 12^{th} year. They also contended that cashew yields range from 200kg to 800kg/ha in Ghana. However, the old varieties normally result in 200kg/ha among small holders because of poor varieties, old trees, poor spacing in addition to poor management practices (ibid).

It is instructive to note that analysis of the agronomic practices in the cashew crop sector is imperative for insurance decisions, particularly in the area of product development, marketing as well as drafting of insurance policies. This is in order to be able to include appropriate conditions, warranties and clauses in the insurance contracts with the aim of helping farmers improve their risk management techniques and also foster the development of the sector by reducing potential perils.

2.21 Economic Importance of Cashew

Cashew kernels are luxurious and nutritious commodity with steady sales. It is one of the most commercialised edible nuts on international markets (Chakravorthy, 2007; Hammed *et al.*, 2008), and among the most popular nuts because it is rich in mineral salts (Topper, 2002). Dodzoe *et al.* (2001) indicated that the bark and leaves of the cashew tree can be used in the treatment of gastro- intestinal disorders such as dysentery and diarrhoea. Resins obtained from the tree, have commercial value in the book industry. Cashew nuts are known to reduce blood cholesterol and rich in proteins, unsaturated fatty acids and soluble sugars, making them suitable for agroforestry and a plant with higher nutritional significance among the health conscious consumers (Nandi, 1998). Ashitey and Nicely (2012) maintained that cashew apples and cashew nuts are excellent sources of nutrition because the cashew apple contains vitamin C, calcium, iron and vitamin B1 and the shell contains 21% of vegetable protein, corrosive phenols which when extracted can burn the skin.No wonder it is used in the polymer – based industries for manufacturing break and clutch lining in the automotive industry. The juices from the cashew fruit can be processed into wines because its alcoholic contents hovers around 18% (Chemonics, 2002). The cashew tree is said to purify the environment by reducing the carbon concentration (Ashitey and Nicely 2012) hence can be planted in large scale to fight the incidence of climate change (CIAT, 2011). According to Ezeagu (2002), it creates employment for small holders and women apart from reducing desertification. To reinforce this, Ashitey and Nicely (2012) identified 13 cashew buying companies in Ghana and nine of which are local companies, in addition to processing companies like Mim cashew and Ghana nuts in the study area. Ashitey and Nicely (2012) also maintain that RCN exports contributed to 6.1% of GDP and to 18.2% of Ghana's agriculture GDP apart from providing jobs for about eight thousand people in the BrongAhafo region(ADF,2000).

In Ghana, cashew consumption is increasing as estimated demand for roasted cashew is about 50MT. Cashew kernels are usually roasted, seasoned with salt, packaged and branded for sales on domestic markets, hotels, retail shops, mini marts, restaurants and supermarkets whiles the rest are exported. Other products of cashew include cashew butter (Ashitey and Nicely, 2012).According to Akinkunle *et al.* (2012) and Ezeagu (2012) cashew was next to cocoa and a major source of income for small holders farmers in Nigeria. In terms of employment. In Tanzania, it is an important source of income for 280,000 small holder farmers (Mitchell, 2004). Similarly, in Ghana, factories such as Mim cashew and agricultural product factory in Asunafo north district processes cashew into brandy and cashew wines, while Nsawkaw, Sampa and Awisa cashew factories in Tain, Jaman North and Wenchi districts respectively process cashew kernels for local consumption and export. In the 1970s, Africa used to be the largest producer of cashew nuts accounting for 67.5% of the world's production (Hammed *et al.*, 2008). However, the production declined to 35.6% by 2000 and Tanzania, Mozambique and Nigeria were the largest producers (ibid). The production in Asia during the same period also rose from 26.8% to 49.5% in India, Indonesia and Vietnam, with South and Central

America also recording 4.5% in 1970 and 14.5% in 2000 with Brazil and Elsalvador being the leading producers (Hammed *et al*., 2008).

2.22 Constraints to Cashew Development

Recently, the prospects for increased production of cashew crop for local consumption and export have been on the increase (CFAO, 2009). Cashew demand is flourishing on the export market (GIZ, 2010). The nut produced is less than the demand and the cashew industry is constrained by limited access to inputs, high incidence of pests, weak FBOs and limited access to credit or working capital (Osei Tutu, 2012). The net effect is that the demand for cashew continues to outpace its supply.According to Ashitey and Nicely (2012), other constraints in the sector include: incidence of pests and diseases, weak extension services, inactive farmers' associations because farmers are widely spread, lack of seed companies to produce and supply cashew seed or grafted seedlings. Other constraints also relate to lack of labour, processing equipment, land, know-how in addition to public and private infrastructure (Kane and Sand, 1998 cited by Kane 2004). According to Wakabi (2004), Ghana has the potential to grow the cashew industry, but need support from financial instutions, who are prepared to come to their aid only when they have agricultural insurance (Osei Tutu, 2012). Other constraints include lack of skills, lack of capacity to handle large volumes of Raw Cashew Nut (RCN), inconsistent supply of raw cashew nuts and high transport costs in addition to unstable prices which are determined by the forces of demand and supply.Consequently prices of RCN vary from place to place denoting a lack of market integration. Moreover, international cashew demand and supply dynamics affect the pricing of cashew in Ghana and buyers are the determinants of prices not farmers (Ashitey and Nicely, 2012; CDP; 2010; MOFA; 2010). Another constraint the Ghanaian cashew farmer faces is how to meet the international standards with the introduction of ISO – 6477 standard introduced in 1998 based on the Brazilian and Indian taxonomy which classified cashew nuts into high premium W180 (jumbo) and W210 (large) grades. Many African countries normally produce W320 and W280 categories which attract low prices on international markets and highly priced ones are the Brazilian W180 and W210 whiles the madras nut falls between W280 and W450 categories based on international standards of classification (Handem, Anikwe and Adedeji, 2008).Moreover, lack of modern risk management instruments such as hedging in the futures market, forward contracts, and contract farming and agricultural Insurance are also constraints to the development of cashew subsector in Ghana (Ben-Houassa, 2010; Wanner, 2005; Muewwissen and Molnar, 2010),making farmers have to rely on what Fafchamps (1999) and IFAD (2010) view as traditional risk management practices to reduce exposure to shocks *ex-ante* (fear) and also to cope with shocks *ex-post* (fate) (Ben- Houssa 2010, Muewissen and Molnar, 2010, Wenner, 2005).

CHAPTER THREE METHODOLOGY AND STUDY AREA

3.0 Introduction

This chapter gives insights to the development of appropriate and sound methodology for the entire research process in order to create or extend sound empirical knowledge that will add to literature and also inform policy. It also crystallizes and contextualizes this study by exposing the methodological orientation of the study, research approach based on previous methodological review, and econometric models for the empirical analysis such as, factor analysis, Kendall's coeffient of concordance, perception index, mix logit, latent class and multinomial logit amongst others.The chapter also had description of the study area. It also presents the theoretical framework on choice experiment, in order to address the objectives of the thesis. Specification and estimation of empirical models are also discussed. The Chapter also presents the design and administratin of choice experiment survey. The chapter ends with the description of sampling design, methods of data collection and analysis.

3.1 Previous Methodological Reviews

Research is not neutral, but reflects the researchers' interest, values, abilities assumptions, aims, ambition and philosophies (Owusu-Manu, 2013). Wittingly or unwittingly, every research is based on a philosophy, particularly the philosophy of the researcher which should be informed by the philosophy of the area of knowledge or discipline, since every discipline has a way of thinking (Nosich, 2005). With the rise of various disciplines and sub-disciplines in the exploration of modern world has meant different world views and domains of knowledge, ranging from hard science, human science, applied science, business, and humanities among others. Clearly, advancing and extending knowledge require researchers to develop and demonstrate skills within the disciplines accepted methods of enquiry, thus moving from knowing about the discipline(s) to being able to function within or through it, this Pokinghorne, (2005) captures as follows:

> *The great mistake of the grand, but in the end unsuccessful, project of modernity was to assume that there is a single universal rationality that applies across board particularly in forms of scientific reductionism that seeks to cut down the rich variety of human experience into a truncated form that can be forced to fit into the procrustean bread of crass kind of physicalism. This means that we have to employ a variety of forms to fulfill the task of gaining knowledge because the entities we encounter are not of one kind (Pokinghorne, 2006; 50 and 51).*

This means that to kick start a research, one must be well vest in knowledge creation techniques, however the greatest challenge for every researcher is a choice of appropriate research methodology, since the methods must be informed by the epistemology what can be known, ontology the nature of reality and axiology the values (involving ethics and aesthetic) of the discipline and also apply the right orthodoxy and methodologies to extend knowledge in that chosen area. According to Creswell (1994), Collis and Hussey (2003), philosophical thinking revolves around epistemological, onthological and axiological assumption. EstherbySmith *et al.* (1997) maintains that the choice of the appropriate research philosophy helps to choose the right research methodology

In order to give this study intended rigour and vigour and to assess and validate the knowledge that emerges from this study in terms of its validity and reliability, there is the need to explore various methological reviews.

This is necessary because to make original contribution of knowledge, the researcher should be well informed about methodologies that underpin the cannon of knowledge in that particular area pearse (Kumar, 1995; Dainty, 2007). Consequently a methodological review becomes imperative, as it would help the researcher to identify the right orthodoxies and methodologies. Arguably this also help to broaden the perspective of the researcher in terms of the choice of research strategy, research design, data collection and data analysis techniques in order to extend knowledge in agricultural insurance literature, with particular reference to the cashew sub sector in Ghana. According to Owusu-Manu (2009) the rationale behind methodological reviews it to trace the pattern of knowledge that researchers has explored in the field over years and to detect a pattern for this study, so as to boost the confidence of researchers about the validity of their chosen methods.

This review utilised empirical literature in agricultural risk management from 2000 – 2014 based on the five point scale taxonomy developed by Pauline *et al.* (1982).

Shown in Table 3.1 are the methods employed by researchers in the area of agricultural risk management and insurance.

Table 3.1: Previous Studies Review

No	Authors	Research Emphasis	Sample	Method of Data Collection	Data Analysis Techniques
1	Akter and Brouwer (2007)	Assessment and test for commercial viability of crop insurance in Bangladesh	3599 Household heads Using systematic sampling techniques	WTP Contingent valuation method, interviews in Ten districts. Case study and focus group discussion	Descriptive statistics and chi -square
2	Mojarradi, Zamani and Zarafshani (2008)	Analysis of factors influencing farmers attitudetowards private crop insurer	385 farmers from7 towns	Structured questionnaires, surveys, interviews, pilot on 40 farmers	Descriptive statistics, Path analysis
3	Kakumamu et al. (2008)	Weather based crop insurance, concept of willingness to pay	400 farmers	Choice experiment using 8 choice set of hypothetical insurance schemes	Multinomia Logit model
4	Meuwissen, M.P.M and Molnar,T (2010)	Perception of innovativecrop insurance in Australia	Two (2) provinces Sixty (60) farmers selected from a broker.	Surveys and Structured Interviews	Factor analysis and ranking methods
5	Meuwissen, Huiren and Hardarker (2001)	Risk and risk management; an empirical analysis of Dutch livestock farmers	737 farmers	Questionnaires, survey, pilot –study on 15 farmers	Factor analysis, multiple and logistic regression
6	Patrick (1988)	Mallee Wheat farmers demand for crop insurance	68 farmers in the high risk of Australia	Direct elicitation of willingness to pay, cross sectional survey	Descriptive statistics and Tobit regression model
7	Ben Houassa	Risk, risk			

	(2010)	aversion and	362 cocoa	Survey, choice	and descriptive
		management of cocoa farmers in Western Cote	stratified sampling technique	Likhert scale	
8	McCarter (2003)	Demand for rainfall – index based insurance	48 households from each region	WTP using cross sectional data from 4 regions in Morocco	Probit and Logit regression models
9					
10	Sarris, Karfakis and Christiansen (2006)	Producer demand and warfare benefits of rainfall insurance	1849 households in Tanzania	WTP using cross sectional survey	Probit Models
	Nimo,F, Baah,K and ThamAgyekum Enock Kwame (2011)	Investigating the interest of farmers and insurance companies' interest in farm insurance. The case of Sekere west Municipal of Ghana	100 farmers and 10 insurancecom panies	Quantitative measurement by means of Questionnaires	Probit Model
11	Meuwissen et al(2011)	Income Insurance as risk management tool after 2013 CAP reforms	30 Statements on risk management and income stabilization issues evaluated by a panel of 26 experts from government and farm organisations	One day workshop in Warsaw in Augusts,2008 and statements coded in liket scales 1-4 Fully disagree to Agree	Percentages Quantitative Analysis of statements Percentages Descriptive statistics
12	Enjolras,G. and Sentis ,P(2011).	Crop Insurance Policies and Purchase in France	3,514 Farms belonging toFADN	Observations Historical data of insured farms	Logit model Cross sectional analysis and longitudinal analysis
13	Bielza DiazCaneja, M and Ganido, A(2009)	Evaluating the Potential of Whole farm insurance cover crop specific insurance policies	2representati ve farmers of Val d'Albada data based on their records	3-Crop whole insurance designed for combination of crops apicot, plums and grapes	Simulation and numerical study
		choice of risk	households, two stage	experiment, questionnaire with	statistics
		D'Ivoire	from 6 villages		
		Probit model			

14	,Erdlenbruch ,K and Foudi,S (2011)	The role of irrigation in farmers risk management strategies in France	243 observation for European farm Maize growers Accountancy data in 2006 and 2007 with farm size of 58ha in France	Historical data from	Probit Model
15	Zhou, M(2009).	Review and Research on Crop insurance System of China	569 interviews with farmers , insurers and regulators	Questionnaires	Descriptive Statistics
16	Wie,P(2012)	An Assesment of Farmers Willingness to adopt crop insurance :A case of Maize and Cassava farmers in the In sunyani municipality in Ghana	Cluster Sampling to Select 120 farmers	Questionnaire	Logistic regression model OLS
17	Nwusu, F.O et al.(2010).	Output performance among of food crop farmers under the Nigerian Agricultural Insurance Scheme in the Imo State, South East Nigeria	77 Farmers using simple random sampling	Structured Questionnaires	OLS Multiple Regression
19	Boccaletti and Deniel, M(2000)	Consumer willingness to pay for GM food products in Italy	38Consumers	CVM Questions	Probit Logit
20	Raju,S and Chand,R(2008)	Agric Insurance inIndia, Problems and Challenges	150 farmers	Questionnaires	Instability Index

Source: Researcher's construct (2012)

It is important to recognize that most of these studies in this area, employed quantitative techniques, and few employed mix approach, none of them employed pure qualitative studies, giving credence to the notion that their methods were either based on positivism (quatitative approach)or pragmatis m(Mix Methods). Moreover the research strategies employed constituted; contingent valuation methods, choice experiment ,case studies and surveys strategies whiles the design were mostly correlational (explanatory) and descriptive.With regard to the data c ollection techniques, overwhelming majority (35%) employed the use of questionnaires, to collect primary data, while 10% of the authors' also utilized historic or secondary data, 15% made direct observations of documents, with 10% utilizing focus group, while 10% employed game method and 20% utilized structured interviews to collect primary data. With regards to data analysis the tools employed were logistic regression models, probit models, Tobit models, factor analysis, path analysis, descriptive statistics, ordinary least square regression (OLS), multiple regression, However the prominent tools employed were: descriptive statistics, (30%) and Logit models (20%) after using systematic random or cluster sampling techniques to choose their sample size. Moreover only four (4) authors representing 20% had employed a single approach of analyzing data, whereas over whelming majority (16) of authors representing 80% of the methodological reviews done had utilized integrated data analytic techniques in tandem with the perspectives of Dillman, 2000; Bryman and Cramer, 2005) who succinctly opine that skilful combination of methods help researchers to reshape their thinking in a knowledge area, and become endowed with skills that makes them able to reconcile theoretical and empirical knowledge.Consequently this state of the art in research was the impetus behind the researcher's choice of triangulated data collection technique and integrated data analysis framework in order to extend knowledge in agricultural insurance using the Brong Ahafo Region of Ghana as a test case. Similarly data collection techniques employed were focus group discussions, key informant interviews, in-depth interview and questionnaires, while factor analysis, mix logit models, latent class, descriptive statistics and Kendall coefficient of concordance were employed in this studies.

3.3 Theoretical Framework for Eliciting Farmers PreferenceFor Insurance Approaches and Products

Elicitation of farmer's preference for goods and services can be a herculean task for practitioners and academicians (Castelló, 2003). Vast array of stated preference techniques have been developed for eliciting consumers' preferences and measuring willingness to pay (WTP) for goods and services (Bateman *et al*., 2002 Lee *et al.*, 2011 and De-Groote *et al.*, 2011).Notable among them are the Hedonic pricing models (HPM), Travel cost method (TCM) contingent valuation method (CVM), choice experiments (CE), discrete choice methods, experimental auctions and conjoint analysis (Owusu and Anifori, 2013; De-Groote and Alfnes, 2009; CIE, 2001 and Castelló, 2003). It is instructive to note that most of these methods either employ stated preference or revealed preference techniques. One of the key differences between the two techniques is the data origin and collection method while revealed preference data are obtained from the past behaviour of consumers, stated preference data are collected through surveys (Castelló, 2003). Moreover, revealed preference techniques are used to estimate farmers' valuation for attributes when data already exists from past behaviour of consumers, whereas stated preference techniques comprise of asking respondents to consider one or more hypothetical options and to identify their preferences through surveys. Stated preference techniques have been found to offer some advantages over revealed preference technique (Castelló, 2003). Consequently stated preference techniques are also widely used as a marketing research tool as it helps marketers to understand the value proposition of consumers their purchase decisions of a product or service the technique and also have advantages where historical data does not exist (CIE, 2001). In this study, conjoint analysis was inappropriate since theorists who fraternize with this methodology normally used it to estimate the willingness to pay for marketed goods. Following from this various stated preference techniques discussed are Travel cost method, Hedonic pricing model, contingent valuation and choice experiments are discussed below:

3.3.1Travel Cost Methods (TCM)

In this study, various Travel Cost methods (TCM) were analysed, with particular emphasis on zonal TCM, individual TCM and Random TCM. It was found out that zonal TCM was the simplest however; it uses secondary data for estimation, based on information on the number of places for selling insurance products.Travel distance and travel time are also estimated, however the assumption made in this approach is that the population in a zone are homogenous and all face the same travel cost.

This methods was rejected as the researcher cannot address the research objectives which can be met only through the collection of primary data, and this led to assessment of the individual TCM which is similar to zonal TCM, however, this method was also not appropriate for the study because of its data requirement, which fall beyond the scope of this work because it is appropriate for revealed preference technique.

Another TCM model that was analysed was the random utility TCM which assumes that individuals acts as rationalisers and would make trade-offs between quality of products and price of travel to the places of sales, but the outright rejection of this method stems from the fact that TCM models become appropriate when dealing with market goods, and consequently ruled out in this particular study. The next was the hedonic pricing model (HPM) as a lot of willingness to pay studies has been conducted with the HPM.

3.3.2 Hedonic Pricing Model (HPM)

Hedonic pricing model (HPM) according to Griffith and Nesham (2013) is normally dependent on the relationship between price, product features, and attributes and grossly rooted in the notion that the consumers make their purchase decisions based on the product characteristics such as: risk levels, basis of claim settlement, payment methods, coverage, distribution channels, among other variables with agricultural insurance for the cashew crop farmer as a reference product. The underlying theory of hedonic pricing model is anchored on the premise that for any heterogeneous products, its price is a function of its attribute. Thus the relative importance of each attribute helps dictate the price of the product. In these model consumers who are price takers are assumed to decompose the product into interior or exterior attributes, and the usefulness of each attribute is captured, ranked and priced by the consumer. Consequently hedonic pricing models offer marketers a unique framework for capturing the value proposition consumers place on products and services, and also used for tax purposes since portion of product and service that contribute to tax, can be estimated through this method of pricing products and services. In view of the aforesaid, this method becomes very useful in circumstance where a study on pricing is to inform policy and also for planning purposes (Sanders and Haight, 2012).

However, hedonic pricing model was also rejected inspite of its relevance to this study, because of its limitation in estimating actual stated preference for marketed goods, nonetheless it offered this study a framework for premium estimations, for the hypothetical agricultural insurance products developed for this study. The next stated preference techniques considered were Contingent Valuation Method and Choice experiments.

3.3.3 Contingent Valuation Method (CVM)

CVM was first used by Cirlacy-Wantrup (1974).Contingent valuation according to Green and Srinivasan as cited by Castello (2003) and Hanley *et al.* (2001) is relevant in welfare economics, specifically in the neo-classical concept of individual utility maximization. In this approach, respondents are asked to express their maximum willingness to pay for, or their minimum willingness to accept for the change in the level of attributes and features of a range of hypothetical products, in a hypothetical market situation. CVM can be used to elicit the maximum WTP for a hypothetical product and also provide answers to questions relating to respondents socio-economic characteristics that influence preference for non-market goods. This methodology thrives on the assumption that customers have an idea of the amount of money they are willing to pay for the hypothetical product under consideration, and will report their true value, if survey was optimally designed (Venkatachalam, 2003; Viladrich-Grau, M, 2005). Also CVM technique uses techniques such as Bidding game, payment card (PC) openended (OE) and dichotomous choice (DC) approach which is further divided into single – bound dichotomous choice and double bound dichotomous choice and triple bounded dichotomous choice which is an extension of the double-bounded DC (Batman *et al.*, Boyle *et al.*, 1996; Christie, 2007; and Christies, 2009).These techniques are usually analysed with Tobit models or logit models. Koistinen (2010) noted that, due to the complications of eliciting values using an open-ended question; several CV studies are now undertaken using the referendum or dichotomous choice elicitation. The preference data generated using this method normally employ dummy variables, as respondents are only given the option of answering 'yes' or 'no', which denote the application of random utility function.

Potential weakness of CVM is that it may induce some respondents to behave strategically, particularly when public goods are involved (Castello, 2003). Also respondents may find openended questions too difficult to answer because they are not familiar to paying for nonmarket goods and services (CIE, 2001).

Initially the study considered bidding game in tenets with the proposition made by Randall *et al.* (1974) who posit that bidding game work well in developing countries, however it was rejected due to its utilization of mailing surveys which would be impractical in the rural communities of the study area (Loomis,1990). Again, CVM methods have received a lot of criticism in terms of validity in terms of accuracy and reliability (Venkatechalm, 2003). CIE (2001) reported that, the open-ended CV method is now seldom used since it is prone to an array of biases such as: implied cue bias, starting point bias, benefit aggregation, scenario misspecification. Besides CVM studies is affected by a lot of errors, notably among them are embedding effect that is frequently reported in many CV studies (Bateman *et al*, 1997) , others include 'question order bias'. Again the nature of market created in a contingent valuation survey in a hypothetical setting make it vulnerable to "hypothetical bias" which is the divergence between real and non market goods, (Venkatachalam, 2003). Consequently the study also rejected CVM methods. What appears to be the most general and broadly accepted classification of stated preference techniques are multi-attribute valuation techniques (MAV) which include conjoint analysis and choice modeling approaches but conjoint analysis is normally used for market goods(CIE, 2001).

3.3.4. Choice Experiments

According to Lusk and Schroeder (2004), choice experiment comprises of numerous choice sets with two or more products, which in this study are hypothetical insurances presented to the respondents. These hypothetical insurance products differ in their levels of attributes:

such as, price, basis of claim's settlement, the type of risk covered among others. Choice experiments are mostly used by researchers to evaluate the value of products or trade-offs between product attributes in situations where market data are non-existent or unreliable

(Schroeder *et al.,* 2003). In choice experiments much emphasis is placed on the combination of various attributes and their levels and consequently use for designing multi-dimensional policies, conflicts resolution and negotiations over the use of non- market goods (Bateman *et al.,* 2002 and Mogas *et al.,* 2006). Also, individual choice sets are typically framed in a manner that closely relates to cashew crop farmers purchasing decisions, and perceived to be less prone to the drawbacks of contingent valuation method prominent among them is hypothetical bias in WTP estimates. Besides choice experiment consider several hypothetical insurance products simultaneously described in terms of their attributes and their levels.Consequently, choice experiment was the most preferred Multi attribute (MVA) stated preference technique for this study.

3.4.Conceptual Framework for Choice Modelling for Insurance Approaches

Choice Modelling is regarded as the most suitable method for estimating consumers' willingness to pay when multi-dimensional products are involved (CIE, 2001).Lisesivaara and Myräi (2014); Kakumawu *et al*. (2014) also employed it to measure willingness to pay for agricultural insurance products. In this approach, respondents were presented with different alternative descriptions of insurance packages, differentiated by their attributes and levels and are asked to choose from different alternatives, particularly their most preferred. Prices are normally included as one of the attributes of hypothetical products such that the WTP can be indirectly ascertained from respondent's rankings, ratings or choices (Bateman *et al*., 2002; CIE, 2001).Choice experiments therefore allowtrade-offs among alternatives by minicking realistic purchasing situations and allowing evaluation of multiple attributes (Lusk *et al*., 2003).Thus choice experiment allows various hypothetical agricultural insurance choices sets based on index, indemnity, simulation, benchmarking and functional synthesis approaches or philosophies to be presented to respondents which are cashew farmers, head of credits and stakeholders of GAIP.

The decision rule is that hypothetical products alternatives must differ in the levels of their attributes. This helps to determine the demand, preferences and willingness to pay (WTP) for such products in a hypothetical markets situation.

WTP is derived indirectly and does not involve explicitly probing for monetary valuations and the willingness to pay amount (Bateman *et al*., 2002). Accordingly, it can either be binary or multinomial, denoting that respondents can be asked to choose between ranks or rate of multiple hypothetical agricultural insurance products differentiated by the level of attributes of the product (CIE, 2001). Moreover, in choice experiments several attribute levels can be varied simultaneously making it similar to a real buying situation compared to other methods for analysing WTP (Holmes and Adamowicz, 2003; Hensher *et al* ., 2005 ;MacKerron *et al* ., 2009).It minimizes hypothetical bias (Hensher*et al.*, 2005). The choices farmers make between alternatives reveals their relative implicit preferences for the particular insurance product attributes according to random utility theory. The study incorporated cashew farmers' willingness to pay for five different attributes of agricultural insurance presented in Table 3.3

Attributes	Attribute level
Insurance philosophies and their products	Functional Synthesis
	Index
	Benchmarking
	Simulations
	Indemnity
Duration	Annually Quarterly
Payment mode	Cash mode
	Bank mode
Methods of loss assessment	Weather station
	Satilite stations
	Triggers on selected farms
	Detailed farm visits
Key insured perils	Fire
	High temperature Excess rain fall
	High Wind speed
	GH¢116.97

Price/insurance product/year	GH¢100.46 GH¢119.46 GH¢116.97 GH¢53.4

Table 3.3 Insurance attributes and attribute levels in choice experiment

Source: Author's construct, 2011

Table 3.3 summarizes the attributes and attribute levels evaluated in the choice experiments for respondents including cashew farmers, financial institutions and Ghana Agricultural Insurance Pool Stakeholders. The farmer was then probed to choose one of the alternative choice scenarios or a possible no-choice option. The experimental design of the choice sets, or the combination of the attribute levels into different choice scenarios was determined using an experimental design to create choice sets. A full factorial design which includes all possible combinations of the attributes would yield large number of choice sets. Since it is not practically feasible to work with such a large number of choice sets, an orthogonal main effects design combined with a blocking strategy was generated, which resulted in 18 choice grouped under five insurance philosophies or approaches namely: Index , Indemnity, Simulation, Benchmarking and Functional synthesis approach.

3.5. Econometric Models and Tools for Analysis for this Study

This section is devoted to discussions on Mix logit, Latent class and Multinomial logit models that were applied to gauge farmers' fianánciers and insurers preferences and utilities of hypothetical agricultural insurance product attributes modelled for various insurance approaches or philosophies. Perception Index and Factor Analysis as a tools used in idenfying risk perception as well as the perception towards agricultural insurance by cashew farmers in the study area were also discussed. Kendall's coefficient of concordance which was used to indentify and rank the constraints the will impede both insurance and cashew development was also discussed under this section.

3.5.1 Mixed Logit Model

The mixed logit model is employed in the study to estimate cashew farmers' heterogeneous preferences for agricultural insurance products, because recent literature on willingness to pay studies suggests preference heterogeneity exists among farmers (Olynk *et al*., 2010). Therefore, it was appropriate to employ a model that allows heterogeneous preferences (Tonsor *et al*., 2005, Olynk *et al*., 2010). Moreover, mixed logit estimates are devoid of the independence of irrelevant alternatives (IIA) assumption and allows correlation in unobserved factors over time, thus, eliminating three limitations of standard logit models (Train, 2003; Tonsor *et al*, 2005) including conditional logit model which assumes a homogeneous preference for consumers resulting in bias estimates (Lusk *et al*.,2003). In this regard the utility decision maker n obtains from choosing alternative j is given by

$$U_{nj} = V_{nj} + \varepsilon_{nj} \qquad (3.1)$$

Where V_{nj} a function of observable attributes of the alternatives, X_{nj}, of the decision maker, Z_n and ε_{nj} is unknown and treated as random. According to Hole (2013), various assumptions can be made about the distribution of the error term. If we make the assumption that the random terms are independently and identically distributed (IID), we obtain the conditional logit model. The mixed logit model however overcomes these limitations by allowing the coefficients in the model to vary across decision makers. The mixed logit choice probability is given by:

$$P_{ni} = \int \frac{\exp(x'_{ni}\beta)}{\sum_{j=1}^{J}\exp(x'_{nj}\beta)} f(\beta/\theta)\, d\beta \qquad (3.2)$$

The mixed logit model for this study which included only choice specific attributes was specified as follows:

$$Choice = \beta_1 index + \beta_2 indemnity + \beta_3 functional + \beta_4 simulations + \beta_5 benchmarking + \beta_6 annually + \beta_7 cash + \beta_8 price + \varepsilon \quad (3.3)$$

The value the cash crop farmer place on the various attributes differentiating the insurance products can be determined using the model estimates. For a given insurance product attribute, the willingness to pay estimate is given by the negative ratio of the alternativespecific coefficient to the price coefficient (β_j/β_{price}). The average WTP estimate is said to be a representative for the entire cashew farmers chosen for the study, if the standard deviations of the insurance product alternative coefficients are not statistically different from zero. If the standard deviations of insurance product alternative coefficients are statistically significant, then it means preference heterogeneity exists among the farmers and average WTP estimates cannot be interpreted as being representative of the population (Tonsor *et al*., 2005).Though the mix logit is good at estimating heterogeneous preference of consumers, it fails to explain the sources of heterogeneity (Boxall and Adamowicz, 2002). Literature suggests latent class estimation approach allows respondents to be grouped into different distinct classes with each class having similar or homogenous preference.

3.5.2. Latent Class Model estimation techniques

In the latent class estimations, first the conditional logit model is estimated to test whether it fits the data better (Hole, 2008). The log-likelihood ratio test is employed to test the null hypothesis that the conditional logit model fits the data better. If the null hypothesis was rejected, then mixed logit model is specified with n replications. The standard deviation estimates of the mixed logit tests the existence of preference heterogeneity but does not indicate the class membership or sources of heterogeneity. Hence we proceed to specify the latent class model but prior to that, the number of classes must be determined.

According to Pacifico and Yoo (2012), the number of classes is determined by estimating the model with different number of classes, say from 2 to 10. Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) for each class are normally predicted and the class that yields the lowest AIC and BIC information criteria is the optimal class (Boxall & Adamowicz, 2002).

A unique identity (ID) and grouping (GP) variables must be generated and included in the empirical specification. Empirically, our latent class model was specified as:

$$Choice = \beta_n index + \beta_n indemnity + \beta_n functional + \beta_n simulations + \beta_n benchmarking + \beta_n quarterly + \beta_n cash + \beta_n price + \beta_i age + \beta_i ag\_training + \beta_i Hhead + \beta_i Hsize + \beta_i F\_years + \beta_i Farm\_size + \beta_i Farm\_age + \beta_i male\_edu + \beta_i years\_edu + \beta_i Family\_land + \beta_i Family\_labour + \beta_i Insur\_fire + \beta_i Insur\_rich + \beta_i Insur\_delay + \beta_i Insur\_trust + \beta_i Insur\_h\_prem \quad (3.4)$$

Where *n* attached to the coefficients represents the number of latent classes to be estimated. The definitions and measurements of the utility and class membership estimates are presented in Table 3.4

3.5.3. Multinomial Logit Model

Based on Lancaster the characteristics methodology and random utility theory discussed, multinomial logit model was used to determine the determinants of each of the insurance approach or philosophy. In selecting any of the insurance approaches or philosophies, the farmer considers the costs and benefits associated with the use of the insurance products and how it would lead to maximization of their utilities. The multinomial logit can be expressed as:

$$Y_{ij*} = X_i \beta_j' + \varepsilon \quad (3.5)$$

Where X_i denotes the vector of observations on the variable *X* for farmer *i*, and β'_j are parameters to be estimated and ε is the error term respectively. In equation (3.5), Y^* is not observed; instead we observe the choice made by the farmer. Each respondent will fall into the category, for $j = 0,1...4$ with some probability. Let P

$P_{j0},...P_{j4}$ be the probabilities associated with these possible choices of hypothetical insurance products based on five insurance philosophies or approaches available to the farmers. The probability P_{ij} of a farmer using a particular alterative is conceptualised to depend on variable X_i and with assuming a logistic distribution. The probability of a respondent *i* using a particular option *j* can be presented in a multinomial logit form as:

$$P_{ij} = \frac{e^{x_i \beta_j'}}{\sum_{j=0}^{m} e^{x_i \beta_j'}} \quad j = 0,...m \quad (3.6)$$

Where $m = 4$ the likelihood function for the multinomial logit model can be written as:

$L \; {}_{iN\,1} \; P_{i0yi0} \ldots P_{i5yij}$ (3.7) Equation (3.7) gives multinomial density function for one observation while equation (3.8) gives the likelihood function for a sample of N independent observations with j alternative option is presented as:

$$L_N = \prod_{i=1}^{N} \prod_{m=0} y_{ij} \ln P_{ij} \qquad (3.8)$$

The log like likelihood function can be re-formulated as:

$$L = \ln L_N = \sum_{i=1}^{N} \sum_{m=0} y \ln P_{ij} \qquad (3.9)$$

Where Pij is a function of parameters β, with first order condition for the MLE of $\hat{\beta}$ as:

$$\frac{\partial L}{\partial \beta} = \sum_{i=1}^{N} \sum_{j=0}^{m} \frac{y_{ij}}{p_{ij}} \frac{\partial p_{ij}}{\partial \beta} = 0 \qquad (3.10)$$

The probability of a farmer selecting the first option (base category) $j = 0$ has been normalised to zero since all the probabilities must sum up to 1 (Maddala, 1999; Green, 2000). Therefore, out of the five insurance approaches, only four distinct sets of parameters are identified and estimated. Empirically, the multinomial logit model is specified as:

$$P_{i0} = \frac{1}{1 + \sum_{j=0} \exp(\beta'_j X_i)} \text{ for } j = 0 \qquad (3.11)$$

The probability of the respondent using any of the alternatives instead of the base category is given by

$$P_{ij^*} = \frac{\exp(\beta'_j X^*_i)}{1 + \sum_{j^*=1}^{4} \exp(\beta'_j X^*_i)} \text{ for } j = 1,2,3,\text{and} 4 \qquad (3.12)$$

The estimated coefficient for each choice therefore reflects the effect of X_i on the likelihood of the respondent's choice for that insurance product relative to the reference option (Simulation insurance). Substituting the explanatory variables, the multinomial logit model is specified as:

$$ChoiceIns = \beta_i age + \beta_i Ag\_training + \beta_i Hhead + \beta_i Hsize + \beta_i F\_years + \beta_i F\_size + \beta_i F\_age$$
$$+ \beta_i Male + \beta_i du\ \beta_i years\_edu + \beta_i Family\ land\_ + \beta_i Family\ labour\_ + \beta_i Insur\_fire$$

$$ {}_{i}Insur\_delay \quad {}_{i}Insur\_trust \quad {}_{i}Insur\_h\_prem \qquad 3.13 $$

Variable	Definitions and measurement	Apriori sign
Choice	1 if a farmer chooses an alternative from the insurance choice set, 0 otherwise	Dependent variable
ChoiceIns	0 if simulation, 1 if index, 2 if indemnity, 3 if benchmarking, 4 if functional synthesis	Dependent variable
Price	Price in GH¢ for insurance per acre/ year	-
Functional	1 if farmer prefers functional synthesis, 0 otherwise	+
Indemnity	1 if farmer prefers indemnity, 0 otherwise	+
Benchmarking	1 if farmer prefers benchmarking, 0 otherwise	-
Simulation	1 if farmer prefers simulation, 0 otherwise	+
Mode	Mode of payment. 1 if cash, 0 if bank	+
Duration	1 if quarterly, 0 if annually	+
Price	Price in GH¢	-
Age	Age of farmer in years	+
Ag_training	1 if farmer receives agricultural training, 0 otherwise	+
Hhead	1 if farmer is the head of household, 0 otherwise	+
Hsize	Household size in numbers	-
F_years	Years of farming	+
Farm_size	Farm size in acres	+
Farm_age	Age of cashew farm	+
Male_du	1 if farmer is male, 0 if female	+
Years_edu	Years of formal education	+
Family_land	1 if farmer uses family land, 0 if rented land	+
Family_labor	1 if farmer uses family labour, 0 if hired labour	+
Insur_fire	1 if farmer perceives insurance as inviting fire, 0 otherwise	-
Insur_delay	1 if farmer agrees insurance companies delay in payment of claims, 0 otherwise	-
Insur_trust	1 if farmer trust insurance to be fair, 0 otherwise	+
Insur_h_prem	1 if farmer agrees insurance premiums are high, 0 otherwise	-

Table 3.4 Definitions and measurement of variables in the models

Source : Author's Construct, 2011

3.6. Factor Analysis

Factor analysis is a standard mathematical procedure used for data reduction and structure detection. The fundamental concept underlying factor analysis is its ability to analyse relationship among several variables to reveal conjectural constructs of the relationships (Kreuger and Neumann, 2003). The process of performing factor analysis starts with a correlation matrix, in which the intercorrelations between the variables under study are presented. The dimensionality of this matrix can be reduced by "looking for variables that correlate highly with a group of other variables, but correlate very badly with variables outside of that group" (Field, 2000). These variables with high intercorrelations could well measure one underlying variable, which is called a 'factor'.

Communality of a variable represents the proportion of the variance in that variable that can be accounted for by all ('common') extracted factors. The decision rule about communality values is that; extracted values (eigenvalues) of more than 0.50 at the initial iteration indicates that the variable is significant; and should be included in the data for further analysis or otherwise removed (Field, 2005a, b). The extraction of principal components or factors in principal component analysis takes place by calculating the eigenvalues of the matrix. According to Rietveld and Van Hout (1993), the number of positive Eigen values determines the number of factors or components to be extracted. This implies that the construction of the factor itself is then calculated via a transformation matrix that is determined by the eigenvectors of the eigenvalues (Rietveld and Van Hout 1993). Factor loadings is done simply by calculating the correlations between the original variables and the newly obtained factors or components .However this may not always lead to the right solutions, as it is possible to obtain eigenvalue that are positive but very close to zero. Therefore, some rules of thumb have been suggested for determining how many factors should be retained (Field 2000; Rietveld and Van Hout 1993: 273-274): Here the decision rules are as follows:

1. Retain only those factors with an eigenvalue larger than 1 (Guttman-Kaiser rule);
2. Keep the factors which, in total, account for about 70-80% of the variance;
3. Make a scree-plot; keep all factors before the breaking point or elbow.

Components with Eigenvalues greater than 1.0 were extracted using the factor loading of 0.50 as the cut-off point. In this study 79.1% cumulatively explained components with Eigenvalues greater than 1.0 were extracted using the factor loading of 0.50 as the cut-off point. According to Norusis (1988) and Dogbegah *et al.,* (2011) the ability to interpret the results of principal component analysis can be improved through rotation. SPSS offers five kinds of rotations known as: varimax, quartimax, equamax, direct oblimin and promax. The first three options are orthogonal rotation while the last two are oblique.To decide which type of rotation to undertake Field (2000: 439) contended that, “the choice of rotation depends on whether there is a good theoretical framework to suggest that the factors should be related or independent and also determine how should be clustered the variables cluster on the factors before rotation”. In this regard, a fairly straightforward way to decide which rotation to take is to carry out the analysis using both types of rotation; “if the oblique rotation demonstrates a negligible correlation between the extracted factors then it is reasonable to use the orthogonally rotated solution” (Field 2000: 439). However, varimax is mostly used in orthogonal rotation and direct oblimin in oblique rotation.In orthogonal rotation, there is no correlation between the extracted factors, but correlation exists in oblique rotation. As noted by Chris (2004), results after factor rotation indicate the amount of variance between the variables that each factor accounts for and provides loadings of all the variables on each factor (Ibid). If several factors have high loadings on the same variables, rotation can best be explained by imagining factors as axes in a graph, on which the original variables load and by rotating these axes, then, it is possible to make clusters of variables load optimally to undergo orthogonal and oblique rotation.

Orthogonal rotation results in a factor matrix that presents the ‘post-rotation’ loadings of the original variables on the extracted factors, and a transformation matrix that gives information about the angle of rotation. In oblique rotation, the results are a pattern matrix, structure matrix, and a component correlation matrix. The pattern matrix presents the ‘pattern loadings’ (regression coefficients of the variable on each of the factors”; Rietveld and Van Hout 1993: 281) while the structure matrix presents ‘structure loadings’ (“correlations between the variables and the factors” (ibid.); however, the pattern matrix is used to interpret the factors in most situations. Hence, rotation was done to achieve a simple structure from the large loadings factors in absolute value for some of the variables, making it easier to identify and interpret them.

In this study factor analysis was used to identify dominant risk factors from the cashew crop farmers’ perspective, and also group the risk factors into various components. In applying the latent root criterion, three (3) components were extracted in this study.

3.7 Probalilities and Risk Attitude Estimation techniques

The Probabilities of the occurrence of each risk factor was estimated to give an idea of the likelihood of the risk factors affecting cashew crop as well as the farmers’ income for the past five years. The probability was measured based on the highest ranking value, thus virtually certain representing 7. The higher the probability close to 1, the certainty of respondent to the effect of the factor on cashew crop, and the lower the probability value, the less likely, the factor will affect the cashew crop. This was measured by summing up the scores of the 398 respondents for each risk factor divided by the product of the highest degree of ranking and valid number respondents. The expected total score for each risk factor by 398 valid respondents was 2786, (ie,398 7 2786). Below was the formula used to calculate for the probability of occurrence:

$$P = \frac{\sum a n}{7 N} \qquad (3.14)$$

Where; *a* is the constant expressing weighting given to each response (ranges from 1 for extremely unlikely up to 7 for virtually certain), *n* is the frequency of the responses, and *N* is total number of responses. On the effect column, respondents indicated that the effect is on their income, thus, "affect us" from that 1st factor to the 22nd factor. This was done to identify whether risk factors affected cashew crop farmers income from the past five years in the study area.

Also following Nmadu *et al*. (2012), Cashew crop Farmers risk attitude was determined, based on a three point Likert scale, which was constructed, and respondents with an average of 1 to 1.99 were classified as Risk Averse, those with an average of 2 classified as Risk Neutral and those with an average of 2.01 to 3 classified as risk lovers.

3.8 Perception Index Estimation Procedure

Cashew farmers' perception and attitutided towards agricultural insurance was gauged using perception indices. In this approach perception statements considered in the study were measured on 5-Point Likert scales starting from strongly disagree to strongly agree. The Likert scale responses were coded as
-1=strongly disagree, -0.5=disagree, 0-neutral, 0.5=agree and 1=strongly agree. The mean scores from the responses are calculated as:

$$\text{Mean score} = \frac{(Frequency_1 \times code_1) + \ldots + (frequency_5 \times code_5)}{N} \qquad (3.15)$$

The overall perception index is calculated by summing the estimated mean scores over the number of items or statements (n). This is specified as:

$$\textit{Perception index} = \frac{\textit{Meanscore}}{n} \qquad (3.16)$$

Where n refers to the number of perception statements.

3.9 Constraint Analysis

There are several methods for conducting constraint analysis. From literature constraints can be ranked and some ranking techniques are Pearson's correlation coefficient, the spearman rank correlation, Garrett's ranking techniques, Friedman's two-way analysis of variance, and Kendall's coefficient of concordance. Pearson's correlation is used for interval data, if normal distribution of variables being considered is in ranks. Spearman rank correlation or Kendall's correlation coefficient can be used when the variables are collected as interval or ordinal (Rodgers and Nicewander, 1988). It is important to recognize that there is a close relation between Friedman's test and Kendall's coefficient of concordance (Legendre, 2005). Though they both address the hypotheses concerning the same data and useses Chi square test for testing, they differ in the formulation of their respective hypothesis. Whereas Friedman's test focuses on the items being ranked, Kendall's test focuses on respondents or rankers themselves. Garrett's ranking score techniques on the other hand uses average score of the rankers and arrange them in either ascending or descending order.

The disadvantage of the Garrett's ranking technique is that it involves several steps and does not test the level of agreements between rankers. Kendall's coefficient of concordance is employed for this study because the Kendall's W provides the test of agreement of the respondents among their rankings which is the limitation of Friedman's and Garrett's.

Kendall's coefficient of concordance measures the strength of relation in a direct and easily understood way. Kendall's coefficient is simple to interpret than Spearman coefficient and can be computed from the actual observation without first converting them to ranks (Edward, 1964). Kendall's coefficient of concordance measures the degree of agreement among respondents when a number of constraints are to be ranked. According to Mattson (1986) Kendall's coefficient of concordance is an index that measures the ratio of the observed variance of the sum of ranks to the maximum possible variance of sum of ranks.

In this study,the degree of agreement or concordance between a given set of constraint to agricultural insurance and cashew development were identified are ranked.The identified constraints were ranked on liket scale from the most pressing to the least pressing using numbers: 1,2,3,4,....*n* in that order. Computing the total rank score for each constraint, the constraint the the highest score is ranked as the most pressing, whilst the one with the lowest score is ranked as the least pressing. The rank scores computed are then used to calculate the coefficient of concordance W , to obtain the degree of agreement in the rankings. The coefficient of concordance W ranges from zero (0) to one (1). It will be 1 when the ranks assigned by each respondent are exactly the same as those assigned by other respondents and it will be 0 when there is a maximum disagreement among the respondents. If T represents the sum of ranks for each constraint being ranked, the variance of the sum of ranks is found by the formula;

$$VarT = \frac{\sum T^2 - \left(\sum T\right)^2 / n}{n} \qquad (3.17)$$

The maximum variance of T is then given by;

$$\frac{m^2\left(n^2 - 1\right)}{12} \qquad (3.18)$$

Where 'm' is the set of rankers (farmers) and 'n' is the number of constraints being ranked. The formula for the coefficient of concordance (W) is computed as:

$$W = \frac{\left[\sum T^2 - \left(\sum T\right)^2 / n\right] / n}{m^2\left(n^2 - 1\right) / 12} \qquad (3.19)$$

The is simplified as;

$$W = \frac{12\left[\sum T^2 - \left(\sum T\right)^2 / n\right]}{nm^2\left(n^2 - 1\right)} \qquad (3.20)$$

Where: T = sum of ranks for each constraint.
m = number of rankers (farmers).

n = the number of constraints being ranked

Hypotheses and Significant Test for W: (F – Test)

H_0: There is no agreement among the rankings of the constraints by respondents.

H_A: There is an agreement among the rankings of the constraints by respondents.

Where H_0 and H_A denote null and alternate hypotheses respectively.

The coefficient of concordance (W) may be tested for significance in terms of the F – distribution.

The F – ratio is given by;

$$F - ratio = \frac{(m-1)Wc}{(1 - Wc)} \qquad (3.21)$$

Wc Is the calculated Kendall's Coefficient of Concordance (*W*) (Edwards, 1964).

3.10. Statement of Hypotheses

Hypothesis	Reference

1. Cashew farmers are heterogeneous in their preferences for insurance products.	Olynk *et al.*,(2010);Tonsor *et al*.,(2005)
2. Price of insurance products will have negative influence on farmers' willingness to pay.	Jehu-Appiah(2011); Bierer and Eling(2012
3. The type of insurance product significantly influences farmers' choice of agricultural insurance.	Jehu-Appiah(2011), Black and Dorfman(2000)
4. Farmers' socio-demographic characteristics and institutional factors such as age, gender, educational level, farming experience and being head of household, access to agricultural training and tenure will have positive or negative influence and farmers' preferences and willingness to pay for agricultural insurance whereas household size is expected to have a negative influence.	Jehu-Appiah(2011),Ben-Houssa(2010) ,Chankora *et al.(*2008), Brugiavani and Pace(2011)
5. Farm characteristics such as farm size, age of farm, agricultural training and tenure, exert a positive influence farmers' choice of agricultural insurance products.	Atker and Brouwer(2007), Sherrick *et al.,* (2004)
6. Farmers' perception of insurance companies will exert a positive or negative influence their preferences and willingness to pay for agricultural insurance.	Jehu-Appiah (2011);
7. Farmers' trust in insurers will exert a positive influence on farmers' preference and willingness to pay agricultural insurance.	Jehu-Appiah (2011); Atim and Sock(2000)
8. Product type exert both positive and negative influence on farmers choice.	Jehu-Appiah(2011); Bierer and Eling(2012)
9. Higher preferences and willingness to pay exist for functional synthesis insurance approach.	

Source, Authors formulation base on literature, 2014

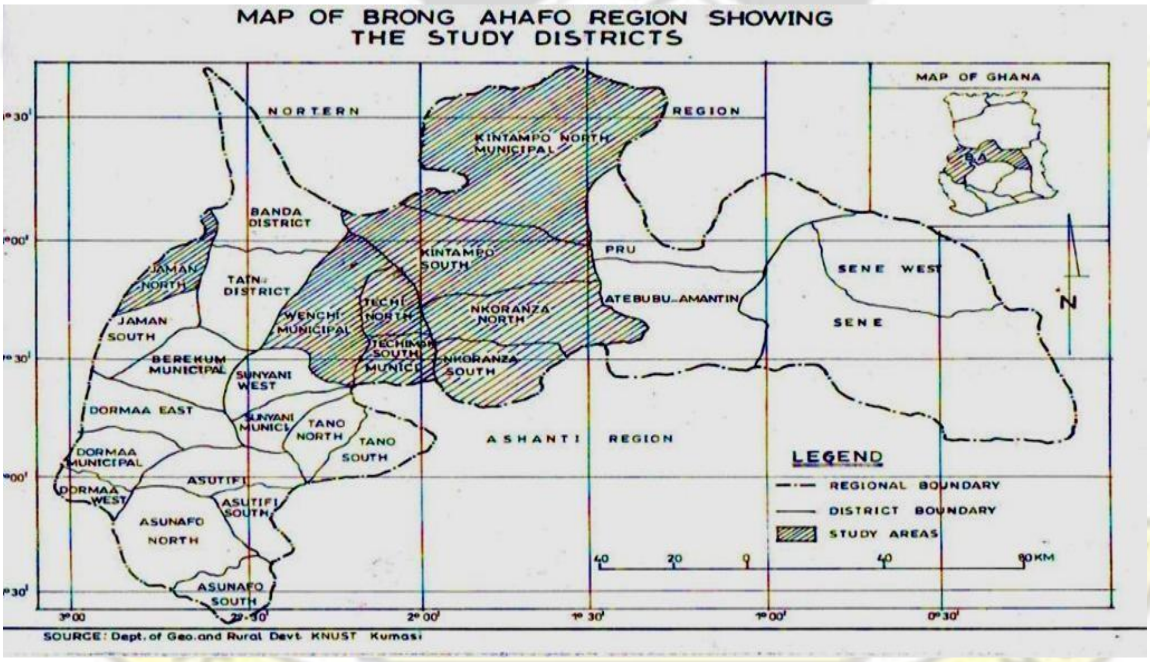
3.11 Discription of the Study Area

The study was conducted in the Brong-Ahafo Region of Ghana, the second largest region in Ghana with a land area of 39,558km^2, constituting 16.6% of the country's total land area.

The region was considered suitable for the study out of a lot cashew growing areas, because of the presences of the highest number of selected weather stations for insurance purpose in Ghana. Besides a study done by International Centre for Tropical Agriculture (CIAT) using a maximum entropy (MAXENT) crop prediction model, with the aid of G.P.S, MAPS, expert knowledge employing a maximum likelihood estimation methods for the correlation between precipitation and temperature rightly predicted that climate change in 2030 will make most districts in Brong Ahafo Region of Ghana favourable for cashew production.

The region has 27 administrative and political districts and the dominant ethnic group is the Akan. The regional capital is Sunyani and is the home of the regional directorate and MoFA has a directorate in each of the regional directorate of agriculture in the region. Also the region is located within longitude 0^0 15'E – 3 'W and latitude 8 45'N – 7 30's in the central part of Ghana. Moreover, the region has varied vegetative cover raging from forest, transition to savannah and rainfall is bimodal also known as double maxima, stretching across the region, however, there is a gradual decrease of rainfall from the south where average rainfall is well over 1651mm, but the average annual rainfall of 1,088mm – 1,197mm making the region suitable for cashew production. It also interesting to note that the climate in the region reflects that of a tropic, the temperature is generally high averaging over 23.9 ^{0}c (75 ^{0}F) making it suitable for cashew production (Dedzo *et al.*, 2001, Mole 2001) and the relative humidit y in the region is also quite high that is an average of 75%, and higher in wet season, but lower in dry seasons.

Figure 3.1 Map of Brong Ahafo Region Showing the Study Districts



Source: Geo and Rural Dept., KNUST, Kumasi, 2013

0 0 0

The soils in the region, are mainly three types namely: i. forest ochrosols covering the southern-western part, ii, savanna ochrosols which stretches from the west and narrows towards the east and iii, ground water latent ochrosols inter which integrates in the northern part of the region in addition to small patches of Oxysols and Ribnsols (Obeng,2000).These unique features of the soils in addition to the variations in the type of vegetation give rise to variations in the type of economic activities in the region which is revealed in the taxonomy of crops cultivated in the region as follows; staple crops, maize, cassava, plantain, yam cocoyam, cash crops, cashew, cocoa, cotton, tobacco, coffee, oil palm, mango potentially important crops; rice, pineapple, watermelon, citric and soya, VegeTables: tomato, chilli, garden eggs, okra, onion, cabbage and lettus (Obeng, 2000; MoFA, 2011).

According to Ghana Statistical Services (2005), about 819,190 persons, representing 79.2 per cent of the population in the region are economically active. However, about two-thirds (66.4%) are engaged in Agriculture, out of which eight thousand are into cashew production.Others are engaged as cashew farm labourers and its ancillary activities.

The moist deciduous forest zones are used for the production of cashew and cocoa.Though some indigenes engage in aquaculture production, crop production accounts for 70% and arable land in the region is 23, 734km^2 (60%) of land area. Min Cashew and Ghana nuts are cashew processing companies found in the Region. With regard to the population growth, it has been growing at a steady rate. For instance, in 1960 when the region was created the population was 587,920 and increased to 766,509 in 1970 which equates to 30% increase with a growth rate of 2.7% in 10yrs (GSS, 2012). According to Mofa, the major constraint of agriculture in the region is lack of long-term access of credit. (www.ghana.gov.gh, www.modernGhana.com,soilresearch institute, CSIR-Kumasi, accessed on 28/01/2014).

3.12. Research Design and strategy adopted

The strategy adopted in this study is the cross sectional survey utilizing exploratory, descriptive and explanation design. According to Estherby- Smith (2000), a different research tradition enables a researcher to cater for constraints. Also these traditions were chosen as they involve the utilization of both qualitative and quantitative techniques, inherent in the pragmatic research ontology which is the nature of reality, this study seeks to utilize in achieving the objectives of this study, and also add to empirical literature.

3.13. Types and Sources of Data

This study utilized both primary and secondary data obtained from primary and secondary sources. Primary data were sourced from Cashew farmers, Financial Institutions(GAIP), made up of Stake holders of Ghana Agricultural Insurance Pool management such as Technical Management(TMU), GAIP's Management Board Members(MB), Technical Committee of Agricultural Insurance(TCAI) as well as Steering Committee of members of Agricultural Insurance(SC) while secondary data information were obtained from peer reviewed academic journals, Ghana Agricultural Insurance Pool's report, books on agricultural insurance, National Insurance commission's reports, in addition to documents and text books and reports from IIPACC project of GIZ in Ghana.

3.14. The population of the study

The population of the study constitutes all cashew crop farmers in the cashew growing districts and communities in the Brong Ahafo Region of Ghana, stakeholders of Ghana Agricultural Insurance Pool (GAIP) including the technical management unit (TMU) Technical Committee of Agricultural Insurance (TCAI), steering committee, member (SC).

Also, heads of credit of financial institutions in the study area form part of the population.

3.15. Sampling techniques and sample size determination

Utilizing Barttlett *et al*. (2001) samples size determination method given by:

$$n = \frac{s^2(x)(y)}{E^2} \qquad (3.22)$$

Where n = sample size, S =value for selected level of 0.025 in each tail =1.96(the alpha level of 0.05indicates the level of risk the researcher is willing to take that true margin of error may exceed the allowable margin of error), X= proportion of population who have access to financial services. GSS(2008) reports that 42% of rural dwellers have access to financial services. Y=proportion of population who do not have access to financial services, E= acceptable margin of error =0.05, was computed as:

$$n = \frac{1.96^2 \times 0.42 \times 0.542}{0.05^2} = 374$$

This estimation method helped the researcher to arrive at a minimum sample size of 374 for cashew farmers in the study area. However, to improve the response rate and also correct for sampling errors, a contingency of 10.95% was added to arrive at a sample size of 420 for cashew crop farmers in the study area. A multi-stage sampling technique was employed in the selection of the respondents because of the multiplicity of techniques that tend to overcome the weakness in one stage sampling (Owusu Manu, 2013). The first stage involved purposively selecting the Brong-Ahafo Region for the study, since it is the region with the highest number of weather stations and has been identified for cashew development in order to mitigate the effect of climate change from 2030 and beyond (CIAT, 2011; Mania, 2004).The second stage also involved the use of simple random in selecting seven (7) districts where cashew production is a vibrant economic activity in the region. The third stage involved the use of simple random sampling technique to select twenty (20) respondents from each selected communities in the districts.A total of 420 cashew farmers were sampled for the study with the aid of a list from the extension office in those selected distric t by employing a lottery method. Following the same method, 30 stakeholders of Ghana Agricultural Insurance pool comprising of respondent from the Technical Committee (TC), Steering Committee (SC) while purposive sampling was employed to select Technical M anagement Unit (TMU) and Management Board Members (MB), with the aid of a list from GAIP.Additionally, 25 financial institutions mainly, universal banks, rural banks, credit unions and savings and loans companies were randomly selected the same districts with the aid of a list utilizing the lottery method. Heads of credit and one credit officer in the selected financial institutions were purposively sampled for the study. Following Kakumanu *et al.* (2010); Mojarradi *et al.* (2008); Ben -Houassa (2010) and Zhou (2009) who utilized a sample size of 400 farmers, 385 farmers, 362 farmers and 569 sample made up of famers, and insurance regulators. In this study, a total sample size of 500 respondents comprising 420 cashew farmers, 50 heads of credits and creditofficers of financial institutions, and 30 stakeholders of Ghana Agricultural insurance pool (GAIP) were selected for the study. The districts and communities sampled for the study for risk perception, agronomic and meteorological survey in 2013 and choice experiment and insurance development survey in 2014 are captured in Table 3.5

Table 3.5 Districts and Communities Sampled for the Study

DISTRICTS AND COMMUNITIES			
Districts and Communities for Risk and Agronomic Survey in 2013		**District and Communities for Willingness to Pay Survey in 2014**	
Districts	**Communities**	**Districts**	**Communities**
Techiman South	Tanoso, Techiman and Twemia Nkwanta	Techiman South	Tanoso, Techiman and Twemia Nkwanta
Jaman North	Duadaso No. 1, Duadaso No. 2 and Sampa	Jaman North	Duadaso No. 1, Duadaso No. 2 and Sampa
Kintampo North	Kintampo, Kunsu and Ntankro	Kintampo North	Kintampo, Kunsu and Ntankro
Kintampo South	Chirehin, Jema Nkwanta and Kokuma	Kintampo South	Chirehin, Jema Nkwanta and Kokuma
Nkoranza North	Dwenewoho, Kranka and Manso	Nkoranza North	Dwenewoho, Kranka and Manso
Techiman North	Tuobodom, Tano Boaso and, Buoyem	Techiman North	Tuobodom, Tano Boaso and, Buoyem
Wenchi	Akrobi, Koase and Nkonsia	Wenchi	Akrobi, Koase and Nkonsia

Source: Field survey, 2013 **Field survey, 2014**

3.16. Methods of data collection

Six field assistants were trained in July, 2013. The team constitute one agricultural economist, two extension officers and three HND agriculture graduates. Risk perception agronomic and meteorological survey started from August 2013 - December 2013. Multiple approach of gathering data was employed. The study utilized mainly semi structured questionnaires, indepth interviews and focus group discussions. The focus group was first done in two communities in Jama District, where key informants in cashew production were identified with the help of MOFA's extension officers and that helps us to identify the rest of the group, where the researcher acted as a moderator to illicit response on the risk factors. A similar approach was done to illicit response from insurer and financial institutions in the study area to identify the risk factors whicht were inculcate into the questionnaires, prior to the risk perception, agronomic and meteorological survey to ensure that no risk factor was left out.

3.16.1 Interviews

The choice of the interview strategy for the stakeholders in the agriculture and insurance industry was based on the pragmatic research ontology utilizing an in-depth interview to collect data from from Ministry of Food and Agriculture (MOFA) Ghana Metrological Agency (G. Met), head of credit of financial institutions, and stakeholders of GAIP in a respondent interview so that the researcher could direct the interviews to achieve the research objectives. The rational for the interview was to generate more insight on risk perceptions and variables in the cashew subsector, the agronomic practices, the agricultural policies on cashew and agricultural insurance in the country and also gain insight into insurers and financial industry risk perception, as well as their insurance preferences, and also to avoid common method bias.

3.16.2. Questionnaire Development

Following the work of Frazer and Lawley (2000), a booklet type of questionnaire was adopted in the study.This made it easier for respondents to handle. A total design method (TDM) was employed in the design of the questionnaire. Inherent in the semi structured questionnaire were mostly close-ended questions with few open-ended questions so as to make it appropriate for collecting both quantitative and qualitative data to reflect the pragmatic research onto logy (Sanders *et al.*, 2007). Also, the researcher utilised some works found in empirical literature particularly the works of Muewissen and Molnar (2010) and also adapted and modified some questions in the work of Anifori (2010); Adobea *et al.*, (2012) and also supplemented it with custom made questions to address the research objectives. Again, the questionnaires were designed based on the suggestions of Mensah, (2008), Esterby-Smith (2002) who maintained that questionnaires should collect precise data for meeting the research objectives while avoiding specialized vocabulary or jargons that will create Semantics. Questionnaires were deemed appropriate because majority of respondents were literates. For non literates the questions were translated into Akan by the researcher and his assistants to enable them answer the questions.

3.16.3. Pretesting the Questionnaire

Obeng and Loria, (2003) and Dilman (2000) amplified and resonate the benefits of pretesting, 50 questionnaires were pre-tested in a cashew farming community in the JirapaLambussie district. This enabled the researcher to vet the questions in consonance with the common sense rule iterated by Yeboah (2002) and Mensah (2008), be straight forward, give clear instructions use simple and concise language and make the layout easy to follow. After this, it was so glaring and obvious that the questionnaires were poised for data collection in the study area.

3.17.1 Risk Perception, Agronomic and Meteorological Survey

In order to identify the prominent risk factors in the cashew subsector in the study area and also determine their frequency of occurrence so as to model evidence-based hypothetical agricultural insurance products for the insurance development and choice experiment survey, a risk perception , agronomic and metrological survey was carried out by the researcher and his field assistants in seven districts and 21 communities from August 2013 – December 2013, as shown in table 3.5 utilizing the sample technique described above.

More interestingly, the risk assessment survey gave insight into dominant risk factors in the cashew subsector, those that are systemic or idiosyncratic. More importantly, it also illuminated the researcher’s understanding on farmers traditional risk management practices, cashew farmers crop production budget per acre, their dominant risk management strategies, their cropping calendar, their agronomic practices, their perception of key perils that affect cashew at a particular phase in the crops life cycle, the number of dry days and wet day required for cashew production in addition to cashew crop farmer residual risk which are the risk factors beyond the control of the farmers for which insurance was being sought. This helped the researcher to ascertain their insurance preference and also assess their knowledge on meteorology, particularly their knowledge on G.Met weather station which was prerequisite of developing weather index insurance products. Admittedly, the risk perception, agronomic and meteorological survey helped the researcher to model evidence based hypothetical agricultural insurance products based on four insurance philosophies identified in literature and practise, and also to invented and tested a fifth philosophy modelled by the researcher, known as functional synthesis approach. It is noteworthy that out of 420 questionaires sent to cashew farmers in the study area, 398 were received.

3.17.2 The Choice Experiment Design

Based on the results of the risk perception, agronomic and meteorological survey, choice products were designed to carry out the choice experiment. Arguably, the first step in choice experiment is to identify the good to be valued in terms of its attributes and levels in a hypothetical situation, after which respondents are asked to choose their preferred option from several choice set (Burton *et al.*, 2001 and Blamey *et al.*, 2001). Choice experiment products are modelled such that each option has a number of attributes that takes on different levels. In this study various hypothetical insurance products were modelled for cashew crop farmers, financial institutions and insurers based on index or parametric, indemnity, simulation, benchmarking and functional synthesis insurance philosophies or approaches.

Each approach has various choice sets that describe the number of attributes and their levels. Based on the results obtained from risk perception, agronomic and meteorological survey, which is discussed in chapter four, descriptive statistics, were to identy the risk factors and their probability of occurrence from the cashew crop farmers' perspective. Factor analysis was used to extract prominent risk factors that were perceived as important from the cashew crop farmers' perspective and was also used for structure detection for the prominent factors. From the results of risk perception, agronomic and meteorological survey, risk or perils beyond the control of farmers' refered to by Wenner (2005) as residual risks for which insurance was being sought were climatic risk such as: excess rainfall, high wind speed and high temperature and fire, which is a social risk factor or peril. Hypothetical agricultural insurance products were modelled to cover these perils based on insurance philosophies such as index, indeminity, simulation, benchmarking and functional synthesis approaches.

Attributes utilized for modelling choice sets were summarised in Table 3.6, 3.7 and 3.8

Table 3.6: Cashew crop farmer's residual risk factors with their probabilities and their cashew crop production budget per acre.

Residual risk	Insurance preference	Risk classification	Probabilities	Stages of cashew crop life, for which cover is required.
	Excess rainfall	Systematic, wide spread and correlated	0.93	Flowering, fruiting and harvesting
	High wind speed (wind storm)	Systematic wide spread and correlated	0.98	Flowering and fruiting
	High temperature	Systematic and wide spread and correlated	0.99	Germination seedling and fruiting
	Bush fire	Idiosyncratic localized and non-correlated and partly systematic	0.75	All phases (or stages)
			The mean farmers crop budget per acre	
			GH¢910.00	

Source: Author's own construct, 2013

Also the main attributes and their levels for modelling an array of hypothetical insurance choice sets for the willingness to pay survey were partly based on the work of Muewissen and Molnar, (2010) in which their work included attributes such as method of assessment, risk covered (key insured perils or payout triggers). Their study illustrated the extent to which one can combine various attributes to obtain hypothetical insurance products. At the core of the calculation of the administrative premium which is a combination of the technical premium which is the pure loss cost plus cost loadings for various choice sets and these were determined following an estimation method developed by Nodling *et al.* (2010) for pricing insurance products given by:

$$P_t \;\square\;\square\;\square P_o C\, A \qquad (3.23)$$

Where P_t is the total premium comprising of the pure loss cost and administrative expense loadings and P_o is the probability of the insured event and C is the cost of cover for the loss normally known as pure loss cost and A is the administrative charges or loadings.

This model was only effective at determining the technical premium, as it only gave a snapshot of administrative charges without explaining what goes into it from agricultural insurance perspective.

Consequently, the detailed premium estimation was done following Global Ag risk (2009) estimation method: given by:

Premium cost of the expected annual loss
* Expense loads* :

 Cost of information to control adverse selection
 Cost of monetary control of moral hazard
 Cost of loss adjustment
 Cost of delivering (3.24)
 Cost of administering the insurance programme
 Cost of product development
 Cost of correlated rate
 Cost of needy access to capital

The above equation was modified and utilized to do the actual estimation for various choice sets as:

Price of insurance cost of the annual expected loss expense loads .

 Cost of loss adjustment
 Cost of administering the programme
 Cost of product development (3.25)
 Cost of data acquisition for satellite for satellite index
 Cost of data weather data from G Met for weather index.
 Cost of loss assessment (*see appendix v, vi, vii, viii for details*).

The package of attributes and their levels used in designing the choice sets are shown in Table 3.7

Table 3.7 The Package of the Attributes

Attributes	Description	Attributes levels	Coding
Methods of loss assessment	Weather stations detailed farm visit satellite data district average yield selected farm in homogenous area % shortfall in famers annual production history	Index, indemnity, simulation, bench marking and functional synthesis	0.Simulation 1. Index 2. Indemnity 3. Bench marking 4. Functional synthesis
Key insured perils/ risk covered or payout triggers	High temperature, excess rainfall High wind speed (wind storm) fire	Index, indemnity, simulation, benchmarking and functional synthesis	0.Simulation 1. Index 2. Indemnity 3. Bench marking 4. Functional synthesis

Technical premium per acre	Actual value
Administrative premium per acre	Actual value

Source: Author's own construct, 2013

To validate the residual risk factors or key perils the farmers cannot handle, the farmers were asked open ended questions on what accounted for the differences in their best and worst harvest, 63 represents (17%) maintained their farm got burnt, while 131 (35%) attributed it to high temperature while 44 (12%) attributed it to excess rainfall, and 95 (25%) attributed it to windstorm, while 24(6.4%) attributed it to pest and disease that attack flowers, leaves and fruits with the rest attributing it to poor management and unknown course. Since majority of the respondents which were mainly cashew farmers indicated that it was a management issue, it did not meet the requirement for insurance contracts since poor management is moral hazard issue, and the doctrine of proximate cause looks at immediate cause of a peril for claim settlement. The levels of attributes were developed from literature (see the works of Muewissen and Molnar (2010) on simulation crop insurance for water stress fire and hail. conventional/traditional indemnity (Stutley, 2010; GAIP, 2012 Mahul and Stutley, 2010), Bench marking (Swiss-Re, 2012) and functional synthesis combines elements of all the approaches which in this work can be detected based on the method of loss assessment.

Based on the insurance philosophies and frameworks in theory,residual risk factors and attributes emanating from the risk , agronomic and meteorological survey were deemed appropriate because, inclusion of too many attributes in a choice experiment is associated with cognitive demand from respondent with regards to selecting options from a range of hypothetical products, and may carelessly choose options or employ some strategic behaviour to select options that may not reflect their true utilities (Alphazar *et al.,* 2003).

Eventually, 18 choice set of hypothetical insurance products based on 5 insurance philosophies were modelled and coded as: 0 for simulation, 1. for index, 2 for indemnity, 3 for bench marking and 4 functional synthesis product for the willingness to pay survey.An example of insurance product for some of the choice set modelled from the risk agronomic and meteorological survey is shown in Table 3.8

Table 3.8 An Example of a Choice Set

Attribute	**Choice set A**	**Choice set B**	**Choice set C**
Method of loss Assessment	Weather Sta tion	Satellite data	District Average yield

Risk covered (payout triggers) Or insured perils	High Tempe rature Excess rainf all High Wind s peed (Windstorm)	High Temperature Excess rainfall High Wind speed (Windstorm)	High Temperature Excess rainfall High Wind speed (Windstorm)
Technical Premium and Administrative premium in GH¢	***GH¢*100.46**	***GH¢*88.79**	***GH¢*64.03**
I would purchase	☐	☐	☐
No buy	☐		

Source: Author's Construct, 2014

Arguably, the uniqueness of this study involves gauging the attributes from the results from the risk perception, agronomic and meteorological survey, to identify evidence based risk factors by employing factor analysis to gauge and amplify the risk attributes and their levels to model hypothetical agricultural insurance product which reflect the actual preference of products needed to cover cashew farmers' residual risks in the study area. This was then followed up with a choice experiment and insurance development survey in 2014.

3.17.2.2. Choice Experiment and Insurance Development Survey

The Choice experiment and Insurance Development survey was conducted from July, 2014 to December 2014. FollowingKakumanu *et al.*, (2010) farmers, insurers and credit officers of financial institutions were asked to choose from a range of different hypothetical insurance products or schemes, with variation in the insurance premium, coverage, attributes triggers and payouts levels, channels and supply models and perception statetements. The survey was carried out by the researcher and the research assistants in 21 communities on 420 cashew farmers in the Brong Ahafo Region. 30 agric insurance stakeholders made up of the TMU, TC, SC and Management Board (MB) of GAIP were interviewed and questionnaires also administered to avoid common method bias as well as 50 head of credits. In this study, respondents were asked to choose choice sets from 18 hypothetical agricultural insurance products grouped under five insurance philosophies. This was done to elicit their stated preference based on state dependent utility theory, random utility theory, human capital theory and traditional insurance theories of insurance to illicit the insurance preference of cashew crop famers. This approach helped the research determine the utilities of the farmers subject to their budget constraints and also to ascertain the kind of insurance philosophy that will thrive in the agricultural insurance market and also develop a framework for providing demand driven and market oriented insurance product for financial institution as well as the cashew crop farmers. In order to come out with a strategy for insurance development following the system approach, data were collected on the supply models, payment methods, distribution channels to help implement agricultural insurance system for cashew crop farmers Ghana using Ahafo Region as a test case. More so, data were also collected on the socio-economic, institutional and product characteristics or variables such as age of respondents, their gender, household, size, tenure, awareness of other insurance products, their perception of other insurance companies and benefits derived from insurance products, their farm size, off farm income, on farm income, distance of insurance companies, public help in terms of disaster, farming experience, the cropping system, farm vulnerability, insurance approach, and product option or type among others to explore their influence on cashew crop farmers willingness to pay agricultural insurance, based on the human capital and state dependent theories . Data was also sourced on the cashew crop farmers' attitude, knowledge, and benefit perception and premium perception indices to in order to formulate strategies to ensure cashew development. Data were also sought on the constraints facing both agricultural insurance development from the insurers' perspective and constraints to cashew development from the cashew crop farmers' perspective. The study like other studies encountered some challenges which manifested in the unwillingness of some opinion leaders to take part in the survey because they were used to receiving handouts from the NGOs before partaking in a survey. Since most people collected data from them without addressing their concerns, they were only few and some of them only participated after the researcher and his assistants explained to them that this study was for academic purpose and also aimed at developing innovative insurance products for cashew crop farmers to enhance their access to credit with a spill over effect in complementing government revenue in the era of climate change.It is interesting to note that out of 420 questionaires sent to cashew farmers in this survey only 383 responded, whereas all the respondents from the financial institution and pool stakeholders participated fully in the study.

3.18. Ethical Consideration

According to Saunders *et al.* (2007), researchers must be ethical in their approach to data collection by allowing respondents to participate in a survey based on their own volition. Similarly, respondents who were still unwilling to partake in the research opinions were respected and subsequently dropped from the study.Moreover, confidentiality and anonymity of the respondents were ensured throughout the study.

3.19. Data Analysis

In this study both descriptive statistics and inferential statistics were employed. Descriptive statistics involves the use of piecharts, frequencies, percentages, and bar charts. Inferential analytical tools such as factor analysis, mix logit, latent class, multinomial logit and Kendall's coefficient of concordance were used in analysing the socio –demographic characteristic of the respondents. Following the methods of Adobea *et al.*, (2013) descriptive and inferential statistics such as , bar charts , pie charts,frequency, percentages, and means and factor analysis were employed in the analysis were used to analyse the risk perception of cashew farmers , and financial institutions to ascertain their insurance preference. To determine cashew crop farmers' heterogeneous preference and mean willingness to pay for agricultural insurance products, mix logit and latent class were employed in the analysis. Multinomial logistic regression was used to identify the factors that influence the choice and prefrence of a particular insurance philosophy or approach by cashew crop farmers. Moreover in identifying the farmers perceived feasible distribution channels and supply models for marketing agricultural insurance product to the cashew crop farmer in the study area, frequencies, percentages and means scores were employed.Also farmers and financial institutions, preference for insurance cover for their residual risk were analysed employing frequencies, percentages and pie chart Cashew crop farmers' knowledge, perception, and attitude towards agricultural insurance were analysed utilizing perception index.In relation to evaluation of stakeholders of the Ghanaian Agricultural Insurance Pool (GAIP) interest in designing agricultural insurance for cashew crop farmers and also to analyze their basis for rating, underwriting and adjusting of agricultural insurance claims, descriptive statistics such as percentages involving the use of bar charts and content analysis were employed in the data analysis. Finally, to determine the key constraints that would impede both agricultural insurance and cashew development, Kendall's coefficient of concordance was employed.

The analysis were done after raw data obtained from the field were selected, categorized, and coded before the analysis using Excel,Stata -12 and SPSS version 20 software. However, it must be noted that prior to the actual data from the pilot study was analysed based on the suggestions of Tull and Hawkins (1987) who posit that these dummy activities enable researchers to pre-test their data analytical techniques prior to the actual data collection, to ensure that the researcher does not collect data based on wrong measurement of variables are avoided in the actual data collection.

3.20 Framework for validation

Owusu-Manu (2013), maintains that validity reflects the essential value of the study and also refers to the process of aligning the research finding to theory or conceptual principles.

Validation is the process of ensuring that a research instrument is credible and controls all plausible biases in the study (ibid). For construct validity which is the extent to which constructs in the conceptual framework are operationalised accurately, internal validity is the extent to which casual conclusions can be drawn from variables, while external validity has to deal with the extent to which it is possible to generalize from the data in the study context. While statistical validity also deals with the extent to which the study has used appropriate sample size, measurement and statistical methods (Owusu-Manu, 2013). To ensure that these requirements were met, a thorough review of literature was done to select methods, and questionnaires of authorities were adopted and modified followed by pre-testing to ensure internal and construct validity, while statistical validity was ensured by choosing appropriate sample size by employing Bartlett *et al*.(2002)'s estimation formular. Moreover multiple sources of data collection techniques were employed. In order to maximize the external validity and also to avoid common method bias.Multiple techniques were and instruments were used to collect data.The results obtained from data analysis were presented at seminars and also reviewed by my supervisors, academics and practitioners in the field of agribusiness, marketing, agricultural economics, insurance and finance to reduce the researchers' bias in order to improve its external validity. Furthermore, the results were subject to peer reviews through conference and publications in peer reviewed journals. Also the response rate of the study was validated by comparing the response rate of this study which was 94.8% for the risk, agronomic and meteorological survey and 91.1% for farmers, 100% for financial institutions and agricultural insurance pool stakeholders during the insurance development and choice experiment survery.When these response rates were compared to the response rate of obtained by Muewissen and Molnar (2010) which was stated as 73% and that of Boccaletti and Daniel, (2000) which was 52%.Infering from this , it was obvious that the statistical validity requirement was met.

3.21 Reliability

According to Yin (1994), reliability refers to a situation in which data collection techniques would produce similar results in terms of precision, relevance and accuracy (Sarantakos, 2005).

It also deals with the reliability of survey instrument, in terms of producing consist results during replication and is not sensitive to the researcher biases so as to ensure the robustness of the instrument that it does not become sensitive to the changes of the research environment. It also deals with stability apart from precision accuracy and consistency (Sarantakos, 2005) to ensure that the instruments are reliable; the instruments were peerreviewed after a prestesting it in the Jirapa-Lambusse district and expert's opinions were sought, apart from adapting and modifying questionnaires of works in empirical literature in addition to chrombach alpha test which gave results above 0.766 for most of the constructs in the questionnaire made the instrument valid for data collection.

3.22. Limitation of the study

Correlation between yields and excess rainfall, high temperature, wind were not done by the researcher. It was the International Center for Tropical Agriculture (CIAT) using G.P.S, MAPS, expert knowledge, maximum entropy (MAXENT) crop prediction models and maximum likelihood estimation methods which did a correlation between precipitation and temperature predicted that a climate change that will favour cashew production in the study area. However, Green house experiments were not done to subject the plant to water stress conditions to determine the threshold of water that will make a growing cashew crop to blossom or wilt at various stages of the plant life or the excess amount of water at the flowering and fruiting stage that would affect yields.Undoubtedly this was beyond the scope of this work. Again, soil analyses were not done to determine the water holding capacity and Salinity concentrations that would support cashew growth because it is beyond the scope of this work. Since it fell within the preview of crop and soil science, farmers were asked of the types of soils in the study area. Admittedly empirical literature, including that of Dedzo et al.(2001), and CIAT (2011) have made it explicit that the study area is suitable for cashew production. Another limitation that was overcome was the reluctance of some cashew crop farmers to participate in the survey for want of handouts in the form of money or inputs to farmers after interview and workshops. However, this was overcome through rapport building whiles those who were still unyielding were left alone in consonance with the ethics of research. Also the negative attitude of some officers in the financial institution towards the filling of the questionnaires; nonetheless, this was overcome through patience and also follow-ups through emails and phone calls. Finally, the study was done in two different years, one for risk perception, agronomic and meteorological survey, the practical challenges involved in sampling 420 cashew farmers for each year gave rise to different response rate that brought a variation in the socio-demographic characteristics of respondents in the two different years the study was undertaken.

3.23 Chapter Summary

In this Chapter, we discussed the research methodology of the study. This chapter has discussed in detail the choice of methods for this study and has also justified them by discussing the limitations of other methods. The next two chapters unravel the f indings based on data analysis, and make it explicit to stakeholders. Chapter four was devoted to risk perception, agronomic and meteorological analysis, while chapter was devoted to the results and discussions.

CHAPTER FOUR

4.0 RISK PERCEPTION, AGRONOMIC AND METEOROLOGICAL ANALYSIS

4.1 Introduction

This chapter presents analysis on Risk perception, agronomic and meteorological analysis, which was a prerequisite in modelling hypothetical insurance products in order to conduct the

Insurance development and choice experiment survey. This portion of the study helped the researcher in identifying the crop varieties cultivated in the study area, the risk perception of financial institutions, farmers and insurers. Through this survey, the various risk that were systematic or covariate that affect all cashew crop farmers as well as idiosyncratic or unique risk that affect individual farmers' farm or household were identified. Their risk attitude, management strategies as well as cashew residual risk, and key perils for which insurance was sought, were analysed.

This analysis also aided the study in identifying farmers' knowledge of weather stations, their cropping calendar, cropping modes for detecting sowing window and insurance cover for phases such are germination, growth, flowering and fruiting phases. Key perils that affect various stages of cashew crop life cycle were also identified.Communities were analysed for the presence of micro climates in order to analyse the possibility of the presence of spatial basis risk which is a challenge for index, were ascertained. Additionally, farmers perceived crop water requirements at each stage of the cashew crop was also analysed to calibrate index triggers. Moreover cashew farmers crop production budget per acre which is a pre-requisite for insurance claim payment or payout and also to estimate both the technical and administrative premium were also done. Besides, every stage of the process was executed with due reference to the problem, research questions as well as the objectives of the study.

4.2 Characteristics of Respondents

Table 4.1 Farmer and farm characteristics

Characteristic	Frequency	Percentage
	Gender	*N=398*
Males	300	75.4
Females	98	24.6
	Main occupation	
Cashew crop producer	200	50.3
Salary worker	15	3.8
Trader	50	12.6
Craftsmanship	10	2.5
Labourer	18	4.5
Other	105	26.4
	Religion	
Christian	360	90.4
Muslim	30	7.5
Traditional	8	2.0
	Marital Status	
Single	51	12.8
Married	333	83.7
Widow	14	3.5
	Education	
No formal education	78	19.5
Primary	69	17.3
JSS/JHS	66	16.5
SSS/SHS	171	42.9
Training/poly	62	15.5
University	16	4.0
MSLC	3	0.7
	Household head	
Yes	315	79.1
No	83	20.9
	FBO Membership	
Yes	15	3.8
No	383	96.2
	Credit access	
Yes	80	20.9
No	303	79.1
	Agric training	
Yes	141	35.4
No	257	64.6
Characteristic	**Mean**	**Standard deviation**
Age	48.67	12.17
Household size	4.47	1.38
Farming experience	21.94	12.03
Income	1470.49	2975.89139
Farm age	14.71	4.12
Farm distance (km)	5.23	4.96

Source: Field survey, 2013

Analysis of data gather from the field indicated that majority (75.4%) of the farmers interviewed in the study area were males and 24.6 females. About 50.3% of the respondents interviewed were Cashew crop farmers. Majority (90.4%) of the farmers were Christians. However, 83.7% of the farmers interviewed were married. About 42% of the farmers had SSS/SHS education. 79.1% of the farmers were household head. 96.2% of the farmers interviewed are not members of farmer based organisation in the study area. Also, majority (79.1%) of the farmers had no access to credit. The result from the table further indicates that, majority (64.6%) of the farmers had no Agric training. The average household size was 5 per household. From the result, the average number of years in farming among the farmers was 22 years. Also, on average the age of farms in the study area was 15 years. The average distance from a farmer's house to his farm was 5 km. The mean age of the respondents is 48.7 years. This was consistent with results from the Insurance development and choice survey, done in 2014. The mean age of 48.7 means farmers can take other lines of insurance products including life insurance, since one has to be about 65 years to be debarred from insurance contracts. The results also show that mean income per acre for cashew crop farmers in the study area was GH₵1470.49, which connote their capacity to pay for agricultural insurance in the study area.

4.3 Cashew crop Variety in the Study Area

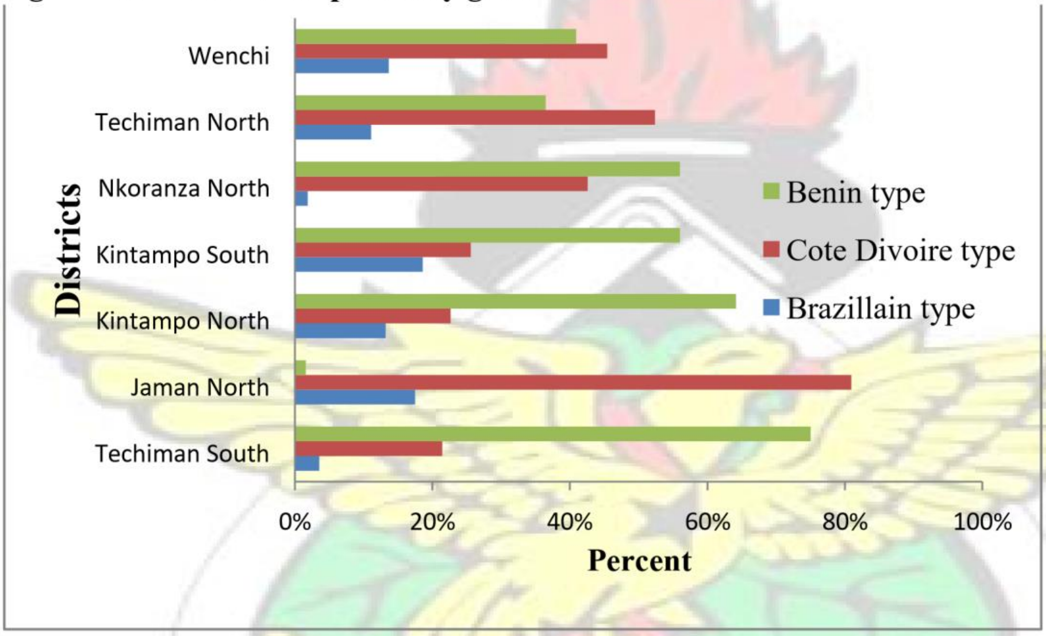
Data was collected on cashew crop variety in the study area and the result is presented in the Figure 4.1:

Figure 4.1 Cashew Crop Variety Grown in the study area

Source: Field Survey, 2013

The analyses show that cashew crop farmers cultivate three main varieties of cashew crops in the study area. These are locally known as Cote d'Ivoire, Brazilian and Benin types. Cote d'Ivoire and Benin types are mostly grown in the areas which are 44% each for both varieties while 12% of the respondents' indicated that they grow Brazilian cashew. For insurance purposes, knowledge of variety is key, as it helps the underwriter to identify its viability, and resistivity to weather related risk or perils such as drought, and diseases and fire. Moreover, having different varieties on a farmers field will bring about product and crop specifice basis risk in index insurance product calibrations since different varieties have their plant water requirements and yield potientials (IFAD, 2011; Miranda and Vedenov, 2001).

Figure 4.1.1 Cashew crop Variety grown in each district



Source: Field Survey, 2013

The figure 4.1.1 shows the district and the type of cashew crop farmers cultivated. It was observed that all the districts cultivate all the types of cashew crops. However, some varieties were dominating in some districts than others. In Kintampo North and South district, Techiman South districts, dominant cashew crops cultivated were Benin type represented by 64%,56%,75% respectively. In Nkoranza North, Benin and Cote d'Ivoire types were cultivated representing 56 %and 43 %respectively.The results also indicated that Techiman

The low percentage for the Brazilian type seems to suggest that farmers are now adopting it. For cashew development to be done in tandem with international standards, they should give attention to Iso-6477 standard based on Indian and Brazilian taxonomy of high premium: W180 jumbo and W210 large grades (Handem *et al.,* 2008).

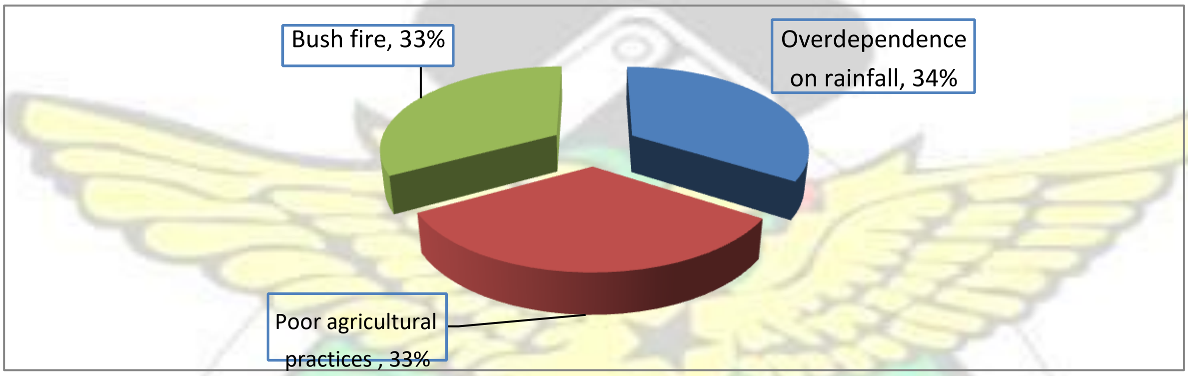
North districts cultivate the Cote d'Ivoire type which recorded more than 52%. In Jaman North and Wenchi district, Cote d'Ivoire type was mostly cultivated represented by 81% and 45% respectively. In Kintampo North district, Benin type was the dominant variety that was cultivated in the district and was above 64%. Also, less than 20% of farmers in each district cultivate the Brizilian Cashew variety in all the districts and this has the tendency to undermine cashew exports on markets where Brizillian and Indian W180 and Jumbo W210 are preferred. This is supportive of the observation made by Handem *et al.*(2008) who noted that African countries normally grow W30 and W280 categories which attract low prices on international markets.

4.4 Dominant Risk Factors in Cashew Subsector in the Study Area

4.4.1Source of risk from financial institutions' perceptive

Protection and motivation theory relates to risk perception and torelance.To gauge out the risk perception of the financial institutions in the cashew subsector, the results was as shown in figure 4.2 and stated that unreliable rainfall, overdependence on rainfall, and poor agricultural practices were perceived as risk.

Figure 4.2 Sources of Risk in Cashew Subsector- Financial Institutions perspective



Source: Field Survey, 2013

In-depth interviews of head of credits of the head officers were also done to augment this and other risk factors such as drought, reliance on traditional methods of farming, long term loan repayment on the part of cashew farmers, pest and disease, lack of appropriate farming methods, total loss due to loss of investment. Loss due to lack of yields, litigation, late planting, theft, reliance on third party service, the use of non-viable seeds, improper harvesting techniques, lack of storage system to facilitate staggered sales, polygamous marriage that leads to diversion of cash and farm inputs, delay in adoption of new technology i.e. farmer's resistance to new ideas, consistent with the findings of Osei-Tutu(2012), Poor regulation of market, unfavourable climate conditions, such as drought, pest and diseaseses , lack of technical knowledge, in addition to unstable price. According to Korrir(2011) the probability that farmers income will fall below a certain threshold connotes safety first approach, similarly financial institutions risk perception also include the probability that farmers profit will fall below 30% of their crop budget.

However, of the tall list of risk enumerated only pest, drought and unfavourable climatic condition were insurable, the rest are management issues and unstable price, though can be insured with revenue insurance, it is well suited for advanced economies where there is price stability with occasional fluctuation and can be eliminated through contract farming , forward contracts, since there is no agricultural commodity exchange to aid farmers in hedging their price risk in a futures market in Ghana.

4.4.2 Source of Risk from Agricultural Insurance Pool Stakeholders Perspective When asked to identify insurable and uninsurable risk in the sector, the pool stakeholders identified fire, theft, excess rain, flood, temperature and evapo-transpiration as insurable; however, they viewed flood as act of God coming from act of man is unisurable, but flood coming from act of God is insurable while flood under wilful act of man is regarded as uninsurable risk. They also identified poor farming techniques, perishing of farm produce, lack of knowledge, resistance to new ideas, poor attitude of farmers towards work, loss of soil fertility, and inability to recruit skill labour as uninsurable. This is consistent with the report by Bittel *et al*. (1998) who maintained that insurable risk should be accidental and not fundamental to doing business.

4.4.3. Risk from Cashew Crop Farmers Perspective in the study area

Regarding dominant risk factors faced by cashew sub sector from the cashew crop farmer's perspective, Table 4.2.3 below shows the results of the risk factors and their probabilities from the cashew crop farmer's perspective in the study area. Risk perception survey was carried out to identify level factors as indicated by the mean ratings and their probabilities gauged from the relative importance index. The mean ratings of approximately 7 indicate that most of the respondents rated the risk factors of each variable as "virtually certain". From the 1st risk factor to the 14th risk factor, respondents rated them as virtually certain. From 15th factor to the 24th factor, respondents rated them as very likely and the rest were indicated as likely and medium likely.

The analysis indicates that, 22 risk factors out of 69 were seen as affecting cashew crop farmer's income within the past five years. The risk factors identified as well as their probabilities range from climatic, labour, production, and price, biological, regulatory and institutional risk factors as shown in table 4.2.3 with their probabilities or the likelihood that that risk had affected cashew crops and farmers income for the past five years.

Table 4.2.3: Dominant sources of risk in the Cashew Sector from the cashew crop farmers' perspective and their probabilities

Descriptive Statistics	SOURCES OF RISK				EFFECT ON FARMERS' INCOME			
	N	Sum	Mean	Prob	N	Sum	Mean	Prob
Rising cost of labour and inputs	335	2332	6.96	0.99	315	630	2	1.00
Lack of regulation of the activities of buyers	384	2668	6.95	0.99	379	749	1.98	0.99
Difficulty in accessing loans	335	2324	6.94	0.99	323	639	1.98	0.99
Lack of cashew marketing board	386	2676	6.93	0.99	381	748	1.96	0.98
Lack of pricing policy	396	2742	6.92	0.99	388	770	1.98	0.99
Lack of labour at critical times	396	2735	6.91	0.99	384	593	1.54	0.77
High temperature	361	2485	6.88	0.98	349	694	1.99	0.99
Lack of credit facilities	394	2710	6.88	0.98	380	737	1.94	0.97
Lack of knowledge	32	219	6.84	0.98	30	56	1.87	0.93
Excess rainfall	391	2551	6.52	0.93	391	2551	6.52	0.93
Low price as a result of excess products on market	391	2538	6.49	0.93	383	762	1.99	0.99
Dry spells	71	452	6.37	0.91	39	76	1.95	0.97
Excess moisture	61	384	6.3	0.90	52	104	2	1.00
Pest and Disease	331	2026	6.12	0.87	321	482	1.5	0.75
High Wind Speed	127	756	5.95	0.85	100	196	1.96	0.98
Low yields	45	263	5.84	0.83	35	36	1.03	0.51
Fire	372	561	1.03	0.75	372	561	1.51	0.75
High cost of credit facilities	189	890	4.71	0.67	182	363	1.99	1.00
Poor farming techniques	116	518	4.47	0.64	92	104	1.13	0.57
Lack of market for produce	357	1585	4.44	0.63	338	675	2	1.00
High costs of labour	218	872	4	0.57	7	14	2	1.00
Inability to pay wages for labour	184	689	3.74	0.53	168	248	1.48	0.74

Source: Field Survey, 2013

This was consistent with Roberts (2003), Wenner (2005) and Stutley, (2010) who found risk factors prevelent in the Ghanaian, Carribean and Latin America's agriculture as climatic, biological, and marketing risk. The results also made it explicit that twenty two risk factors were seen as dominant and their probabilities estimated, through the relative frequency approach, making it subjective since they were not estimated from historic data, but the opinion of farmers which reflect their subjective beliefs or their observation of the occurrence of these risk factors in the study area.

For insurance purposes, there was the need to estimate the probabilities of the farmers' residual risk which are risk factors beyond the farmers' management capacities in the study area. The estimated probabilities for cashew crop farmers' residual risk were 0.93, 0.98, 0.99 and 0.75 respectively for excess rainfall, high wind speed, high temperature and fire. The residual risk factors and their probabilities were necessary for determining the technical premium and also modelling hypothetical agricultural insurance products for the insurance development and choice survey. This is in harmony with the cumulative prospect theory of risk which suggests that individuals assign weight to probability to losses or gains (Kanemanann and Tversky, 1997).

4.5. Factor Analysis of sources of risk in the cashew subsector from farmers' perspective

Factor analysis was run on the dominant risk factors in Table 4.3.2 in order to determine the pattern and structure of the risk factors and to also identify dominant risk factors. Factors chosen by more than 50% of the respondents as affecting their income for the past five years were used as variables to run the factor analysis. 13 variables were obtained and used for analysis in the factor analysis. This was done to identify risk factors the cashew crop farmers in the study area perceived as important and critical to their farming business. Here, analysis denotes variables, and Eigenvalues greater than 1 are extracted.

The extraction sums of squared loadings and rotation sums of squared loadings observed means only three components can be extracted as shown in Table 4.3.1.

The Table 4.3.1 show the total variance explained which displays the initial eigenvalues, extraction and rotated sum of squared loadings. Thus, the variance explained by the initial solution, extracted components and rotated components is presented in the Table 4.3.1. The initial eigenvalues shows the total variance which indicates the amount of variance in the original variables accounted for by each component. The percentage of the variance gives the ratio, expressed as a percentage of the variance accounted for by each component to the total variance in all the factors. The cumulative percent gives the percentage of variance accounted for by the first n components. The extraction sum of squared loadings shows the extracted components. The extracted component explains nearly 79% of the variability in the 13 variables as shown in the cumulative percent column. In applying the latent root criterion, three (3) components were extracted. The first principal component accounted for 43.7% of the total variance whilst the second component, explained 24.1%. Component 3 accounted for 11.3%, with a cumulative variance of 79.1%.

Table 4.3.1: Total Variance of Dominant Risk Factors From Cashew Farmers Perspective

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	5.682	43.707	43.707	5.682	43.707	43.707	5.647
2	3.135	24.114	67.821	3.135	24.114	67.821	3.134
3	1.471	11.313	79.135	1.471	11.313	**79.135**	1.873
4	0.638	4.906	84.04				
5	0.551	4.236	88.276				
6	0.48	3.689	91.965				
7	0.391	3.008	94.973				
8	0.319	2.453	97.426				
9	0.236	1.816	99.242				
10	0.099	0.758	100				
11	7.61E-17	5.86E-16 -	100				
12	-6.74E-17	5.19E-16	100				
13	-9.89E-17	-7.61E16	100				

Extraction Method: Principal Component Analysis. **Source: Field Survey, 2013**

The rotation sums of square loadings evenly distribute the variance over the components. This makes the interpretation easier than the unrotated matrix. Here the cumulative percentage of variance explained is the same. To better identify which of the risk factors that were predominant among cashew crop famers in the study area, the results from the communalities and extracted components are shown in Table 4.3.2. The results of the factor analysis indicated that 13 risk factors were dominant factors that affect cashew production and marketing in the study area from the farmers' perspective.

From the principal component analysis, the decision rule is that variables whose coefficients were greater than 0.5 were extracted. Also, the communalities and extracted risk factors were grouped into three component factors and the coefficient values of most of the variables in component 3 were weaker relative to component one and two as shown in table 4.3.2.

Table 4.3.2 Factor Loadings of Dominant Risk Factors from Cashew Crop Farmers Perspective

	Pattern Matrix			Structure Matrix			Communalities
	1	2	3	1	2	3	
Excess rainfall	0.525	**0.489 0.923**	-0.207	0.536	**0.568 0.904**	-0.218	0.604
High temperature	-0.07	**0.945**	0.081	0.016	**0.942**	-0.089	0.826
High wind speed	-0.061	**-0.579**	-0.011	0.014	**-0.593**	-0.184	0.892
Pest and Disease	0.338	-0.192	0.236	0.325	-0.331	0.385	0.545
Fire	0.055	0.192	**0.821**	0.155	0.246	**0.862**	0.779
Lack of labour at critical times	**0.746**	-0.047	0.037	**0.766**	0.031	0.108	0.623
Lack of cashew marketing board	**0.99**		0.006	**0.987**		0.154	0.977
Lack of regulation of the activities of buyers	**0.99**	-0.047	0.006	**0.987**	0.031	0.154	0.977
Lack of common pricing policy	**0.99**	-0.047	0.006	**0.987**	0.031	0.154	0.977
Lack of market for produce	-0.061	0.221	0.924	0.087	0.055	**0.877**	0.818
Low price as a result of excess products on the market	0.31	**0.757**	0.124	0.389	**0.761**	0.037	0.701
Difficulty in accessing loans from financial institutions	**0.77**	-0.078	0.003	**0.764**	-0.017	0.125	0.59
		-0.047	0.006		0.031	0.154	
Rising cost of labour and inputs	**0.99**			**0.987**			0.977

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.

Source: Field Survey, 2013

The factor coefficient values of component 1 and 2 compared with the expected initial and extracted values showed strong correlation for all the variables. In fact, this suggests that the variables examined were indeed significant and have practical relevance. The first component was associated with six risk factors: lack of labour at critical times, lack of cashew marketing board, lack of regulation of the activities of buyers, lack of common pricing policy, difficulty in accessing loans from financial institutions which is a constraint to cashew development consistent with the observation by Osei- tutu (2012), in her supply response among cashew farmers in the study area, as well as rising cost of labour and inputs. These risk factors are marketing, labour, institutional, and financial risk factors affecting the cashew sub sector in the study area.

The second component indicated five dominant risk factors which are excess rainfall, high temperature, high wind speed, pest and disease, low price as a result of excess products on the market. These prominent risk factors were grouped into climatic, biological and, price risks, factors such as difficulty in accessing loans, which denotes lack of credits from formal financial institution and lack of marketing board are institutional risk factors.

The third component of the principal component analysis shows that fire which is social peril or risk factor was dominant. Consequently, the risk factors affecting cashew production and marketing were climatic risk factors which were excess rainfall, high temperature, high wind speed, Social risk factor which is fire, Biological risk factor for pest and diseases, institutional and market related risk factors which were: lack of labour at critical times, lack of cashew marketing board, lack of regulation of the activities of buyers and lack of common pricing policy, consistent with the observation made by Ashitey and Nicely(2012). These findings have also been reported by Stutley (2010); Ben-Houssa (2010) Roberts (2003) Wenner (2005) and Molnar (2005), who identified these risk factors in the assessment of the cocoa and agriculture sector in general, in Ghana, Cote d'Ivoire and other African countries and Europe and Australia respectively.However, lack of credits or difficulty in accessing loans was consistent with the findings of Osei-Tutu (2010) who also noted that cashew farmers faces credit rationing due to lack of agricultural insurance for cashew farmers in Ghana.

4.6. Risk Classification in the Cashew Sub Section in the Study Area

Descriptive statistics was used to classify the dominant risk factors into systematic or idiosyncratic, and also to identify which of these risk factors, whether idiosyncratic or systematic can be managed by the farmers employing traditional method and the ones that are beyond the farmers which need modern risk management tool such as insurance to manage it. The results of the descriptive are found in Table 4.4 and figure 4.3

Table 4.4: Classification of Risk and Insurance Preference from Cashew Crop Farmers Perspective

	Idiosyncratic		Systematic		Traditional Method		Insurance	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Excess rainfall	6	2%	373	98%	8	2%	378	98%
High temperature	5	1%	344	99%	36	10%	318	90%
Fire	187	51%	181	49%	103	27%	272	73%
High wind speed	1	0%	256	100%	0	0%	163	100%
Pest and Disease	170	54%	146	46%	322	100%		
Lack of labour at critical times	176	46%	207	54%				
Lack of cashew marketing board	15	5%	265	95%				
Lack of regulation of the activities of buyers	10	4%	268	96%				
Lack of pricing policy	7	2%	380	98%	372	100%		
Lack of market for produce	1	0%	337	100%	330	100%		
Low price as a result of excess products on the market	5	1%	377	99%	374	100%		
Difficulty in accessing loans from financial institutions	18	6%	296	94%	314	100%		
Rising cost of labour and inputs	10	3%	301	97%	302	100%		

Source: Field Survey, 2013

According to Ibra (2003), idiosyncratic risk also known as diversifiable risk affects sectors or communities and individuals heterogeneously, while systematic, covariate or contagion risk affects a whole community homogeneously.

From the results in Table 4.4, majority of the respondents indicated that excess rainfall, high temperature, high wind speed, lack of cashew marketing board, lack of regulation of the activities of buyers, lack of common pricing policy, low price as a result of excess products on the market were systematic whiles pest and disease and bush fire and lack of labour at critical ties were both systematic and idiosyncratic. About 98% of the respondents indicated that excess rainfall and lack of common pricing policy are systematic while 99% of the respondents indicated that high temperature and price at sales are systematic. Furthermore, 96% of the respondents also indicated that lack of regulation of the activities of the buyers is systematic, 95% indicated that lack of cashew marketing board is systematic and 94%

indicated that difficulty in accessing loans from financial institutions was systematic. Additionally, 97% cited rising cost of labour and inputs as systematic, 54% of the respondents cited lack of labour at critical point as being systematic and 100% of the respondents indicated high wind speed and lack of market for produce as being systematic. For the idiosyncratic risk, 51% of the respondents cited bush fire as being idiosyncratic risk, 54% of the respondents cited pest and disease as being idiosyncratic Holzmann and Jogensen (2001) views idiosyncratic risk as micro affecting individual cashew farmers and systematic risk as meso affecting a whole community or macro affecting a whole region or country.

Figure 4.3 Risk classification by cashew farmers into systematic and idiosyncratic risks

Source: Field Survey, 2013

A clear picture of the risk classification is shown in figure 4.3 above: The results from the study indicated that climatic risk were perceived as systemic risk, while pest and disease and fire which is a social risk was idiosyncratic (Ibra, 2003, Hardwood *et al.*, 1999); bearing in mind that social risk also was of the type that could be wide spread or localized, (Wenner and Aris, 2003).

From theory, those risk factors which are systematic can be taken care of with index insurance products or benchmarking insurance products while indemnity products can be used to handle idiosyncratic risk. Then simulation insurance and functional synthesis insurance products which are combined policies would take care of both systematic and idiosyncratic risk perils. Moreover, cashew farmers risk management strategies were also ascertained in addition to their insurance preference which can be found in figure 4.5 and figure 4.6.1, figure 4.6.2 and figure 4.7

Figure 4.5: Key Risk or Perils Cashe Farmers Manage with Traditional Methods and the Ones they need Insurance to Manage

Source: Field Survey, 2013

Among some of the risk factors, the entire respondents indicated that they prefer traditional method to control them, include lack of common pricing policy, lack of market for produce, difficulty in accessing loans from financial institutions, Pest and Disease, fire and lack of labour at critical times were perceived by the farmers as both idiosyncratic and systematic. For factors like, lack of cashew marketing board and lack of regulation of the activities of buyers the respondents chose neither traditional method nor insurance as management tool.The respondents indicated that they require insurance to manage excess rainfall, high temperature, fire and high wind speed. This is based on the fact that the cashew crop farmers are unable to manage these risks on their own a phenomenon Wenner (2005) termed as residual risks; consequently they needed insurance products or schemes to manage those risks. Also, all the respondents indicated that they prefer the use of traditional method to control pest and disease, lack of common pricing policy, lack of market for produce, low price as a result of excess produce on the market, difficulty in accessing loans from financial institutions and rising cost of labour and inputs. Meuwissen and Molnar (2010) and Wenner (2005) suggest that traditional methods include diversification, asset flexibility, market flexibility and product flexibility as some of the traditional methods of control risk.

4.7. The extent of Application of Risk Management Strategies by cashew farmers

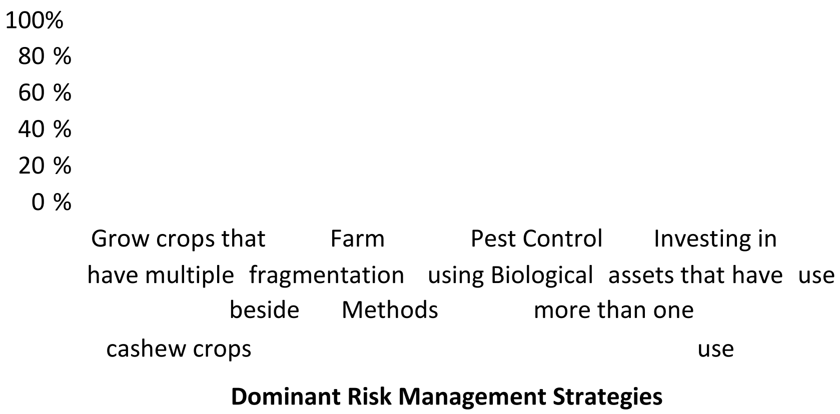
Respondents were asked to indicate the extent to which they apply risk management strategies on the likert scale; very little, sometimes and very much which are shown in figure 4.6.1

Figure 4.6.1 Extent of application of Risk Management Strategies by farmers

Source: Field Survey, 2013.

The respondents made it explicit that their traditional risk management strategies are growing other crops besides cashew, farm fragmentation, pest control using biological methods (farming strategies) and investing in assets that have more than one use (financial strategies), dubbed asset flexibility. It was observed from the result that, 51% of the farmers grow other crops besides cashew all the times (thus, very much) and 48% sometimes grow other crops besides cashew. Therefore, it can be concluded that growing other crops besides cashew crop is a dominant risk management strategy employed by all the farmers. Farm fragmentation strategy is also practiced: 52% and 48% apply it very much and sometimes respectively.Farmers also indicated that pest control using biological methods is sometimes applied as risk management strategy. This they indicated is done by introducing yellow ants into the farm to fight the pest. 74% and 43% of the farmers indicated that they applied pest control risk management sometimes and very little respectively. 55% of them maintained that they invest in assets that have more than one use as financial strategy for risk management. A small percentage of the farmers apply pest control using chemical representing 1.8%, produce at lower possible cost representing 7%, work together with other farmers representing 0.8% and 2 % find ways to lower production cost. This is further illustrated in figure 4.6.2 below:

Figure 4.6.2 Dominant Risk Management Strategies applied by cashew farmers



Source: Field Survey, 2013

Between 79% and 99% responded to four strategies of which one was financial strategy and the other three were farming strategies. The figure 4.8 denotes the dominant strategies among the risk management strategies cashew farmers apply. Others grown crops that have multiple uses beside cashew crops, avoid intercropping with plants that are vectors as well as the pest and disease and use of seeds recommended by MOFA.

From the analysis, the dominant strategies are diversification, which comes out as growing other crop, besides cashew (diversification), farm fragmentation, Integrated pest control management using biological methods, product and assets flexibilities that investing in crops and assets that has multiple use were the dominant traditional risk management strategies employed by the cashew crop farmers. This is consistent with studies done by Wenner, (2005) for farm, when it comes to the issue of farm fragmentation and diversification and consistent with the finding of Meuwissen and Molnar (2010) when it comes to assets and products flexibility. However, pest control using biological methods like yellow ants is unique to the study area.

4.8. Cashew crop farmers Insurance Preference

This section highlights risk factors for which the respondents prefer to use insurance policy for management. The risk factor that represents the cashew crop farmers' residual risks were captured in Figure 4.7 and constitute the key perils for which the insurance contracts should be designed.

Figure 4.7 Cashew crop farmers Insurance Preference

100 %

80 %

60 %

40 %

20 %

0 %

Traditional Method

Insurance

Key Perils and Residual Risk Factors

Source: Filed Survey, 2013

From figure 4.7 about 98% of the respondents indicated they need insurance to manage excess rainfall while 90% of the respondents indicated they need insurance for the management of high temperature. 73% of the respondents also indicated they need insurance for bushfire, while 100% indicated that they need insurance for high wind speed. The preference for insurance for rainfall contradicts the finding of Gine *et al*. (2008) where 2.5% of the respondents from the sampled households indicated they had no preference for insurance against rainfall. However, their preference for insurance to manage fire confirms the study by Burunette *et al*. (2009) who reported that the probability of fire occurrence has positive effect on insurance decisions among forest owners. It is also supported by the findings of Magnoni *et al*. (2012) who studied events and value of property insurance in Ghana and found out that workers are vulnerable to sundry risks including fire and climaterelated damage to their business. Dedzo *et al.* (2001) posit that windstorms have negative effect on cashew production. The study found out that high wind speed was a challenge to the cashew sub sectors. In order to validate these results, respondents were asked of key perils that accounted for the differences in their best and worst harvest.

4.8.1. Factors Responsible for Worst Harvest from cashew farmers perspective

Cashew crop farmer's insurance preference and key insurable perils for modelling hypothetical insurance products for insurance development and choice experiment survey is presented in figure 4.7 based on figures 4.5. To validate the results presented, respondents were asked questions on key perils that brought about their worst harvest and this was captured in the questionnaires as the difference between their good and worst harvest and were also asked to enumerate the causes of their worst harvest.

The causes of worst harvest included factors like farm got burnt, high temperature, excess rainfall and pest and disease. 17% of the respondents attributed their worst harvest to the fact that their farm got burnt, whiles 35 % cited the issue of high temperature for their worst harvest. Also, 44% of the respondents mentioned excessive rainfall and windstorms to account for the worst harvest whiles 3% of the respondents representing mentioned pest and disease to be responsible for their worst harvest. About 1% of the farmers attributed the worst harvest to poor management, (N=374), which is an uninsurable risk, and requires managerial capacity building for farmers through training to manage that risk. The rest of the perils are insurable but famers prefer to use traditional methods to manage pest and disease. The result also indicated that the risks are climatic and systematic and only fire is social and idiosyncratic.

4.9 Risk Attitude of cashew farmers in the study area

Research into risk attitudes is based on a set of axioms proposed by Von Neumann and Morgenstern (1947) who posit that respondents' risk attitude can be observed if the preference ordering and distributional properties of risky prospects are known(Korrir,2011). In general, there are three types of risk attitudes that are normally exhibited by producers including those in the cashew enterprise, identified by Akins and Bates (2010), MITC, (2008) and Harrington and Niehaus (2004) as the risk lovers, risk neutral and the risk averse. Risk attitudes can also be gauged from responses farmers make towards risk statements in a likert scale consistent with the state dependent utility theory of insurance. With this approach, estimates of the Cronbach alpha values of the risk statements was used to determine the reliability for determining risk aversion of respondents.

According to the rule of the thumb, Nunnally (1978), a Cronbach's alpha value of 0.7 and above indicates that the scale statements are reliable and internally consistent. Hence obtaining a value of 0.773 for the seven statements used in this study means they can be used to determine the risk attitude of the respondents which are cashew crop farmers in the study area. Table 4.6 shows the statements of reliability and its Cronbach Alpha estimates.

Table 4.6 Test of Statements Reliability based on Cronbach's Alpha Coefficient of Reliability

Risk Statement	Cronbach's Alpha of Item Deleted
I like experimenting with new ways of doing things	0.687
I take more chances than others	0.699
I am willing to take higher financial risk than others	0.689
I have to take higher risk in order to be successful in business	0.766
Am willing to try new technology and production methods even before others try them	0.758
In selling my cashew I prefer higher credit sales than lower cash sales	0.785
I usually don't like "playing it safe"	0.794
Cronbach's Alpha Coefficient of Reliability	**0.773**

Source: Authors Construct, 2013

Also following Nmadu *et al*. (2012), a three point Likert scale was constructed, where respondents with a mean of 1 to 1.99 were classified as Risk Averse, those with an average of 2 classified as Risk Neutral and those with an average of 2.01 to 3 classified as risk lovers. The results obtained from the survey, indicated 44% of cashew crop farmers in the study area are risk averse, 51% were risk lovers in support of the prospect theory , which view individuals as risk preferers (Kanemanann and Tversky,1997), and only 4% were risk neutral as shown in Table 4.7. This means that cashew farmers will be willing to take more risk to expand their farms if they have resources. 44.2% being risk averse means they would be willing to pay for insurance products, and those who are risk lovers represented by 51% of the farmers sampled in the study area, would also need insurance to embark on risky investment.

Table 4.7 Risk Attitude of Cashew Crop Farmers in the Study Area

Risk Attitude	Frequency	Percent
Risk Averse	176	44.2
Risk Neutral	16	4.0
Risk Loving	206	51.8
Total	398	100.0

Source: Field Survey, 2013

The results also indicated that 4% are risk neutral, meaning they are indifferent and may require to have more resource to increase their risk capacity in order to mitigate the impact of any damage or loss to their investment. This is supportive of the endowment effect theory, which posit that individual risk aversion affect their insurance decision making, it also supports the risk homeostatic theory which argues that individuals are risk takers, since most of the farmers sampled in the study area are risk preferers. It is instructive to note that majority of farmers require insurance and to be able to develop insurance for them, and then estimate of their crop production or market value per acre is imperative. In this study knowledge of their crop production budget per acre was analyzed using their production cost per acre as shown in Table 4.8

4.10. Cashew Farmers Crop Budget per Acre

Data on the crop production budget per Acre for cashew farmers was collected and analysed. Table 4.8 provides the detailed budget statistics.

Table 4.8: Cashew Farmers Crop Production Budget per Acre

Variable	Mean	Std. Deviation	Minimum	Maximum
Land clearing	95.69	11.42	70	160
Pruning	46.89	7.09	30	80
Cost of Fertilizer Application	50.00	0	50	50
Labour cost	15.88	1.41	15	18
Harvesting	25.19	34.03	12	150
Miscellaneous	111.00	0	111 140	111
Mean total production cost	345.59	99.25		910

Source: Field Survey, 2013

Modelling hypothetical agricultural insurance products based on cashew crop farmers residual risk, requires estimation of the sum insured or sum assured, which is the amount of money to be paid to the cashew crop farmer in the event of loss and this is based on the farmers production cost or crop production budget per acre, though it can also be based on market value of products, this study estimated the sum assured based on production cost per acre since the market for cashew in the study area is less developed and not integrated with other market in other regions in Ghana. The estimation of farmers crop production cost was necessary to estimate the technical premium which is the pure loss cost or the cost of paying claims to a cashew crop farmers in the study area .This is normally estimated by multiplying the sum assured by the probability of the risk factors or perils the insurance product will cover, before the premium is loaded for operational cost to arrived at the administrative premium as indicated by Nodling *et al.* (2010) and Global Agrisk(2009) premium estimation models discussed in chapter three.

Table 4.8 shows cashew farmers crop production budget per acre. The average unit cost per acre for land clearing/weeding was GH¢95.69 with minimum and maximum unit cost per acre is GH¢70 and GH¢160 respectively. The average unit cost of pruning per acre is GH₵46.89, minimum and maximum cost is GH₵30.00 and GH₵80.00 respectively. The standard deviation is significantly lower when compared to the mean showing that there is a minimum deviation in the data, hence the mean is representative. Additionally, 378 of the cashew farmers who are the respondents submitted that their cost per acre for harvesting cashew crop, GH₵25.19. Farmers had GH₵111.00 as miscellaneous expenses. From the study, the minimum mean estimate for cashew crop production or their minimum crop production budget per acre was estimated at ¢345.59 and this was consistent with the results of the focus group discussion while the maximum mean estimate was GH¢910. However, taking into consideration inflation and other market related challenges, the maximum crop budget per acre which is GH¢ 910 was used in estimating the technical and administrative premium for hypothetical insurance products for the insurance development and choice survey. This was done with the anticipated price changes of inputs so as to make the results relevant in 2014, the year the insurance development and choice experiment survey was done. Moreover, it made room for unforeseen contingencies in the years ahead, and also due to the fact that a pure loss cost for a risk exposure of GH¢910 per acre will give an optimal premium estimate which will reflect the actuarial technical premium estimate based on validation discussions and in-depth interviews with insurers, reinsurers and MoFA crop directorate in addition to an enterprise budget for cashew production in the study area supported the use of GH¢ 910 per acre.

Table 4.9 Lands devoted for Cashew Production in the Study Area in Acres

Variables	Mean	Std. Deviation	Minimum	Maximum
Total farm land in Acres	11.7	19.806	1	300
Total farm land use for cashew cultivation	4.04	9.267	1	150

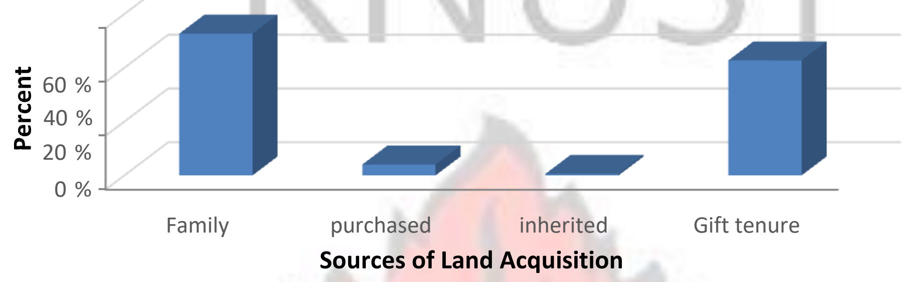
Source: Field Study, 2013

From the results, the mean farm sizes were 11.7 acrest of which 4.04 acres was used for cashew cultivation. This means that most of their lands were used for cashew production and their investment must be protected with insurance also, their farm sizes also suggest that the farmers are small holders and this has implication for insurance product development and marketing.More importantly the results revealed that the farmers in the study area still have lands for expansion of their cashew production when given financial assistance so as to mitigate the effect of climate change in the year 2030 and beyond when cocoa production fall.

4.11. Land Tenure System

When asked of the sources of acquisition of those lands, 50% indicated that the land belongs to their families, while 40% made it explicit that it was given to them as gift from their family, and significant number of them (10%) either purchased the lands or inherited them as shown in figure 4.7

Figure 4.7 Source of Acquisition for the Lands by Cashew Farmers in the Study Area



Source: Field Survey, 2013

The analysis indicated that families are allodial title holders and most farmers have acquired usufactuary rights to use the lands. This has implication for cashew development and insurance product development and marketing, as individuals under usufactuary rights can embark on long term investment on the land in so far us the individual pays allegiance to the stool or family and fulfil their obligations under the tenure system will continue to own the lands. However, those who have it as a gift are at liberty to use the land perpetually.

According to Kane and Sand (1998) as cited in Kane(2004) that land tenure is a constraint to cashew development in Ghana and lack of land titles by owner means they cannot be used as collaterals to secure loans necessitating the development of agricultural insurance products for the subsector(Stutley,2010).

Moreover, Akter and Brouwer (2007) noted that crop insurance demand varied across land ownership. They noted land owners were more willing to buy insurance than landless owners.

4.12. Sources of Labour for cashew production in the study area

Labour play a major role in cashew development, and lack of it at critical times is a major risk.Consequently; availability of labour is a recipe and catalyst for cashew development.

Figure 4.8 unravels the sources of labour in the study area.

Figure 4.8 Sources of Labour in for cashew farmers in the study area

Source: Field Survey, 2013

Farmers were asked to indicate the source of labour they use for cashew production. It was revealed that most of the farmers used both family and hired labour for cashew production. It was observed that 42% use hired only for farming and 7% use family labour only for cashew production. No wonder lack of labour at critical times was identified as a prominent factor in the factor analysis in Table 4.3.2, consistent with the observation made by Kane (2004) who reports that lack of labour was a constraint to cashew development. It must be noted that weed control and other agronomic practises are conditions required to be fulfilled under agricultural insurance contracts particularly multiperil crop insurance (MPCI) contracts and aggregate loss of investment where yields and revenue loss are involved.

4.13. Cropping Calendar

Cropping calendars are important in loan disbursement in financial institutions and insurance product development and marketing. To identify a cropping calendar for the farmers in order to identify insurance cover for the various phases, of the cashew plant, respondent mainly cashew crop farmers were asked of their cropping methods and also state the specific period. It was observed that most of the farmers 62% start their land preparation in February. As

Table 4.10: Agronomic Practices of Cashew Farmers in the Study Area

Type of Preparation	Seasons	Frequency	Percentage
Land preparation	February January	246	62%
		151	38%
	Total	397	100%
Creation of fire belt	December	353 20	95%
	November		5%
	Total	373	100%
Transplanting period	June	1	0.40%
	September	284	99.60%
	Total	285	100.00%
Intercrop at the growth stage	1-4 Years	91	27%
	1-5 Years	251	73%
	Total	342	100%
Length of time for a transplanted plant to get acclimatised	1 Month	394	100%
First weed control	June	338	85%
	June/July	12	3%
	May	26	7%
	May/June	21	5%
	Total	397	100%
Second weed control	December	20	5%
	November	367	95%
	Total	387	100%
Pruning	July	176	77.20%
	June	42	18.40%
	June/July	10	4.40%
	Total	228	100.00%
Harvesting	January-April	356	100.00%

Source: Field Survey, 2013

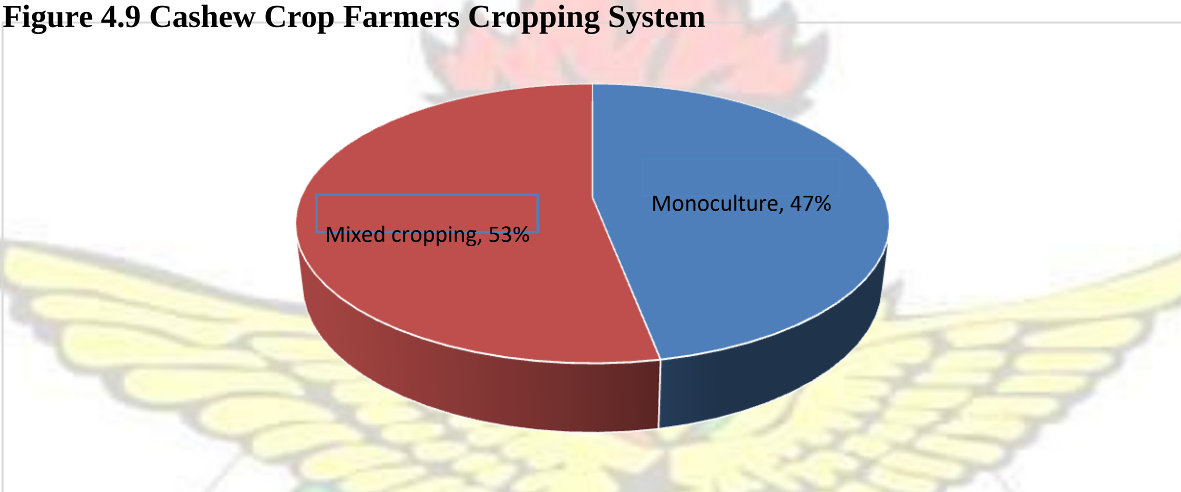
shown in the Table 4.10, 38% of the respondents maintained that preparation mainly starts in January. In December, when the Harmattan is severe represented by 95% of the respondents contended that fire belts are created, while 5% were of the view that, it is created in November. The transplanting period was observed to be in September, 95% of the respondent indicated that, while 75% intercrop at the growth stage from 1-5 years, a system known by foresters as modified Taungya system (MTS) where forest trees are intercrop with food crop, in order to control weeds, and also harvest the food crops, here the author is of the view that, farmer's should rather plant maize as a cash crop, since GAIP, already offer index insurance for maize, and in this regard, insurance product can cover the two products simultaneously, while farmers' harvest the maize crop annually, until the fourth or fifth year when the cashew crop start to produce in order to recoup part of the investment cost in cashew for the project to be viable. Weed control, pesticide application and harvesting were also considered. Most of the respondents representing 95% indicated that the first weed indicated control is done in June while second weed control is done in November as indicated by 95% of the respondent.

With regards to pruning varied results were obtained, but the dominant period for pruning was in July, representing 77.2% while 18% and contended that it was done in June. However, 4.4% of the respondents succinctly opined that it can be done for both months.Knowledge of cashew agronomy and silvicuture such as weed control, pruning, pest control, are absolutely critical to obtaining insurance cover on loss of revenue and loss investments through poor yields

4.14 Cashew Farmers Cropping System in the Study Area

In order to ascertain the cropping system in order to identify the type of insurance contracts would be vital to managing cashew crop farmers residual risk, respondents were asked whether they embark on monoculture or mix cropping , the results in figure 4.9 indicates that 53% embark on mix cropping , while 47% embark on mono culture after canopy formation.

Figure 4.9 Cashew Crop Farmers Cropping System



Source: Field Survey,2013

In order to identify the types of plants intercropped with cashew before canopy formation, the result is shown in the Figure 4.10 on the next page. Those respondents who practise mix cropping before canopy formation, mostly plant maize in addition to cashew crop. All the respondents indicated that at least they plant maize with other crops with cashew crop. 33.7% of the respondents plant maize and cassava with cashew crop. 31% indicated that they intercrop maize and yam with cashew crop. 16%, 13% and 6% inter-crop cashew crop with tomato and maize, groundnut and maize and maize only respectively. However, an exploratory interview with the famers also revealed that crops like cowpeas, makes the cashew crop vulnerable to pest and diseases.

The implication is that, this should be an exclusion clause under indemnity and area yield index insurance contract. However, inter-cropping with maize similar to modified Taungya System (MTS) in forestry governance must be encourage under insurance contracts, but, tomato is also likely to increase pest infestation and must be exclusion under insurance contract, the only crop that should be tolerated under this model, is maize since, there is an index insurance product for maize, and both maize and cashew can be covered simultaneously under simulation and functional synthesis approach which combines indemnity, index and the other approaches until the time that the cashew crop start producing nuts, where the cashew crop can be covered alone. This MTS model involving intercropping with maize product in a contract farming arrangement involving the 90 days variety which is early maturing would generate some annual cash flows from the sales of maize, for financiers of cashew projects, at the initial stages until the fourth year when the crop starts producing nut as indicated by Ashitey and Nicely(2012), so they can make periodic payments to financiers which was also a concerned raised particularly, at the initial stages of the cashew development. However the results in figure 4.10 reveal that tomatoes, groundnut and yam are intercroped with the cashew plantation at the developmental stage

Figure 4.10.1 Plants Intercrop with Cashew in the Study Area

40%
30%
20%
10%
0 %

Crops

Source: Field Survey, 2013

4.15. Detecting the Sowing and Transplanting Windows for Index Insurance Contracts in the study area

For cashew development, there should be insurance for germination to growth. This means the insurance must cover the seedlings as well, however, for the contracts to incept there must be minimum amount of rain, and the number of rainfall can be used as a proxy for the minimum amount of water in the soil for the contract to incept, the number of rainfall respondent expect before nursing/planting/transplanting a cashew plant. Table 4.10 gives the summary statistics on the expected number of rainfall before nursing/planting/transplanting.

Table 4.11: Number of Rainfall Expected Before Nursing/Planting Transplanting

Mean	**Standard deviation**	**Minimum**	**Maximum**
3.67	0.471	3	4

Source: Field Survey, 2013

Admittedly, respondents indicated that they expect approximately 4 conservative times of rainfall before nursing/planting transplanting. From the results, the minimum and maximum number of rainfall expected for nursing/planting transplanting are respectively 3 and 4, this is also good for determining the sowing/planting window for cashew insurance contracts for seedling and transplanting stage. Ultimately, this can be inculcated into the structure of weather index insurance dry days trigger or excess rainfall trigger and can also be a basis for setting triggers for the sowing window.

4.16. Establishing the waiting Period of Insurance Contract inception after transplanting

The respondents were asked the length of time it takes for their transplanted seedlings to get acclimatised. The result is shown in the Table 4.12.

Table 4.12: Length of time for transplanted plant to get acclimatised

Period	Frequency	Percent
1 Month	287	99%
3 Weeks	3	1%
Total	290	100%

Source: Field Survey, 2013

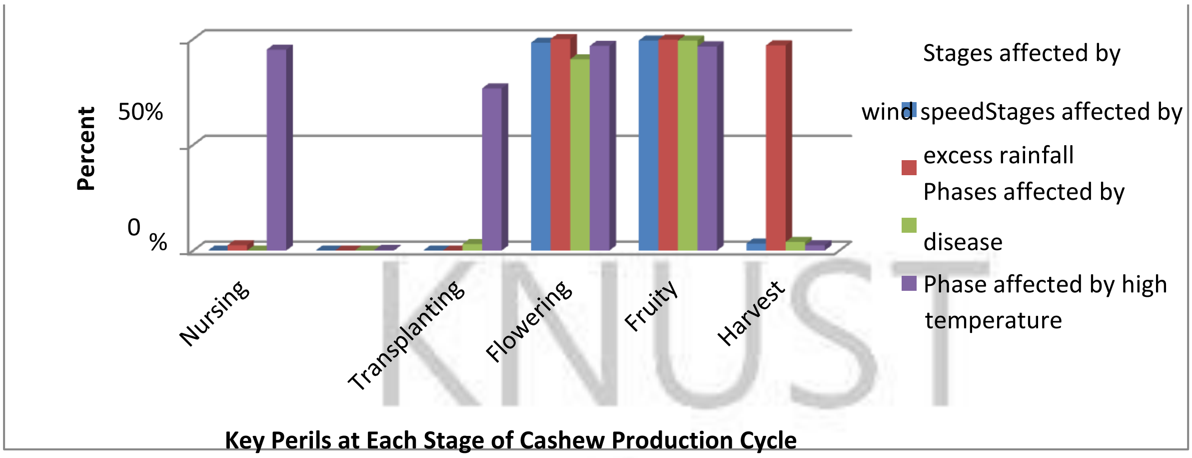
This was earlier on discussed in Table 4.10, however to check the reliability of the results, respondents were asked again. The initial result was 100% consequently it makes sense to conclude that it takes one month. However, 99% of the respondents indicated that it takes one month for a transplanting plant to get acclimatised. Only 1% stresses that it takes 3 weeks this was not too different for transplanted plant to get acclimated, meaning that the waiting period for insurance contract to inception should be one month after transplanting, when cashew plantation is at its developmental stage. This result is also consistent with the observation made by Aknikule *et al*. (2012), who reports that the survival rate is normally high at the nursery from 4-8 weeks.

4.17. Determining key Perils at the Various Stage of a Cashew plant for calibration of index insurance contracts

This section sought to identify key perils the cashew crop encounter during its life cycle. The result is presented in the Figure 4.11.

Figure 4.11 Key Perils at the Various Stage of a Cashew Crop in its production Cycle

100%



Source: Field Survey, 2013

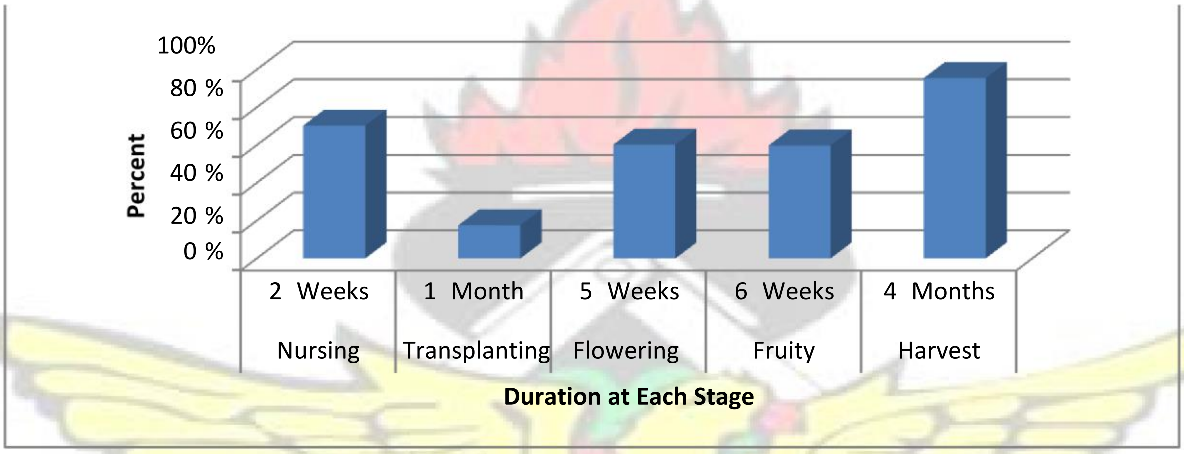
98% and 99% of the respondents indicated that flowering and fruity respectively are affected by wind speed. This is consistent with study of Tsakiris, (1962) who posit that conditions such as storms during flowering and fruits many reduce yields. Stages that are affected by excess rainfall were seen to be flowering, fruity and harvesting. The respondents also posited that diseases affect flowering and fruiting. From the results, high temperature affects all stages of the life cycle of the cashew crop while 95% of the respondents indicated that it affects the nursing stage. The study is consistent with the findings of Kramer and Boyer (1995) who posit that rainfall deficit salinity and supraoptimal temperature are limiting environmental factors that will limit cashew production. The study is also consistent with that Ashitey and Nicely, (2012) and Opeke(1982) in Ghana and Mozambique respectively . From the results 77% indicated that high temperature affects transplanting stage whiles 97% and 96% maintained that it affects flowering and fruity respectively. Form the forging, the insurance trigger for temperature must be set for all stages, from nursery, to fruiting that means there must be a germination trigger. However, the triggers for flowering and fruiting must be high wind speed (windstorm) and excess rainfall from the literature, the mean optimum temperature for cashew ranges between 15 - 35ºc, therefore, trigger for insurance payout, may be set above that temperature, for some number of day in particular times of the month. Besides the optimum rain requirement was also between 900 – 1500 mm per year (Dedzoe *et al.*, 2001; Opeke, 1982). However, the harvesting stage would not have any implication for insurance purpose, since it is purely a management issue and consequently may not be insurable.

Since insurable risk are residuals, which are unforeseen, accidental or fortuitous in nature.

4.18. Establishing the Waiting Period and other Triggers for Insurance Contracts at various stages of Cashew development

The respondents were asked to indicate the length of time it takes for the crop at the nursery to germinate, transplanted, and flowered, fruiting and harvested. This is important for setting triggers for dry days i.e. the number of consecutive days a plant should experience rainfall deficit or excess rainfall in order to affect yields so that the calibration of a weather index product should be aligned with that trigger to avoid temporal basis risk. Similarly, it will also augment the copping calendar to determine the sowing window, ultimately, this will help insurers determine the season for marketing agricultural insurance products. In this study the time for each phase is as shown in figure 4.12.

Figure 4.12Time required for each stage in cashew production cycle in weeks and months

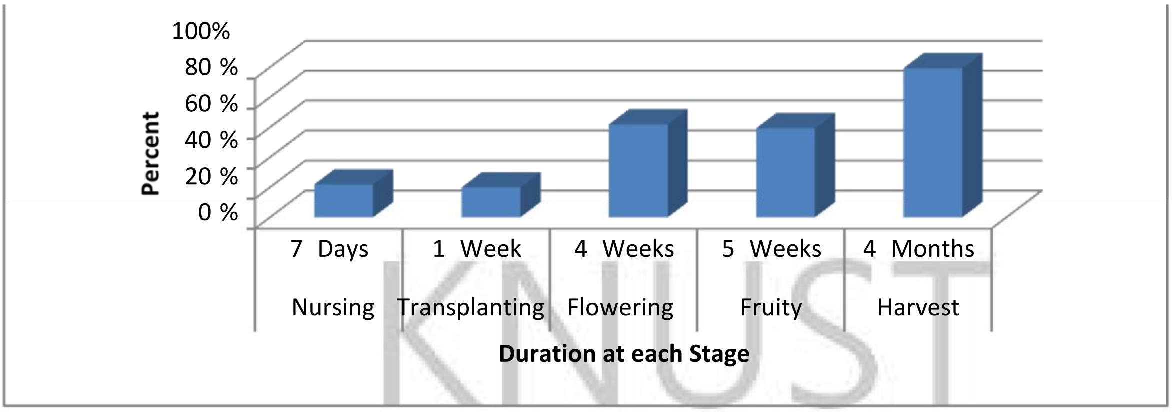


Source: Field Survey, 2013

From the results 70% of the respondents indicated that it takes 2 weeks for the nursed plant to germinate and 18% of the respondents indicated that it takes one month for the crop to be transplanted. 60% of the respondents indicated that the crop takes about 5 weeks to flower, whiles it takes 6 weeks for the crop to produce fruit. Almost all the respondents, 95% indicated that it takes four months for the crop to be harvested. The implication of this is that there should be a waiting period for one month, during the transplanting stage for the insurance contract to incept, and trigger at the flowering and fruiting stage should be set for 5 weeks respectively for high winds peed and excess rainfall at those phases especially for weather and satellite index agricultural insurance contracts.

4.19. Establishing the Dry Day Trigger for Index Insurance Product for Each Phase The respondents were also asked the maximum number of dry days that each phase the cashew crop can tolerate. The result is shown in the Figure 4.13

Figure4.13 Dry spells requirement at each phase during cashew production



Source: Field survey, 2013

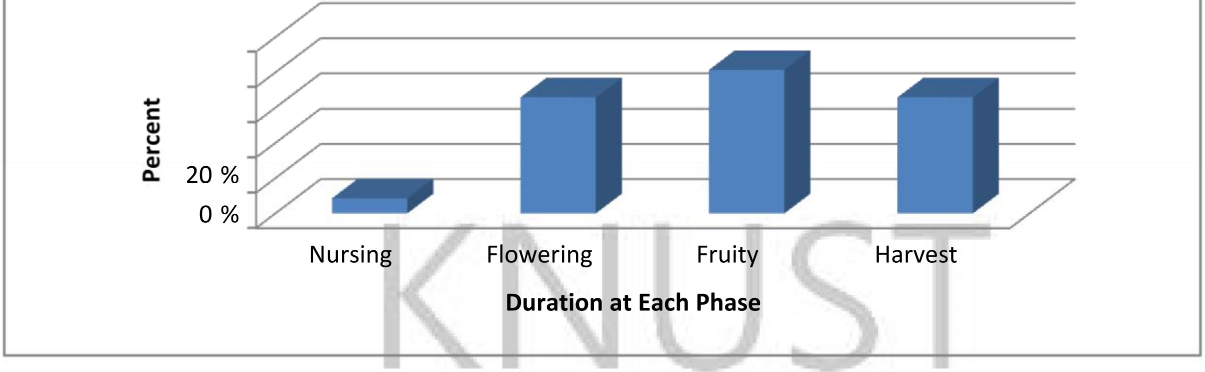
About 28 %t of the respondents indicated that the crop can tolerate 7 consecutive dry days at the nursery stage, while 25% of the respondents indicated that can tolerate a week drought during for transplanting. According to Ashitey and Nicely (2012), dry spells during the flowering and fruiting stages, ensures better harvest. This has implications for insurance contracts, as there should be warranty of rainfall, before nursing 68% of the respondents indicated that the tolerance level of flowering is 4 weeks, while about 62% of the respondents indicated 5 weeks dry to be the level of tolerance for the fruiting stage. Almost all the respondents indicated that the tolerance level for harvesting is 4 months dry period. For insurance purpose, harvesting should be exclusion, since it is a management issue, but triggers for excess rainfall must be in operation, for 4 weeks during flowering and five weeks during fruiting. However, a one-week rain may be okay at the flowering phase, while four weeks' intermittent rain may also be okay as indicated in figure 4.13 on page 133.

4.20. Establishing the Excess Rainfall Trigger for Index Insurance Contracts for Each Phase of the Cashew crop at Production

Besides the consecutive dry days each phase can tolerate, the respondents were also asked the maximum number of raining days that the phase of the cashew crop can tolerate. The result is shown in the Figure 4.14

Figure 4.14Rainfall requirement at each Phase of cashew production cycle

100%
80 %
60 %
40 %



Source: Field Survey, 2013

About 12% of the respondents indicated that the maximum number of raining days that the nursing period can tolerate is 7 days while 66% of the respondents indicated that flowering period can tolerate a maximum of 1 week raining period. 4 maximum weeks of the raining period is tolerated by the fruity stage according to 81% of the respondents. Also 66% of the respondents indicated that harvesting period can tolerate a maximum of 4 months raining days. This is not different from the number of dry days. This means that the calibration of weather index product for excess rainfall should be at flowering and fruiting stages.

4.21. Establishing the Key Parameters for Calibration of Index Insurance contracts through the opinion of Respondents on Key Perils at the Various Stages of the Cashew Crop

To validate the risk factors that have been identified at each phase as potential or key perils that would affect cashew production and subsequently reduce the yield, in case these events occur, and to determine the structure of an index product, through calibration, and also to align the triggers to the various phases of the crop production cycle and budget, respondent were asked to identify the key perils that affect as various stages of growth of the cashew plant as shown in Table 4.13

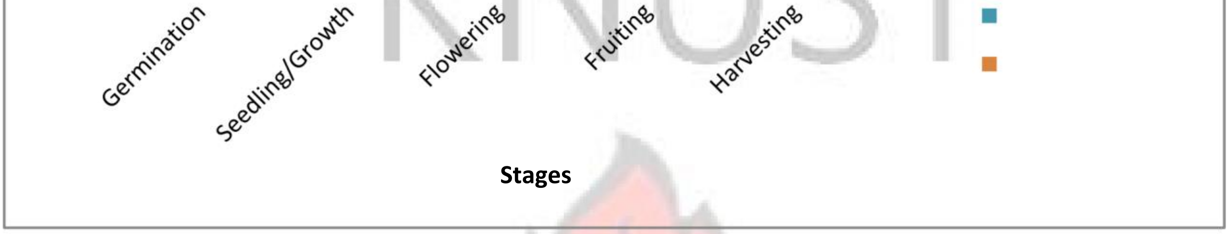
Table 4.13: Opinion of Respondents on Key Perils that affect the various Stages of the Cashew Crop at Production

Stage	Parameters (N=395)					
	Moisture	Excess Rainfall	Drought	Wind Speed	High temperature	Pest damage
Germination	1(0.3%)	69(17.3%)	361(90.7%)	0(0.0%)	355(89.1%)	1(0.3%)
Seedling/Growth	2(0.5%)	22(5.5%)	348(87.4%)	3(0.8%)	299(75.1%)	2(0.5%)
Flowering	0(0.0%)	392(98.5%)	5(1.3%)	392(98.5%)	396(99.5%)	395(99.2%)
Fruiting	0(0.0%)	389(97.7%)	5(1.3%)	392(98.5%)	397(99.7%)	397(99.7%)
Harvesting	276(69.3%)	374(94.0%)	11(2.8%)	1(0.3%)	2(0.5%)	3(0.8%)

Source: Field Survey, 2013 * Frequency (Percentage)

Table 4.13 gives an overview of the perils that affect the cashew crop life cycle. At the germination stage, majority of the respondents indicated that drought, excess rain fall and high temperature were factors that affected the germination process. From the result they were 17.3% for excess rain, 90.7% for drought 89.1% temperature, consistent with the findings of Kramer and Boyer (1995) who contended that excess supra-optional temperature limits product of cashew. Drought and high temperature also affect the seedling stage of plantation, from the results it was indicated by 87.4% of respondents for droughts, and 75.1% for high temperature whiles excess rainfall, wind speed, high temperature and pest and disease were factors identified to affect the flowering stage. During fruiting stage 97.7 of the respondents indicated that excess rainfall and wind speed affect fruiting stage, whiles all the respondents indicated high temperature and pest and disease affect flowering stage of plantation. Finally, majority of the respondents indicate moisture and excess rainfall affects harvesting stage of plantation. Tsakiris (1962), noted that disease, and windstorm during flowering and fruiting also reduce yields. This is clearly represented in figure 4.15.

Figure 4.15. Key perils at various stages of the cashew crop in the study area



Source: Field Survey, 2013

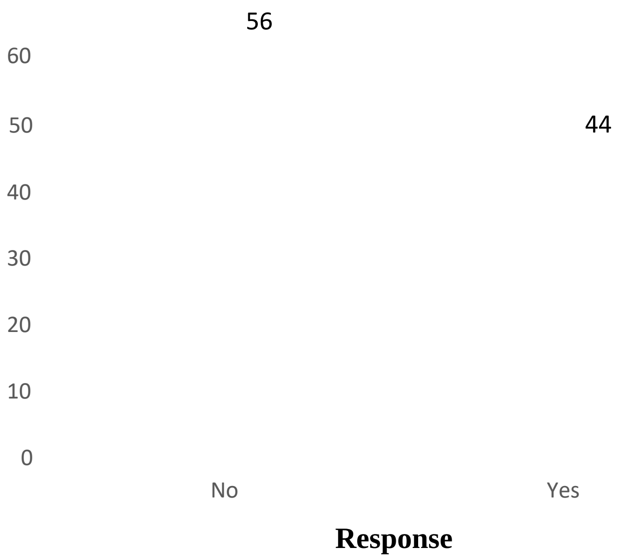
From the results, contrary to the findings of Mole (2000), moisture, is not an insurance issue, it has to do with storage and drying, making it a management issue, which should normally be an exclusion under indemnity insurance contracts. However, rainfall at germination, flowering and fruiting stages of a cashew crop is an issue, and need insurance cover dry spells only at the germination phase, while high temperature can be a challenge at all phase, with the exception of harvesting, with pest and disease, being an issue at flowering and fruiting stage for index, simulation and functional synthesis insurance contracts. However, pest and disease were management issues from the risk perception , agronomic and meterological results as farmers indicated that they used biological methods to contol it and do not require insurance to mange it as indicated by respondents in figure 4.6.1 and 4.6.2 . However, the results indicate that insurance was sought for high wind speed at flowering and fruiting, excess rainfall at the same phase and excessive temperature, for all the phase, consequently insurance trigger for weather index for excess rain, high wind speed, and high temperature, should cover those phase, Moreover, high speed and excess rainfall trigger should cover flowering and fruiting stage of matured plant while temperature should cover all the phases.

4.22 Meteorological Analysis of Cashew farmers' knowledge of Weather Stations for Index Insurance Contracts

From the literature reviewed, index insurance contracts particularly weather index uses weather stations. GAIP uses data obtained from Ghana Meteorological Agency (G.Met) weather stations or satellite agencies. Consequently, cashew crop farmers' knowledge of location of G met weather station is a prerequisite for index insurance contract in the study area as farmers are suppose to be within 20Km radius of Gmet selected weather station to qualify for insurance contracts.

From Figure 2.6.1.1, G.met Selected weather stations for weather index insurance, it was seen that Brong Ahafo Region, which is the study area, has 10 selected weather stations, which is the highest number of G. Met selected weather stations in Ghana and the criteria for selection is that weather station should have 30 years historical data with less than 5% data gaps (Technical Management Unit of GAIP, 2012). Respondents were asked whether they knew of weather stations in their communities and also to find out the location in relation to their fields the results are found in figure 4.18, 4.18.1 and 4.1.

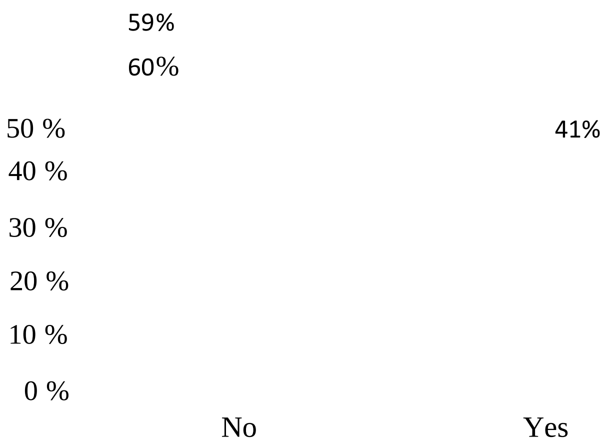
Figure 4.17 Cashew Crop Farmers Knowledge of Weather Station



Source: Field Survey, 2013

From the results 44% had knowlage of weather stations, which is good for weather index insurance constracts. However, to find out if they knew the location of their farms in relation to a weather station, a question was posed to find out if there is a forest between the nearest weather station and their farms in order to find out if there is basis risk. This is revealed in figure 4.18.

Figure 4.18 Identifying the likelihood of occurrence of Spatial Basis Risk in Weather Index Insurance contracts.



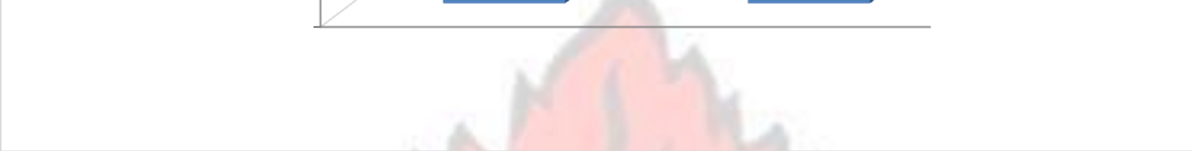
Source: Field Survey, 2013

About 59% indicated no while about 41% of the respondents who had knowledge of the weather stations were of the view that there were forest between their farm and the weather station.Those with forest between their farms and weather stations connotes longer distance between their farms in relation to weather stations, and also connotes the presence micro climates in the 20 km radius required for a farmer to sign on to a weather index insurance contract involving the use of G. Met weather station.This may be a recipe for basis risk.Basis risk is the potential mismatch between the loss experience by the farmer and the pay-out triggered developed by the insurer in index insurance contracts (World Bank, 2010). Particularly spatial basis risk is a situation where there is location variation in the peril occurrence for example rainfall deficit or dry spells, within the area surrounding the weather stations.(IFAD,2011).Depending on the climatology as well as the topography of an area, spatial basis risk, may occur and may not have been captured by the index (Hellmuth *et al*., 2009).

Spatial Basis risk is influenced by the degree of covariate risk in a geographical area and it is lower where there are no microclimates, though products and crop specific basis risk may result from different management practices, crop varieties to distort the impact of climatic risks (World Bank, 2010).

If basis risk is relatively small, noticeable and predictable, then it would not be a challenge for the insured, else it will pose a threat to insurance marketing, as there is a possibility of the insurer to experience reputation risk (World Bank, 2010). A follow up questions was also asked if they knew of mountains between the nearest weather stations and their farms to detect the presence of basis risk shown in figure 4.19

Figure 4.19 determining the presence of Micro climates in relation to spatial basis risk



Source: Field Survey, 2013

To find out if microclimates exist between their farms and selected weather stations, they were asked for the presences of mountains between their farms and the weather stations they knew. The results indicated that 98% of the respondents have no idea of any mountain between any weather station and their farms. Admittedly these questions were asked in order to identify potential basis risk which is the potential mismatch between the loss experience by the farmer and the pay-out triggered developed by the insurer in index insurance contracts(World Bank, 2010). This may be addressed using satellite based product, as discussed in chapter two under the theme responding to basis risk through satellite methodology.

4.20 Chapter Summary

In this chapter we analyzed and discussed the results obtained from primary data from the risk perception, agronomic and meteorological survey, which was a pre-requisite for modeling evidence, based hypothetical insurance products, in order to embark on an insurance development and choice experiment survey. The results indicated that cashew farmers were risk averse and risk preferer. Moreover their residual risk was high temperature; excess rainfall, high windspeed and fire. Based on this hypothetical agricultural insurance was modeled based on five agricultural insurance philosophies.For the index approach, the key perils that affect the germination, transplanting , growth , flowering, fruiting and harvesting stages were dectected and factored into the product design. The next chapter is devoted to the discussions of insurance development and choice experiment results.

CHAPTER FIVE DISCUSSION OF CHOICE EXPERIMENT AND INSURANCE DEVELOPMENT RESULTS

5.0 Introduction

This chapter consists of two main sections. Section one presents a descriptive analysis on farmer and household characteristics, awareness of agricultural insurance and other insurance products, the feasible distribution channels of selling agricultural insurances, preference for insurance supply models and the constraints to development of agricultural insurance and cashew crop farmers in the study area. Also discussed under this section are insurance stakeholders and financial institutions' preference for agricultural insurance approaches and product options as well as Ghana Agricultural Insurance Pool's (GAIP) interest in designing and distributing agricultural insurance for cashew crop farmers in the

Brong-Ahafo Region of Ghana. The required support needed by pool stakeholders to develop agricultural insurance in Ghana was also discussed.

Section two presents discussions on the empirical results. This comprises the empirical estimation of the mean Willingness to Pay (WTP) for agricultural insurance approaches or philosophies preferred by cashew farmers and key perils in the study area using mix logit and estimated with the latent class model. Also latent class and multinomial logit were used to identify the determinants of willingness to pay for agricultural insurance in the study area.All these were done with an aim of identifying agricultural insurance development strategy for cashew crop farmers in the study area.

5.1 Descriptive Results

5.1.1 Descriptive Characteristics of Farmers

Table 5.1 presents the descriptive characteristics of the farmers and their household and farm characteristics.

The results show that 74.7% of the sampled respondents were males with only 25.3% being females. This suggests that cashew production in the study area is dominated by males. Most studies show that female individuals and most households headed by females are more likely to be members of insurance schemes (Owusu *et al.*, 2012). About 52% of the respondents have farming as their main occupation, 38.6% do trading as their main occupation, 4.2% engage in carpentry work as their main source of occupation with only 3.4% being salaried workers. This implies that most of the respondents have farming as their main source of income followed by trading with the second highest percentage; this also suggests that cashew production is one of the alternative employments for traders in the study area.

Characteristic	**Frequency**	**Percentage**
	Gender	*N=383*
Males	286	74.7
Females	97	25.3
	Main occupation	
Farmer	198	51.7
Salary worker	13	3.4
Trader	148	38.6
Craftsmanship	3	0.8
Labourer	5	1.3
Carpentry	16	4.2
	Religion	
Christian	355	92.7
Muslim	20	5.2

Traditional	8	2.1
Marital Status		
Single	45	11.7
Married	330	86.2
Widow	8	2.1
Education		
No formal education	3	0.8
Primary	73	19.1
JSS/JHS	67	17.5
SSS/SHS	163	42.6
Training/poly	62	16.2
University	14	3.7
MSLC	1	0.3
Household head		
Yes	291	76.0
No	92	24.0
FBO Membership		
Yes	3	0.8
No	380	99.2
Credit access		
Yes	80	20.9
No	303	79.1
Agric training		
Yes	127	33.2
No	256	66.8
Characteristic	**Mean**	**Standard deviation**
Age	48.73	11.54
Household size	4.47	1.38
Farming experience	21.94	12.03
Farm size	5.69	3.52
Farm age	14.71	4.12
Farm distance (km)	5.23	4.96

Table 5.1 Farmer and farm characteristics
Source: Field survey, 2014

In this regard, there is a need to protect the farmers' investment by means of insurance, so that in the event of accidental losses, farmers would not fall into what Wenner (2005) refers to as poverty trap.

It was observed that 92.7% of the respondents were Christians; only 5.2% being Muslims and 2.1% were traditionalists. The prevalence of Christians in the study area implies that cashew production is dominated by Christians with few Muslims and Traditionalists; thus Takaful insurance would not be necessary until the Muslim population becomes substantial since Muslims prefer the Takaful Insurance. This is an Islamic insurance, meaning joint guarantee in Arabic, and it is an insurance system based on Islamic law that is anchored on the principle of mutual assistance and voluntary contributions and collective risk bearing, where interest rates, gambling, uncertainty and profit from losses from others are forbidden and deemed to be inappropriate.

Most of the sampled respondents were married with a percentage of 86.2 while 11.7% were singles and only 2.1% were widows. The prevalence of married people in the cashew sector is good for sustainability of insurance scheme, since insurance underwriting assumed that married individuals live longer than singles and also makes insurance a prerequisite in protecting their household investment in order not to fall into poverty trap or old age income insecurity and poverty. Nketia-Amponsah (2009) and Chankora *et al.* (2008) noted that married couples tend to be risk-averse and may demand insurance to protect their children. However, in-depth interview with the financial institutions brought to light that polygamous marriage among farmers has a link with default risk in agri-lending.

Regarding education, Nelson *et al.,* (1966) used the level of education as a proxy for human capital theory indicator to reflect farmers' ability to adopt innovative risk management technique such as agricultural insurance. The results show that most of the respondents have attained senior high school education (42.6%), 19.1% have attained primary level of educations, 17.5% have attained junior high school level of education, 16.2% have attained teacher training or polytechnic education with only 0.8% having no formal education. This implies that most of the respondents have had some form of formal education indicating that cashew production in the study area is dominated by educated farmers consistent with the human captital theory. This is good for insurance contracts since insurance policies should be read and the terms understood to avoid potential conflict which is the source of reputation risk for the insurer. Also Raju and Chand (2008); Sherrick *et al.* (2004) among others found a correlation between education and insurance uptake.

Most of the sampled respondents were heads of their households (76%) whiles 24% were not heads of households. Undoubtedly, this is good for market targeting since household heads are influencers and deciders in consumers decision making units (DMU) (See Kotler andKeller, 2011). Only 20.9% have access to credit whiles 79.1% do not have access to credit in any form. This is consistent with the observation made by Osei-Tutu (2012) and also confirmed by Awunyo-Vitorr from his study of Maize farmers in the study area and Ashanti

Region as well as the results of the factor analysis of the risk perception, agronomic and meteorological survey of the study area in 2013. Out of the 20.9% who have access to credits, their sources of credit are shown in Table 5.1

Table 5.1 Sources of Loans for Cashew crop farmers in the Study Area

Financial Institutions	Frequency	Percent
Bankers	62	82%
Microfinance	10	13%
Farm based organizations	2	3%
Community Banks	1	1%
Credit Union	1	1%
Total	76	100%

Source: Field Survey, 2014

The results indicate that the few farmers that had access to credit had it from the banks; consequently, the banks have the potential to extend credit to farmers if there is an insurance scheme available as observed by Gine and Yang (2009) in Malawi among financiers of groundnut farmers.

From the results of the study,three main challenges in taking a loan/credit from financial institutions were identified in the study area. These were interest rate, time of disbursement and process of appraisal as detailed in Table 5.2. About 33% of 20.9% the farmers who had had access to credit viewed financial institutions in the study area process of appraisal and time of disbursement a challenge in accessing credits. Moreover, 22% of the 20.9% faced the challenge of interest rate and time of disbursement. This is indeed a constraint for cashew development since farmers are left with no option to use equity instead of debt financing. Moreover, the time of disbursement being a challenge means banks do not have farmers cropping calendar in order to align their operations with the farmers' crop production cycle. The results are shown in Table 5.2.

Table 5.2 Cashew crop farmers' challenges in accessing credit from financial institutions

Challenges	Frequency	Percent
Interest rate	25	33%
Process of appraisal	2	3%
Time of disbursement	7	9%
Interest rate & Time of disbursement	17	22%
Process of appraisal & Time disbursement	25	33%
Total	76	100%

Source: Field survey, 2014

Table 5.3 gives credence to the notion that farmers would require debt financing as well from financial institutions as 97% of the respondents in the study area indicated that they purchase inputs on their own; while few of them use stocks from their farms. In this regard, if farmers have access to credit in the form of value chain financing it would be a panacea for cashew development.

Table 5.3 Sources of Inputs for Cashew Farmers in the study area

Sources of Inputs	Frequency	Percent
Purchased	370	97%
Own farm	8	2%
Relatives	1	0%
Purchased & Own farm	1	0%
Total	380	100%

Source: Field Survey, 2014

In terms of agricultural training, 33.2% have received agricultural training before whiles majority of them have not received the training before (66.8%). Out of those who have had training, 85.4 % of 33.2% indicated that they had their training from MoFA, while 13.8 had their training from Both MoFA and NGOs. This shows that collaboration with MOFA for training purposes is imperative in fostering cashew development as well as development of agricultural insurance in the study area. Besides, training is necessary for the usage of credit and is crucial to understanding insurance contract. The results on sources of trainings involving the collaboration with MoFA and NGOs is consistent with Ashitey and Nicely (2012), who report of weak extension services as a constraint to cashew development in Ghana. Coydon and Molitor (2012), also observed that membership of CBOs have positive influence on insurance distribution.

Table 5.4 Sources of Training for cashew Farmers in the study area

Source of Training	Frequency	Percent
MOFA	111	85.4
NGO	1	0.8
MOFA & NGO	18	13.8

Total	130	100.0

Source: Field Survey, 2014

With regard to FBO membership, about 99% of the respondents do not belong to any farmerbased organization in the study area defying the social control theory which views connection with organisation as a tool for ensuring conformity in order to decrease risk behaviours. Osei-

Tutu (2012) noted that weak FBOs' is a constraint in the sub-sector. It is instructive to note that lack of FBO membership is a constraint to credit access since membership in FBO helps in peer to peer guarantees, and credit uptake would have a positive externality effect on insurance uptake. The mean age of the farmers was 48.73, which was not different from the risk perception, meteorology and agronomic survey which was 48.67 and this implies that cashew production is dominated by farmers, who are within the middle age class with mean household size of 4.47. The mean age of farmers coupled with their farming experience suggest that moral hazards in insurance contracts is likely to be low, as younger and inexperience farmers are likely to introduce anti selection in index contract and moral hazards in indemnity contracts.

Ben-Housa (2010) noted that large household size used precautionary savings probability due to the absence of agricultural insurance for cocoa farmers in Cote d'Ivoire at the time of his study. On the average, the sampled respondents have about 22 years of farming experience and an average farm size of 5.69.Enjora *et al*. (2007) as well as Akter and Brouwer (2007) found a positive correlation between farm size and insurance uptake.

Averagely, the age of the cashew plantations of respondents is about 15 years. This suggests that most cashew plants in the study area are at their peak of production. Ashitey and Nicely (2012) observe that the cashew plant production is at its peak during the first 15 to 20 years

Finally, the distance from home to the cashew farm is about 5.2km, which has implications for indemnity contract underwriting, since farms need to be mapped and GPS coordinates taken for indemnity and simulation contracts. While Asenso-Okyere *et al.* (2007) observed that distance to health facility was an insignificant determinant of willingness to pay, Jehu Appiah *et al.* (2011a) found a correlation between convenience and enrolment of NHIS scheme in Ghana.

5.1.2 Cashew Farmers Awareness and Knowledge on Agricultural Insurance

Farmers' awareness and knowledge on agricultural insurance are presented in Table 5.6 and 5.7. The results show that 97.1% of the respondents are aware of insurance in general with only 2.9% being unaware of insurance. This implies that awareness of insurance is high among the sampled respondents in the study area. However, it was revealed that only 6.5% were aware of agricultural insurance products in the Ghanaian insurance market, consistent with observation made by NIC and Imhire (2011); Stutley and Mahul (2010) that penetration is low in Ghana and Africa. The results of the insurance development and choice experiment survey in the study area also indicated that 93.5% were not aware of any agricultural insurance products. This suggests that there is low awareness of agricultural insurance products in the study area. Coydon and Molitor (2011) found out that lack of insurance awareness normally hampers demand for micro insurance.

Table 5.6 Farmers Awareness and knowledge of agricultural insurance

Item	**Percentage (Frequency)**	
	Yes	**No**
I have heard about Insurance before.	97.1%(372)	2.9%(11)
I am aware of agricultural insurance products.	6.5% (25)	93.5%(358)
I am aware of other insurance products.	90.1%(345)	9.9%(38)

Source: Field survey, 2014

Following respondents' lack of awareness of agricultural insurance products in the study area, their opinion on media for promoting agric insurance to cashew crop farmers was also sought. The results indicated that all the respondents were positive that agric insurance can best be promoted on televisions and local radio stations in the study area.

Table 5.7Farmers Opinion on Media for Creating Awareness of Agricultural insurance

Medium for Awareness Creation	Percentage (frequency)	Percentage (frequency)
	Yes	**No**
Television	100%(383)	**0**
Llocal radio station	99.7%(382)	0.3%(1)
News paper	11.0%(42)	89.0%(341)
NGO activities	1.0%(4)	99.0%(379)
Through FBO meetings	0.8%(3)	99.2%(380)
Through corporative meetings	0	100%(383)
Through national commission for civic education	9.7%(37)	90.3%(346)

Source: Field survey, 2014

Almost hundred per cent (99.7%) of the respondents alluded to the fact that agricultural insurance for cashew farmers in the study area can best be done through local radio stations. However, most of the respondents did not view media such as: newspaper, NGOs, farmer based organization, cooperatives and national commission of civic education with the following percentages 89.0%, 99.0%, 99.2%, and 90.3%as useful promotional tools for promoting agricultural insurance in the study area.

Finally, all the respondents were of the view that agric insurance could not be best promoted through cooperative meetings. Their awareness of insurance products in general was revealed in table 5.7.1

Table 5.7.1 Farmers Awareness of General Insurance Products (Name of insurance product(s) they knew)

Categories	Frequency	Percent
Health insurance only	60	16.2
Both health and motor insurance	300	81.1
Property insurane only	10	2.7
Total	370	100

Source: Field Survey, 2014

With regard to awareness of insurance in general 81.1% of them have heard about both health and motor insurance, while 1% have heard about health insurance only and 3% have heard about property insurance only. This means that promotion of agricultural insurance is key, and can be best done in relation to health and motor insurance on radios and television since respondents are already aware of their existences. This is detailed in Table 5. 7.1

Table 5.8 Cashew Crop Farmers Experience with Insurance in General and WTP for Agricultural Insurance Product **Frequency (Percentage)**

	No	Yes
Do you have any insurance package for your self	73 (19.2%)	308 (80.8%)
Do you have any insurance package for your house	369 (99.5%)	2 (0.5%)
Do you have any insurance package for other properties	345 (93.0 %)	26 (7%)
Do you have access to public help in times of disaster?	377 (99.7%)	1 (0.3%)
Are you aware of agricultural insurance products?	380 (99.7%)	1 (0.3%)
Do you have off farm income?	273 (76.7%)	83 (23.3%)
Do you have income from other crops on your farm?	105 (27.8%)	273 (72.2%)
Do you seek support from any source in times of disaster?	376 (98.7%)	5 (1.3%)
Is your farm in drought or flood prone zone?	375 (99.5%)	2 (0.5%)
Are you willing to pay for insurance for your cashew?	38 (10.0%)	345 (90.0%)

Source: Field Survey, 2014

With regard to willingness to pay, majority of the farmers (90%) indicated that they are willing to pay for insurance to insure their cashew farmers. However, their preference for mode of payment whether by cash or cheque, annually, semi-annually, or quarterly is discussed in the latent class utility estimates of the empirical results. About 80.8% of farmers have insurance packages, with only 2% having insuring their house. Indepth interview that the insurance packages 80.8% have experienced is health insurance consequently benefits of agricultural insurance can be related to health insurance for marketing purposes.

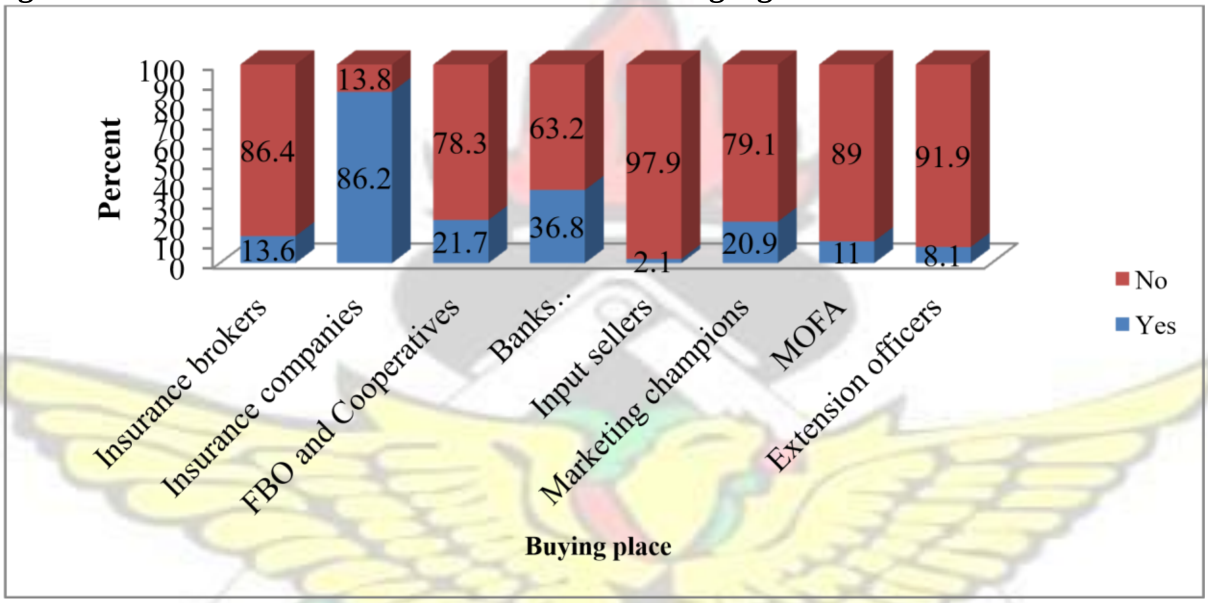
Only 1.3% seeks support from any income sources in times of disaster and 98.7% do not seek support from any sources in times of disaster, necessitating the development of agricultural insurance to cater for them in times of disaster. In the Spanish model, farmers support in times of disaster is tied to the purchase of agricultural insurance.

5.1.3. Farmers' Perception of Distribution Channels of Selling Agricultural Insurance Products

The distribution channels where farmers want to buy agricultural insurance products are presented in Figure 5.1. The results show that 13.6% of the respondents indicated they will want to buy insurance from brokers whereas 86.4% did not prefer buying from insurance brokers. Most of the respondents unwillingness to buy from brokers partially contradicts the findings of Mari (2009) who in his analysis of agricultural markets posit that marketing system vary from farmer markets, cooperative markets, corporate markets to contract markets and identified channels for marketing agricultural products as brokers, cooperative societies, traders, markets, assemblies, wholesalers, retailers and processors in India and Pakistan. About 86% of the respondents indicated they will like to buy the insurance products directly from the insurance companies with only 13.8% not willing to buy insurance directly from the insurance companies. This suggests that the most preferred channel for selling insurance to cashew crop farmers in the study area should be through the insurance companies directly. The results further revealed that 21.7% of the respondents also indicated their willingness to purchase the insurance products from farmer based organizations and cooperatives with 36.8% indicating their willingness to buy insurance from the banks (commercial banks, rural banks and microfinance institutions).This is in agreement with the results of Osei-Tutu (2012), who noted that weak FBO is one of the constraints to cashew development and also reinforces the findings of Ashitey and Nicely (2012), who also reported that inactive farmer associations is a constraint in the cashew sub sector. Hence, formation of FBOs is imperative for enhancing their access to credits.

However, it was found that 20.9% of the respondents also indicated that they will also want to buy insurance products from marketing champions of GAIP's pool members' whiles 11% prefer buying from ministry of food and agriculture (MOFA) and only 8.1% indicated their

Figure 5.1 Perceived Distribution Channels for selling Agricultural Insurance



Source: Field Survey, 2014

It is instructive to note that farmers' preference for insurance agents, banks, and marketing champions, is consistent with Bernhardt , Steinman and McCord(2011) but not consistent with Smith *et al.*(2012) who identify telecoms as one of the distribution channels for marketing micro insurance products to communities in developing countries .

5.1.4 Farmers Preference for Agricultural Insurances Supply Models

McCord (2006) and Cohen (2005) examine model s for supplying micro health insurance schemes that were identified and utilized by Stutley (2010) and also viewed by other researchers on agric insurance as pertinent for supplying agricultural insurance products. These models are: partner -agent model in Uganda, community model in Tanzania, full service model in India, the provider model in Cambodia, voluntary model in Turkey, and Agency model in the USA.

The Bancassurance Model is a model used in Ghana, where insurance is sold through banks. In the bancassurance model, a bank staff may be trained to distribute insurance product of a willingness to purchase directly from MOFA's extension officers. The low percentage of farmers who are willing to purchase from MOFA and extension agents is an indication of cashew farmers' lack of confidence regarding the institution as distribution channel that should be used by GAIP for selling agricultural insurance products to them. Their unwillingness to buy insurance from input dealers, has a repercussion for insurance sales, however in a value chain financing model, input dealer may be one of the useful channels (See **Fig5.3.2).**

particular insurance company or the insurance staff may be allocated a place in the bank to cross sell their products to bank customer. This enables insurers to leverage on the reputation of the bank chosen and also leverage on its database to identify potential customers, who also pay insurance premium and receive their insurance claim through that bank, while the bank receives commission. This saves time and transaction cost. Brand assurance is selling insurance through any agency of a high brand such as selling travel insurance in a wellknown travel agency for insurer, while utility model is the usage of Telecom and Electricity Corporations to distribute insurance. Composite model however, has elements of all the models enunciated, but was not preferred among respondents as a good model for supplying agricultural insurance in the study area.

Table 5.8 presents farmers' preferences for agricultural insurance supply models measured on a 5-point likert scale. Using the mean scores, it was realized that the most preferred model for supplying agricultural insurance to cashew crop farmers in the study area is the agency model with a mean score of 4.58. The second most preferred model was full service model with a mean score of 4.10 followed by the partner-agent model with a mean score of 3.87. The results further showed that brand assurance and composite models were least preferred with mean scores of 2.22 and 2.21 respectively. Banc assurance model was also preferred by the respondents with a mean score of 3.69. According to the NIC (2009), Banc assurance channel is becoming an effective channel for mobilizing premium income in Ghana. However, the farmers were neutral about the community based model of selling insurance to farmers in the study area and utility model was not preferred at all and did not even appear in the results. The intuition drawn from these findings is that, for insurance to be successfully accepted by farmers, it must be channelled through full service, banc assurance, agency model and partner-agency models. This result is consistent with the results of the distribution channels selected by farmers since 86%, 36.8 % 21.7% 20.9% were willing to buy from insurers directly, or through banks, microfinance, community Banks, farm based organisations, and marketing champions respectively.Table 5.9 throws more light on the preferred supply models.

Table 5.9 Models for supplying agricultural insurance to cashew crop farmers

Supply Models Not Least Neutral Preferred Most Mean preferred preferred (3) (4) preferred score

Partner-Agent Model	7(1.8)	5(1.3)	128(33.4)	132(34.5)		3.87
Agency Model	0	1(0.3)	77(20.1)	4(1.0)	301(78.6)	4.58
Community based Model	38 (9.9)	46(12.0)	277(72.3)	21 (5.5)	1(0.3)	2.74
Full Service Model	8 (2.1)	4(1.0)	98(25.6)	104(27.2)	169 (44.1)	4.10
Banccasurance Model	9(2.3)	5(1.3)	185(48.3)	81(21.1)	103(26.9)	3.69
Brand Assurance Model	99 (25.8)	104(27.2)	177(46.2)	3(.8)	0	2.22
Composite Model	102 (26.6)	102(26.6)	178(46.5)	1(0.3)	0	2.21
	(1)	(2)			(5) 111(29.0)	

Source: Field survey, 2014 **(values in the brackets are percentages)**

This study partially agrees with McCord (2006); Cohen (2005) and Stutley (2010) who identify full service and partner-agent model and community models for supplying insurance products to the micro-health and agric sector. However Banc assurance model is a new model that has also emerged as another model that would be pertinent for supplying insurance to cashew crop farmers in the study area.

5.1.5 Farmers Perception on Agricultural Insurance

Farmers' perception and attitude based on the state dependent utility theory of insurance is presented in Table 5.10. Most of the respondents agree with the perception statement that insurance is not expensive to subscribe to with 67.1% agreeing to the statement and a positive mean score of 0.63. However, about 88.8% of the respondents perceive that if they can manage their own risk then there is no need for insurance with a positive perception of 0.40. About 93.2% of the respondents agree that in the absence of any fire or when no farm is burnt, insurance is not needed with a positive perception of 0.44. However, 54.3% of the farmers disagree to not getting any pay-out in the absence any uninsurable peril with a negative mean score of 0.11. About 95% of the respondents agree that if you buy insurance against fire, it is like inviting the fire accident to happen with 89% agreeing that it is better not to think about risks and emergencies in advance. Most of the respondents perceive that insurance is not for the rich with a percentage of 67.4% and a positive mean score of 0.21. It was further realized that about 85% of the respondents disagreed to the statement that insurance is necessary to protect one's family and farm with a negative perception index of 0.44. Overall, the total insurance perception concept index is positive with a value of 0.02.

Farmers' perceptions on insurance companies were also estimated. The results show that about 47.3% of the respondents representing the majority were undecided or neutral about the perception statement that when it comes to paying claims, insurance companies will always try to not to delay and make it difficult but had a positive means score of 0.36. Similarly, most of the respondents (43.6%) indicated that they are neutral about the perception that when it comes to making claims, Insurance companies will normally try to cheat you. Furthermore, 27.9% of the respondents indicated that, they agree with the statement that when it comes to making claims, insurance companies will normally try to cheat you. However, a negative mean score of 0.10 was found. About 44% of the respondents indicated that they strongly agree with the statement that insurance companies do not care more about saving money than about helping you and a positive mean score of 0.47 was observed. Overall, the study found that respondents have positive perception about insurance companies with a positive overall insurance perception index value of 0.12. The results further showed that respondents have overall negative perception on the benefits of agricultural insurance with a value of -0.15. The overall results show that insurers have low reputation in the study area, consequently insurers should build reputation or leverage on reputations on their agents and financial institutions. Also, GAIP must choose agents and financial institutions with good reputations and marketing champions from pool member companies with good reputation in the study area must be chosen to be brand ambassadors for reputation and image building. The results also reflect the fact that insurers in general must embark on reputation risk management to drive sales and marketing.

Specifically, about 51% of the respondents disagree that agricultural insurance will give them peace of mind with a negative mean score of 0.21. However, about 76% of the respondents were neutral about the statement that insurance will enhance their access to loans but had a positive mean score of 0.06. About 35.2% of the respondents indicated that they disagree with the statement that they have heard of the benefits of insurance from other farmers and with had a negative mean score of 0.36.

Table 5.10 Farmers Insurance Attitude and Perception towards Potential Agricultural Insurance System in the study Area

Insurance Concept	**Strongly Agree (1)**	**Agree (0.5)**	**Undecided (0)**	**Disagree (-0.5)**	**Strongly Disagree (-1)**	**Mean Score**
Insurance is cheap relative to the loss which can occur	93(24.3)	257(67.1)	33(8.6)	0	0	0.58
Insurance is needed since I can not manage my risk	0	340 (88.8)	18(4.7)	17 (4.4)	8(2.1)	0.40
Insurance is needed when farms are burnt	0	357 (93.2)	9 (2.3)	17(4.4)	0	0.44
I think is ok that if I pay for insurance for 1 year and nothing happens, I get pay-out in that year.	1(0.3)	208(54.3)	74 (19.3)	72 (18.8)	28(7.3)	0.25
Buying insurance against fire mean inviting the fire accident	2(0.5)	8(2.1)	8(2.1)	365(95.3)	0	-0.46
Insurance is about helping each other	0	17(4.4)	36(9.4)	327(85.4)	3(0.8)	-0.41
It is better to think about risks and emergencies in advance	1(0.3)	37(9.7)	4(1.0)	341(89.0)	0	-0.39
Insurance is for the poor people	6(1.6)	258(67.4)	8(2.1)	110(28.7)	1(0.3)	0.21
Insurance is necessary to protect your farm and family	0	15(3.9)	30(7.8)	326(85.1)	12(3.1)	-0.44
Insurance concept index						**0.02**
Insurance Companies						
When it comes to paying claims, insurance companies do not delay and make it difficult	97(25.3)	97(25.3)	181(47.3)	0	8(2.1)	0.36
When it comes to making claims, Insurance companies will normally try to cheat you	0	107(27.9)	167(43.6)	34(8.9)	75(19.6)	-0.10
I can trust insurance to be fair to me	1(0.3)	65(17.0)	59(15.4)	252(65.8)	6(1.6)	-0.26
Insurance companies do not care more about saving money than about helping you.	169(44.1)	83(21.7)	102(26.6)	0	29(7.6)	0.47
Total Insurance companies' perception index						**0.12**
Benefit perception						

Agricultural insurance will give me peace of mind	0	43(11.2)	141(36.8)	195(50.9)	4(1.0)	-0.21
The insurance will enhance my access to loans	0	69(18.0)	290(75.7)	24(6.3)	0	0.06
I have heard of benefit of insurance from other farmers	0	98(25.6)	29(7.6)	135(35.2)	121(31.6)	-0.36
Total Benefit Perception Index						**-0.15**
Premium Perception						
The premiums attached to my chosen insurance product is not high	123(32.1)	6(1.6)	169(44.1)	85(22.2)	0	0.22
The premium attached to my chosen insurance product is not low	0	178(46.5)	205(53.5)		0	0.23
The premium attached to my chosen insurance product is reasonable	0	68(17.8)	148(38.6)	157(41.0)	10(2.6)	-0.14
Premium Perception Index						**0.11**
Overall						**0.10**

Source: Field survey, 2014 (Figures in parenthesis are percentages)

Overall, there was a negative total benefit perception index value of 0.15. The negative benefit perception index means farmer do not know the benefit of insurance, and insurers must sensitize farmers on the benefit of insurance and must stress on the benefits during sales and marketing.

The perception on insurance premium revealed that respondents in general have negative perception on insurance premium with an overall premium perception index of -0.08. Specifically, about 44% and 54% of the respondents indicate that the premiums attached to the chosen insurance product were high and low respectively with 32.1% and 46.5% of the respondents disagreeing to these statements. About 41% of the respondents disagree that premiums that are attached to insurance products are reasonable with a negative mean score value of 0.14. Overall, the results show that cashew farmers have positive perception towards insurance with a mean score of 0.10; however the benefit perception and payment of claims had a negative mean score. Attim and Sock (2000), identify community perception as the cause of low uptake of health insurance, while Jehu- Appiah *et al.* (2000) observed that household perception of price and benefits influenced the enrolment of NHIS scheme.

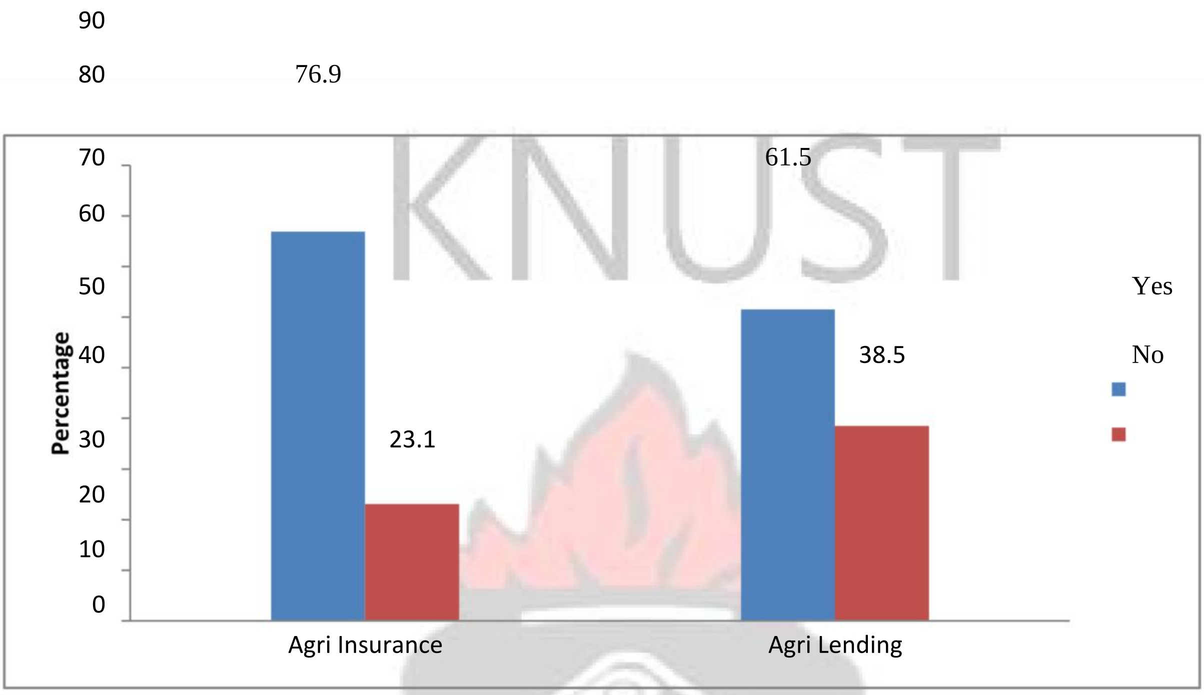
This brings to the fore that education is imperative in changing their perception on the benefits of agricultural insurance.This is in line with the Social Action theory which postulates that individuals actions are guided by community perception that the risk inherent in activity such as purchasing insurance to cover ones residual risk in cashew production is low.

5.1.6 Financial institutions in agri-lending and their willingness pay or offer agric insurance products.

Part of the insurance development process is to find out whether the financial institutions are willing to extend their loan portfolios to finance cashew production. In Figure 5.2, the distribution of financial institutions in agricultural lending willingness to offer loans to cashew farmers with agricultural insurance is presented. The results show that 76.9% of the financial institutions are willing to finance cashew farmers with agricultural insurance whereas 23.1% were not willing to finance cashew farmers with agricultural insurance. The results is supportive of the findings of Gine and Yang (2009) as well as that of Magoni *et al.* (2012) who in a similar study found a correlation between loan uptake and insurance provision in Malawi and Ghana respectively.

Furthermore, the results revealed that 61.5% of the institutions offer part of their loan portfolio to finance agriculture whereas 38.5% of them were not financing agriculture. This implies that farmers still have the chance to seek finance from financial institutions to finance crop production such as cashew if they have agricultural insurance.

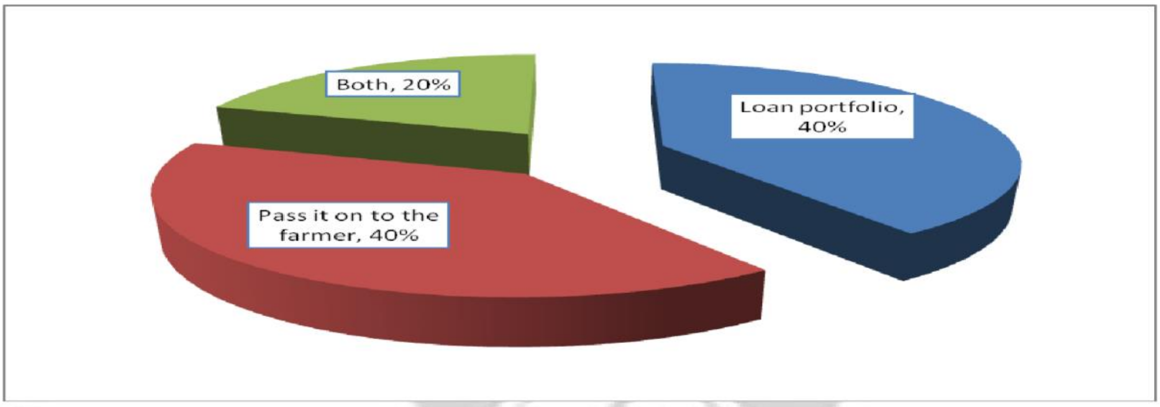
Figure 5.2 Financial institutions willingness to extend their loan portfolio with agric insurance



Source: Field survey, 2014

The results from the study area indicated that currently the percentage of loan being offered by financial institutions to famers ranges from 5% - 10% and 12%, since they were of the view that the sector is fraught with over-dependence on rain, bush fire, drought, exposure to disaster without support, reliance on traditional farming methods, pest attacks and long term repayment which makes farmers default with their loan payments. When respondents of financial institutions were asked if they would increase their loan portfolio if there are insurance products to cover farmers' residual risk, the reply was in the affirmative, making it clear that cashew farming is a lucrative rural business. To state their reasons, some of the respondents for the financial institutions stressed that they would extend their loans to the sector because they are committed to food security and poverty reduction and will do so by helping farmers who need financial assistance but are exposed to natural perils, consequently, if agricultural insurance products are available for agricultural loans, they would extend loans to them and also not lose their investment. They also indicated that they would extend their portfolio by more than 20% with approval from the board of directors if insurance products are developed to cover cashew crop farmers' residual risk in the study area.

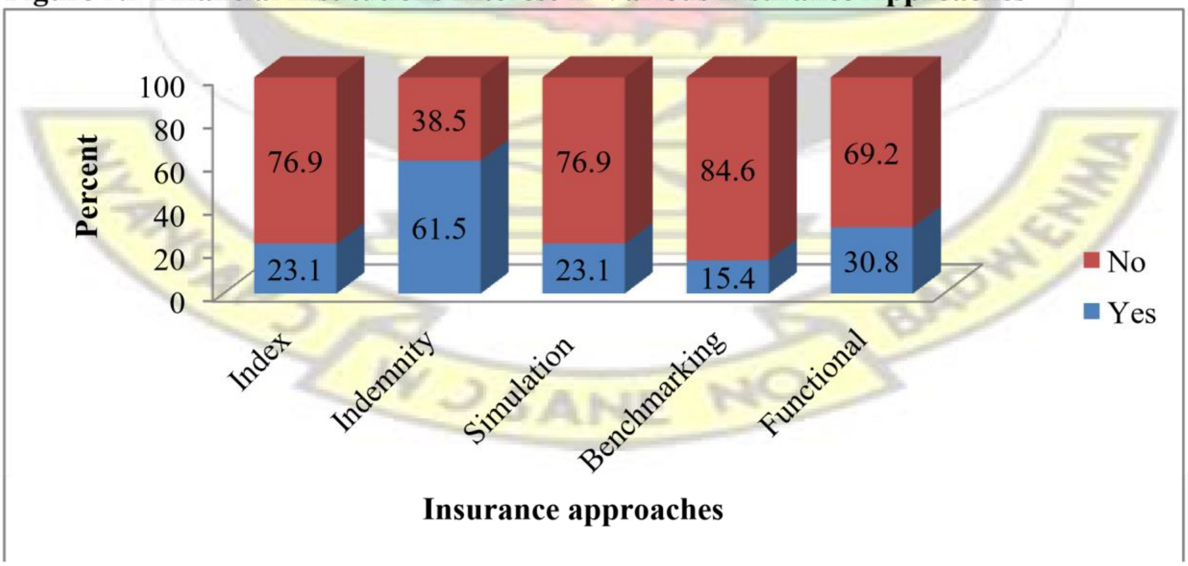
With regard to the payment options, some financial institutions wanted to buy it on their own, while some wanted to pass it on to the farmers, as shown in Figure in Figure 5.2.1. 40% were of the view that they would pass it on to the farmers, where as 40% opined that they would buy



Source: Field Survey,2014

The study further investigated which insurance philosophies or approaches the financial institutions prefer farmers to have insurance in order to assess the loan. Their preferences for the various insurance approaches are presented in Figure 5.3.

Figure 5.3 Financial Institutions Interest in Various Insurance Approaches



Source, Field Survey, 2014

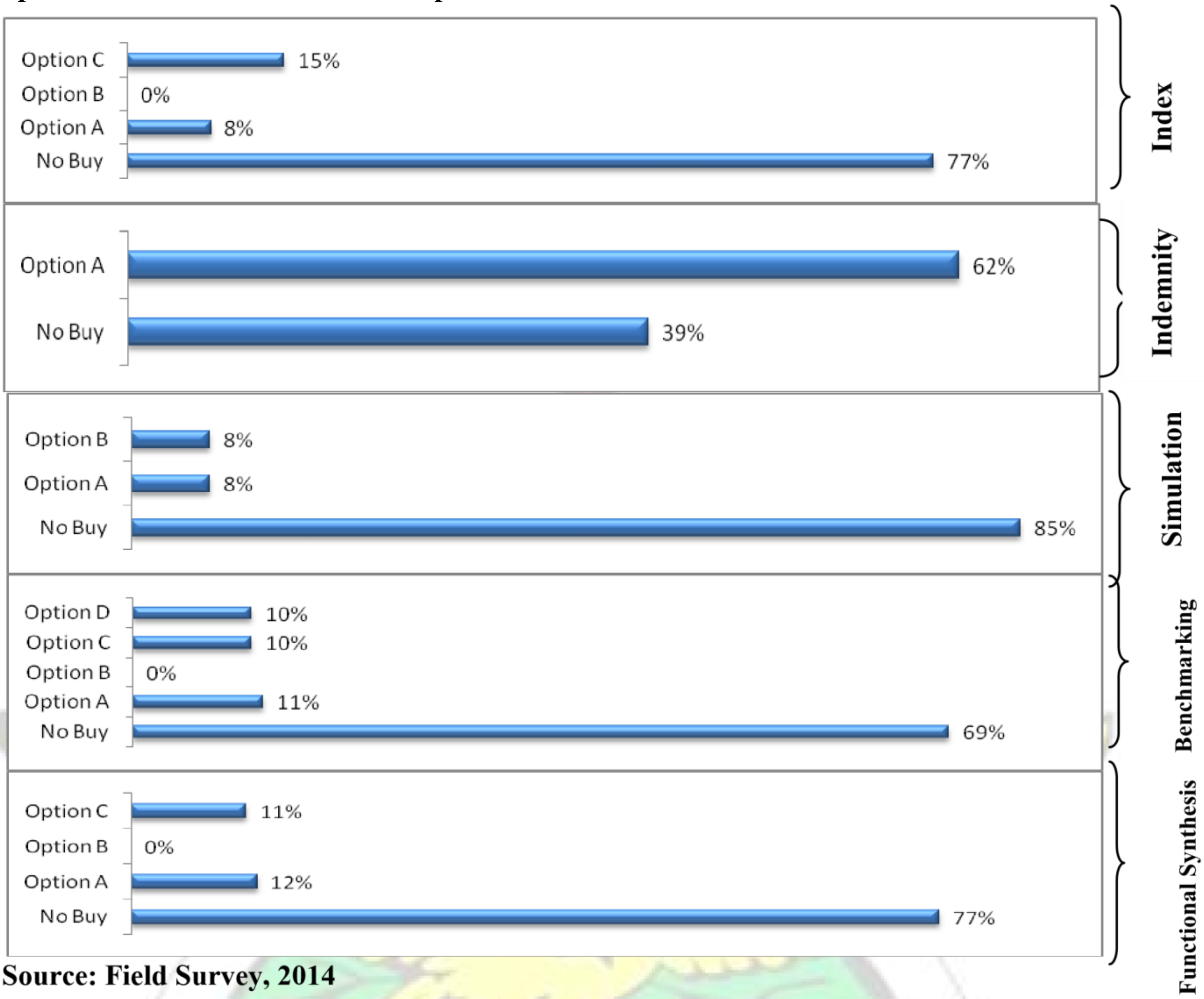
the insurance products to cover their loan portfolios, with 20% maintaining that they share the cost with the risk with the farmers, and would they would buy to cover their loan portfolio while the farmer also buy to cover their residual risk.

Figure 5.2.1 Financial Institutions willingness to pay for Insurance or Pass it on to farmers

The results revealed that most of the financial institutions prefer indemnity approach of providing insurance with a percentage of 61.5% followed by functional synthesis with a percentage of 30.8%. Preference for index and simulation approaches were 23.1% each with benchmarking approach being the least preferred with a percentage of 15.4%. This implies that the indemnity approach is the most preferred approach if financial institutions are to finance agricultural insurance with an alternative approach being functional synthesis. Their preference for indemnity and functional synthesis approach has implication for operational cost since on call and loss adjustor may be required at the claim stage (Stutley, 2010). Moreover, the principles of insurable interest, doctrine of utmost good faith, indemnity principles and its corollaries which are subrogation and contribution must be obeyed. Apart from these, loss minimisation principle in addition to the doctrine of proximate cause must be obeyed in order to affect such insurance contracts (Atkins and Bates, 2010). However, it remains the conviction of the author that in event when the insurance is taken by the farmer and it is being used for loan purposes the principle of insurable interest should be at the inception of the policy so that it could be assigned to the banks and used as collaterals to enhance their loan uptake, just as life insurance contracts can be assigned to third parties including financial institutions, since the normal practice is that financial institutions becomes loss payee on indemnity contracts.

Their preference for agricultural insurance product options is shown in Figure 5.3.1

Figure 5.3.1 Financial Institutions interest patronizing agricultural insurance product options for farmers and their loan portfolios



Source: Field Survey, 2014

Regarding financial institutions interest patronizing agricultural insurance product options for farmers and their loan portfolios, 77% of financial institutions were not willing to patronize index products either to cover their loans or pass it on to farmers. However, 15% were willing to pay option C which is Area Yield Index product while 8% had preference for option A, which weather index insurance utilizing G.Met selected weather station. With regard to indemnity products, only option A which is Named Peril damage base for fire has highest utility among 62% financial institutions that were sampled in the study area. However, Stakeholders of Ghana Agricultural Insurance Pool had no utility for designing single peril indemnity for fire as stand-alone insurance product. Only 8% of respondents from financial institutions were willing to pay for option A which is Simulated Weather Multiperil Product for fire, high temperature and excess rainfall and high windspeed and Option B which

Simulated Satellite Multiperil Product for fire, high temperature and excess rainfall and high windspeed

Preference for Benchmarking Insurance Product Options was low, the survey results revealed that only 11% of financiers had utilities for option A which is Named peril damage based and yield-based Multiperil benchmark product for fire, High temperature, Excess rainfall, and High windspeed, while 10% of respondents had utility for Option C which is Named Peril damaged benchmark product for high wind speed. Functional synthesis approach also had low utilities, which are 12% preference for option A, which isWeather Synthesized Simulated Multiperil Insurance for damage and yield-based for fire, high temperature and excess rainfall and high wind speed,11% for option Cwhich isArea Yield Synthesized Multiperil Insurance for Damage and Yield-based for fire, high temperature and excess rainfall and high wind speed.

5.1.6.1 Model of Agric Lending Appropriate for the Cashew Crop Sector

This model was developed through an in-depth interview with a lot of financial institutions in the study area. From these interviews, Value chain financing was seen as appropriate for agrilending in the study area consistent with what is practised in Uganda, Kenya and Ethiopia identified byEAFF (2013) and Onumah, (2011). This approach starts with registration of farmers in the study area and dividing them in groups of 10 and 15 – 20 for each member of the group to serve as a peer guarantor. Prior to this exercise, FBOs must be formed to serve as a general guarantor. Also credible authorized local input dealers in each community should be identified, to supply inputs to named farmers, in order to reduce transaction cost which normally comes in the form of transportation cost. Loans should be given on time to input dealers so that farmers can receive all the inputs on time within the cropping calendar and the loan must be 60% input and 40% cash or 20% -80% cash and there should not be a situation, where by input dealers will give partial inputs such as seeds without fertilizer.

Also nucleus farmers should be identified and contracts signed with them by the financial institution and aggregators in terms of usage of inputs, acreage to be planted, contract period, and agronomic practice and the nucleus farmers should be ready to have oversight of farmer groups. They must also be trained to know the technical coefficient of cashew production, new technologies, and usage of improved seeds, farm management, input use and budget preparation. In this regard, extensions officers of MoFA should be equipped to provide training that could help farmers and financial institutions to develop cropping calendars for the farmers and credit officers in order to align the disbursement of loans within the farmers' crop production cycles (Awunyo-Vitor, 2011). These would help to avoid:

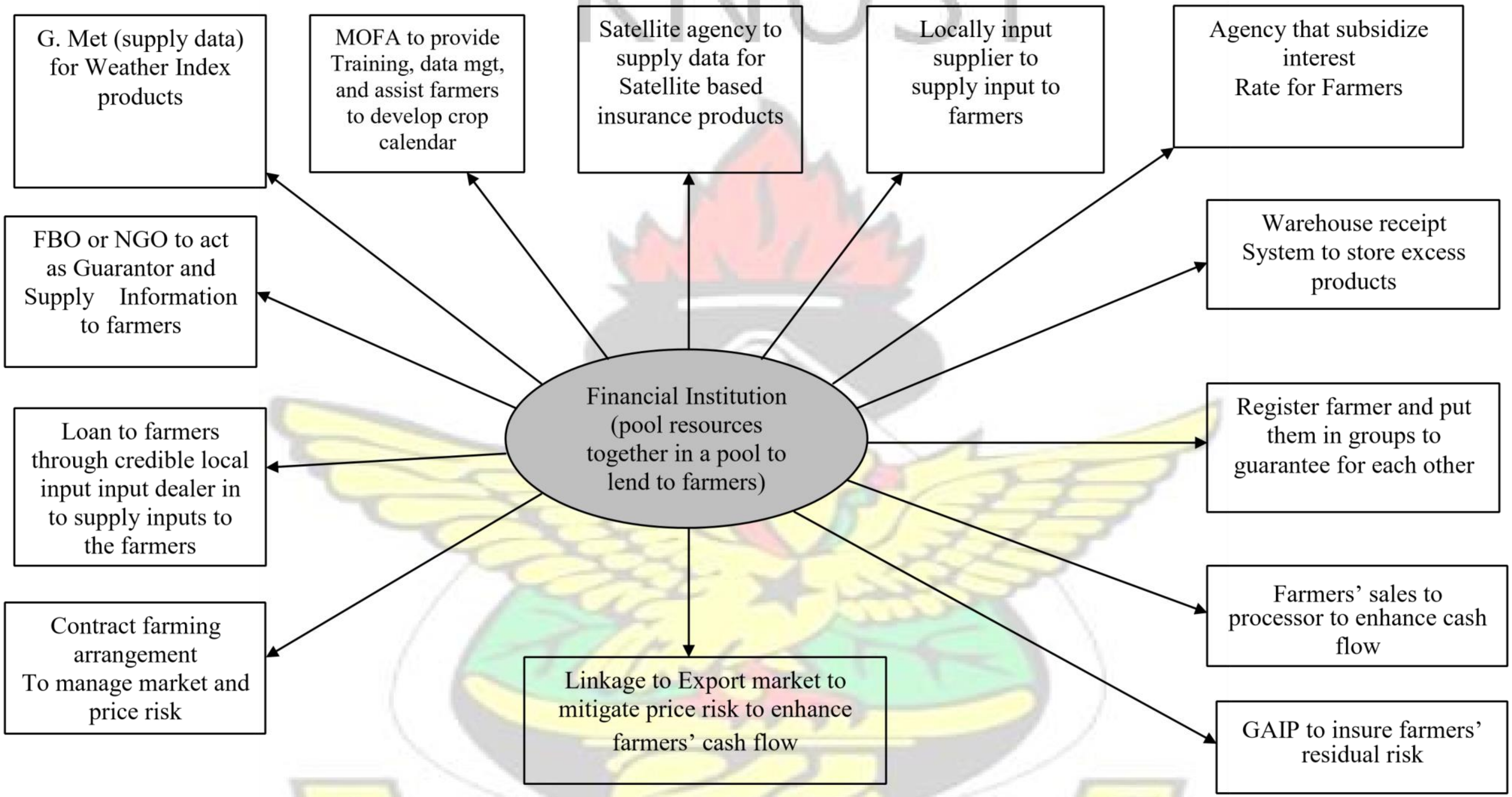
1. **Product basis risk**: a situation where there is no clear cut relationship between loss and the index peril leading to replication because triggers may be set for the same species but different varieties with different water requirement and soils with different water holding capacities may have different results (IFAD,2010).
2. **Temporal basis risk**: it is inter-annual variations in seasonal crop phases, meaning that the insurance phases are not temporally aligned with the intended crop growth stage (IFAD, 2010).
3. **Crop-specific basis risk**: reflects variations in factors such as opportune planting times, the length of the growing season, and the sensitivity to temperature and moisture across different crops, thus affecting production (Miranda &Vedenov 2001).

Since meteorological data is key, alliance must be formed with Ghana Meteorological Agency and other satellite agencies to choose specific weather stations for insurance contracts. Where there are no weather stations, either stakeholders agree to use Benchmark for small holder farms or they agree on the agency to supply satellite data.

In this model, the FBOs will act as a custodian, and should provide at least five years data on their production history and cash flows to insurers and financial institutions. While the FBO coordinate and link farmers to the inputs dealers, and also find an agency to subsidize the interest rate. In this regard, government can use subsidies on certain inputs to subsidize interest on agric loans, but care must be taken in order not to create moral hazards and adverse selection.This value chain financing model employs multi-stake holder approach and concerted effort to appoint a value chain committee from FBOs and NGOs to serve as guarantor and also help lending institution to do more cashless credit with farmers. However, the loan will be in the name of the farmer and not the committee, and pressure groups such as chiefs in the community should be involved in loan recoveries in times of default as shown in Figure 5.3.2.

In this model, the major role insurers will play is to cover the residual risk in the chain from both farmers and financial institutions and other agencies in the chain. Insurers will also improve the risk in the chain through advice to stakeholders, imposition of conditions and warranties and may cover default from force majeur risk such as wheather, death of farmer, theft, fire, excess rain, high temperature and high wind speed that are residual and beyond the control of the farmer by employing index, indemnity, benchmarking and functional synthesis. However, other products such as aggregate loss of investment or multi-peril crop insurance on yield and damage base, fire for ware house among others may be covered by the insurer. This may be extended to cover goods in transit and business interruption, also planting of pest resistant varieties of cashew may be a wa rranty and canal construction in flood prone areas may also be a warranty. Contract farming or forward contracts should be arranged for farmers and buyers or processors to reduce price risks. Finally, in order to manage default risk through risk pooling, financial institutions could form a pool based on GAIP's model, so that each lending institution would put amounts that constitute their value at risk into the pool for agric lending. However, if a financial institution will lend on its own, then their ri sk tolerance and appetite should be determined. Moreover, every step must be approved by their board. From the foregoing approach to the value chain financing is imperative. This should involve the micro which are the farmers, meso which are aggregators s uch as input dealers and financial institutions and macro levels which are government institutions such as MoFA (Wenner, 2005; Herbold 2012), as shown in figure 5.3.2

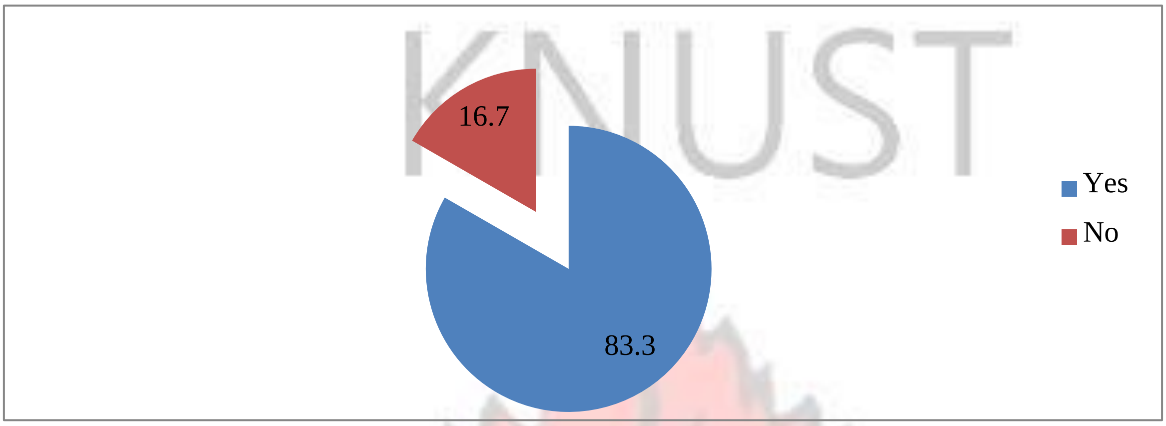
Fig. 5.3.2. A Value Chain Lending/Financing Model for Financial Institutions in the study Area



Source: Field Survey, 2014

5.1.7. Pool Stakeholders' willingness to design agricultural insurance for cashew farmers and their financiers

Figure 5.4 Pool Stakeholders willingness to design agricultural insurance for cashew farmers



Source: Field Survey, 2014

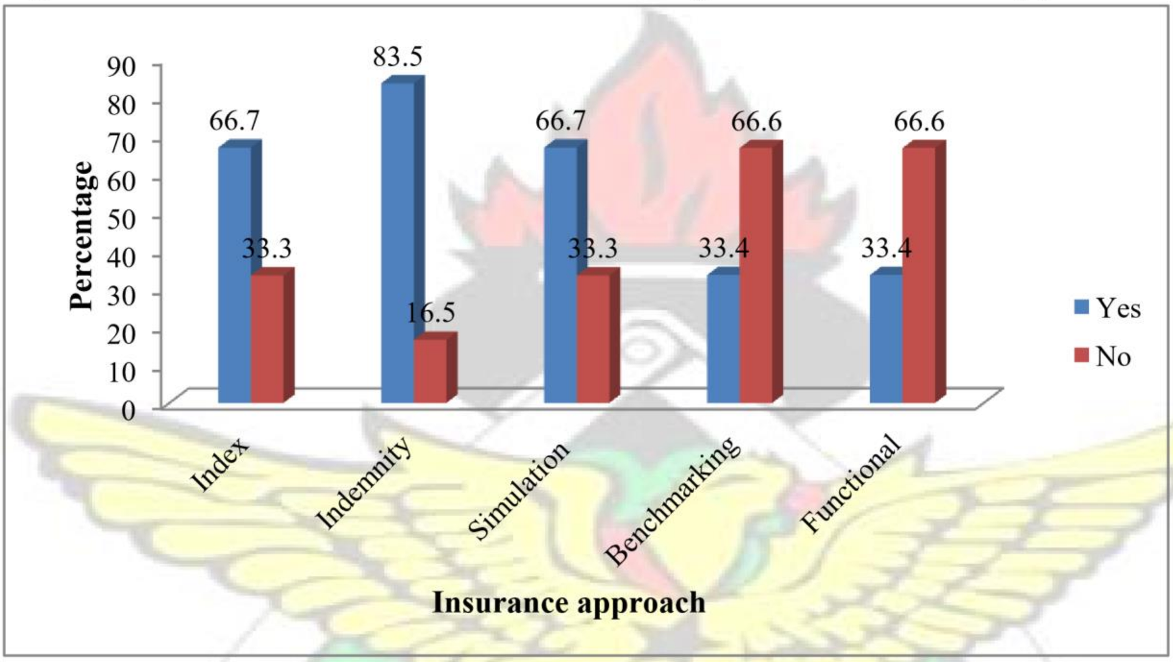
The results indicate that most of the insurance pool stakeholders are ready and willing to design agricultural insurance for cashew farmers in the study area with about 83% whiles only about 17% were not willing to design insurance packages for farmers. In Figure 5.5, the insurance pool stakeholders were asked to indicate the approach they would prefer in providing agricultural insurance for cashew crop farmers and the results are presented in Figure 5.5. The results show that 83.5% were willing to design indemnity insurance for farmers whereas 16.5% were not willing to design indemnity insurance. Likewise, 66.7% were willing to design index and simulation insurance whereas 33.3% were not willing to design either index or simulation insurance. For both benchmarking and functional synthesis, 33.4% were willing to design products based on these approaches for cashew farmers in the study area. In all, the results imply that agricultural insurance pool stakeholders have higher preference for designing indemnity approach similar to the financial institutions preference for insurance products.

These preferences have their requirements in terms of operational cost, as on farm inspection is a pre-requisite in event of claims to provide compensations that would bring the farmer to their pre- loss financial position (Indemnity principle).

This requires risk mapping to determine the Maximum probable loss(MPL) (Stutley,2012) whereas with the index, purchase of satellite data is a pre-requisite for satellite index and an MOU with Ghana Meteorological agency to supply data is crucial for weather index insurance products (Mathias,2012; GAIP,2012).

Moreover, the choice of these approaches have their implication for reinsurance treaties with reinsurers, as reinsurers prefer volumes of business and in situations where the business volumes are small reinsurers would want to take higher quota of the risk in the treaties and that also has implication for premium flight as most of the premium paid goes to the reinsurer, particularly when they are outside the country (GAIP, 2012).

Figure 5.5 Pool Stakeholders Interest in Various Agricultural Insurance Approaches

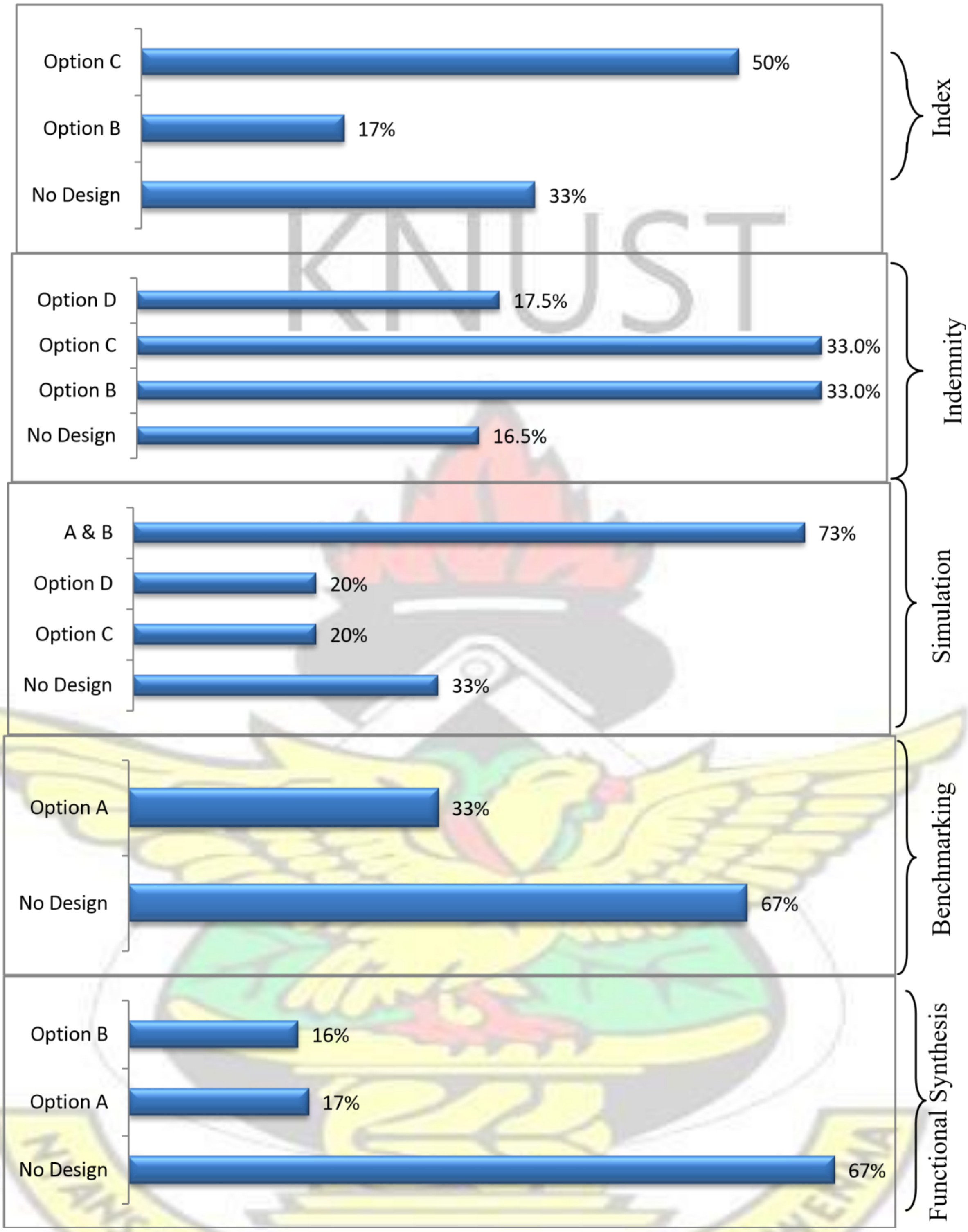


Source: Field Survey, 2014

5.1.7.1 Pool Stakeholders' Interest in designing agricultural Product Options for insurance for cashew farmers and their financier

Pool stakeholder preference for designing insurance product option can be seen in Figure 5.5.1

Figure 5.5.1 Pool Stakeholders interest in designing insurance Product Options



Source: Field Survey,2014

The results indicated that 50% of the pool stakeholder were willing to design 50% of Option C of Index which is Area Yield Index, and 17% were willing to design Option B which is Satellite Index insurance products. With regards to Indemnity product options, none of the stakeholders were willing to design options A which is named or single peril for fire, but 33% were willing to design option B which is named peril damaged base for high wind speed 33% were also willing to design option C, which is also named peril damage base product for excess rain fall, and only 17.5% were willing to design option D which is Multiperil Crop Insurance product for high temperature, excess rainfall and high wind speed.

Preference for designing Simulation Approach Product Options among the agricultural insurance pool stakeholders follows: 73% were willing to design option A and B which are Simulated Weather Multiperil Product for fire, high temperature and excess rainfall and high windspeed, and option B which is Simulated Satellite Multiperil Product for fire, high temperature, excess rainfall and high windspeed. They were also willing to design option C and D which are Simulated Area Yield index Multiperil product for fire, high temperature and excess rainfall and Indemnity and Benchmarking Simulated product for fire, high temperature and excess rainfall and high windspeed respectively. With regards to Benchmarking product, 33% were willing to design only option A which is Named peril damage based and yield-based Multiperil benchmark product for fire, High temperature, Excess rainfall, and High windspeed. Functional synthesis approach also had low utilities, which are 17% preference for option A, which is Weather Synthesized Simulated Multiperil Insurance for damage and yield-based for fire, high temperature and excess rainfall and high wind speed, and 16% were willing to design option B which is Satellite Synthesized Simulated Multiperil insurance for damage and yield base for fire, high temperature and excess rainfall.

5.1.8. How GAIP want to insure Cashew Crop Farmers

An interview with the stakeholders of GAIP's in addition to administration of a questionnaire revealed that they would embark on both individual and group approach in marketing the insurance products depending on the farm size, in which individuals with more than 20 hectares can apply for the insurance individually, Groups should be not less than 10, individuals with optimum of 15 – 20 individuals as conditions for sales of insurance to small holders. They indicated that the Insurance should be sold before the season to avoid adverse selection in the sales.

5.1.8.1. Requirement for Insurance Contract

With regard to requirements, they indicated that they would require information on client details, variety of crop to be insured, total area, location of field, total sum to be insured, that is the farmers production cost per acre, expected crop yield, the cost of various input, location of the field as well as GPS coordinates for indemnity and Aggregate loss of investment contracts. Stutley (2010) recommends that an underwriter should verify the accuracy of information, and making sure that the policy falls within the cropping season, consistent with the consumer theories which posit that if consumers have information, they will maximize their utility on consumption of products.

5.1.8.2 Underwriting Considerations

The results from both quesitionaires and indept interviews from pool stakeholders on underwriting considerations revealed that, data should be collected on risk specific factors, demographic characters, claim history and geographical risk factors to identify the issue of moral hazards. They also indicated that, information should be taken on the crop variety or varieties farmers grow, in addition to the soil types and conditions, which may sometimes require soil testing. They also indicated that to help make distinctions between good and bad farmers, farmers management capabilities should be gauged through their educational level they have attained or training they may have attended. Also the number of years they have been involved with the production of a particular crop and the yield per acre or hectare consistent with the human capital theory which uses education as a proxy for human capital formation should be ascertained by means of a proposal form. They were also of the view that, the type of cropping system should also be required, however, the researcher also is of the view that, the cultivation of maize should be the main crop that should be a condition in the insuance policy, since GAIP has already developed an index product for maize. This should be the condition till other insurance products are developed for other crops. They also indicated that they have an MOU with G. Met and SRID of MOFA and Satellite agencies such as National Oceanic and Atmospheric Administration (NOAA) and Tropical Application of Meteorology using Satilite and Ground Data (TAMSAAT) should be done in other to acquire data for setting triggers for indicies for index insurance contracts. The stakeholders were positive that to avoid product basis risk, temporal basis risk, and crop specific basis risk reported by IFAD (2011) and Miranda and Vedenov (2001), development of cropping calendar and collection of information on agronomic practices of cashew farmers should also be collected by means of a proposal forms and should be verified by an external agency such as agricultural research institutions, universities and postgraduate research students should verify and validate the information, so as to utilize it in the development of indices for index products on comprehensive bases or catastrophic bases in an area where there is G.Met Selected weather station. The stakeholders of the pool also indicated that where there are no selected weather stations, Insurance contracts should be based on satellite data from NOAA and other satellite agencies with good resolution with 30 years’ historical data with less than 5% data gaps contrary to the recommendation of IFAD (2011), who recommends that the data should be 20 years with less than 3% data gaps, at the request of the client. This also contradicts the recommendation made by Mathias (2012), who recommends the use of Tamsat data for pricing index insurance products. They also indicated that where small holders with minimum level of education are involved, to set triggers based on satellite data they should be trained to relate to satellite data using mobile phones concept. They also stressed that de-trending of historical data should be done in order to determine the historical payouts in a model.

In relation to indeminity and payouts, they indicated that valuation based on production cost or market value should be done and the option to be used as sum assured or insured agreed upon by both the farmer and insurer. This will help price index insurance on both comprehensive and catastrophic basis. They succinctly opined that it will serve as a basis for loading the technical premium with operational cost, data acquisition cost, uncertainty loading and burning cost, if the client has some loss experience with their product portfolio. This is consistent with the observation made by Harrington and Niehaus (2004) and MITC (2008) that underwriting is a procedure for assessing risk to determine the premium based on appropriate ratings deciding whether to put the client on cover or not.

In relation to an index insurance claims or pay out for cashew farmers in the study area, the pool stakeholders, consistent with a TMU (2013) report indicated that for the weather index, claims or payout should be staggered as follows: 40% at germination stage, since farmers can replant, 100% at growth stage since farmers have invested their money, and 70% at flowering and fruiting stages. However for the area yield index, they argued that it should be   based on an agreed threshold usually below 70% the average yield in the district based on data from MOFA's crop-cut exercise in the district in which the insurance is sold. They however cautioned that for insurance purposes, SRID should attempt to eliminate outliers in their estimates for district average yields during their crop cut exercise, since it will affect area yield index insurance claims or payouts. They also advocate the use of benchmarking insurance approach as an alternative approach where there are no weather stations for farmer in the same ecological zones having fields with similar soil characteristics and climate, planting the same varieties and also have harmonized agronomic practice (Swiss-Re, 2013). This they maintained that farmers should be put into groups in order to market and underwrite benchmarking insurance products to them. Moreover, the stakeholders of the Pool also indicated that there should both farmers and insurers should build consensus in the selection of plots and farm lands to be used as benchmarks, They however brought to the fore the need to benchmark sites that reflect best practice, and triggers must be agreed upon such that, whatever happens to a benchmarks would be deemed to have happened to all the field around that particular benchmark. This in agreement from a document read from Swiss Re (2012) which reports that benchmarking approach is suitable for FBOs or CBOs, and 1020 plots should be around each benchmark, and yield data for five year should be requested and in situation where there are signals of moral hazards, low guarantee should be given to share the risk with the farmers, by giving 50% insurance cover on claims. With regard to underwriting consideration for indemnity based products, pool stakeholder indicated that cover must be provided taking into consideration farmer's management skills since yield is function of experience of the farmer's experience. They also maintained that data on soil type and crop variety, must be estimated using moving averages and relying on long term average yield (LTAY) from historical data from MOFA and commercial or large scale cashew farmers if they have farm records, then an error correction factor of 5 – 10% must be applied, more especially when the data is coming from government institutions.They stressed on the need collect information farmers on actual yield, potential yield and total yield shortfall per acre as well as cashew crop farmers risk mitigation methods. They succinctly opined that this should made a condition precedent to liability. For yield-based indeminity based contracts for cashew farmers, particularly Multiperil Crop Insurance (MPCI) contracts, stakeholders of the pool were of the view that suitability for crops in an ecological zone should be determined and premium may be calculated on input or market value of product which should be agreed by the cashew crop farmer and the insurer. They also were of the view that premium for MPCI products should be estimated after emergence report is produced by specialists after germination to determine long term average yield and midseason report to determine crop growth, long term average yield and also determine potential claim that may arise as well as practices that may void the policy in order to impose warranties. They contended that emergence report would influence the premium, and should be written by professionals such as agronomists, lecturers, or extension officers among others.

They also identified the suitability of location for the crop production, planting data, harvesting date, LTAY, input cost, guarantee level, emergence report, standard procedure could be done by utilizing the services of extension officers, to avoid moral hazards. . In case of aggregate loss of investment, they were of the view that historical data for five years and farmers annual production history must be obtained and the average taken. To them, there must be a threshold for yields and triggers set at the various phases for farming seasons, and continuous monitoring should be done to ensure that farmers adhere to best agronomic practices. Stakeholder also indicated that farm sanitation must be done and site production capacity must be ascertained through soil testing, spacing, fertilizer application and the use of GIS to embark on integrated soil management technique, where satellite methodologies should be used to capture soil fertility rate to ensure that where the soil is fertile more fertilizer is applied in those areas to boost production above average, and where fertility are low optimum production should be obtained. They also indicated that good agronomic practices such as spacing, pruning should be done in a timely manner. This is also consistent with the observation made by Mole (2000), in his study of the cashew sub sector in Mozambique.

5.1.8.3. Conditions, Warranties, Franchise, and Deductibles

In search for conditions and warranties, franchise and deductibles which form part of the research questions, using questionnaire followed by in-depth interview from the stakeholders in the pool, the results were as follows:

Farmers should belong to a group and size of farms should inform the groupings.Slash and burn system must be avoided, and must be a warranty, as it was one of the causes of bush fires in addition to hunters' activities in the study area. They were of the view of that, slash and char should be encouraged and farmers must receive training on it to enable farmers to manage all the fuel loads on their farms through carbon dioxide sequestration. Also, Modified Taungya System (MTS) approach, where cashew is intercropped with other food crops, should be encouraged for the first four to five years in order to control weeds and also to generate some margins for financial institutions for loan repayments. However, intercropping with maize crop only should be a condition since GAIP has expertise in insuring maize by means of index and indemnity approach. The posited that farmers should only expand their cropping system to embrace other crops only when GAIP developed expertise in insuring them. Additionally, they viewed intercropping with crops that would serve as a vector for pest and disease to cashew crop as a non starter and should be treated as a warranty under insurance contract for cashew crop farmers, adding that expert advice from crop scientist and agronomists must be imperative.

Moreover, the results indicated that soil testing should be a prerequisite to starting a new farm to determine the suitability of soil and the site production capacity before the contract. Again, construction of canals should be a warranty in flood-prone areas, while integrated pest management technique, preferably biological methods which is already prevalent in the study area as one of the dominant risk management strategies, should be reinforced. They also identified another warranty to include the age distribution of plants, which must be known declared by the farmer so that plant with different ages and cycles would be calibrated into block such as A, B, C in case of staggered planting to separate from the other. Morever, the also maintained that qualified farm managers and labourers should be hired as most farmers lack knowledge. They were also of the view that training should be a condition and should be to be offered by MOFA, Universities and other research institutions, in addition to registration of farmers and imposition of data management scheme as a condition.They also added that a, five year farming experience in any farming activity should also be a condition and to insurance uptake.

In search of deductibles, the results indicated that it should depend or be based on the average loss over the years and be subject to premium payment warranty,so that those who do not pay on time should not be given a certificate of insurance. The pool stakeholders also contended that a 10% franchise should be imposed on losses less than 10%.

5.1.8.4. Claims Settlements

On the issue of claim settlements or payout methodology, in-depth interviews with stakeholders revealed that claim notification and proof of loss, should be done by the farmer(s) and should be followed by insurer verification, or agent verification, preliminary loss assessment and final loss adjustment for indemnity and simulation products. However, insurers should embark on claim notification for index products as claims are triggered under such contracts. Similarly, simulation products and functional synthesis products will require both claim notification for clients on agreed triggers set for index insurance products. From the results obtained, the study revealed that in case of loss, loss adjustment should be done within 48 hours and must be in agreement with the client. Further more the results also reaveled that adjustors must be agriculturalists or professionals who have skills to determine both quantitative and qualitative loss. They were of the view that, in situations where the loss is systematic, then verification may be made from neighbours since their loss experiences can also be relied upon to adjust claims. Finally, they also indicated that claims must be paid at the end of the cropping season.

5.1.9 Constraint to the Development of Agricultural Insurance in the Study Area

From the Ghana Agricultural Insurance Pool stakeholders' perspective, there are myriads of perceived constraints facing the development of agricultural insurance in the study area. The results of constraints identified in the study were ranked in terms of the severity and are presented in Table 5.11. The results show that high marketing cost was the highest constraint with the highest mean score of 4.83. The second highest constraint was Low collaboration with Financial Institutions with a mean score 4.67, necessitating the need for value chain financing approach with the insurance as linkage in the chain to absorb all residual risks or key perils. The third most pressing constraint was Lack of agricultural legislation with a mean score of 4.63. This is consistent with the observation made by Qingshui and Xuewei (2010) who reported lack of policies supporting agricultural insurance development and lack of agricultural legislation as constraints to the development of agricultural insurance in Chin

Table 5.11 Constraints to the development of Agricultural insurance in the Study AreaSupply Side Perspective

Constraints to development of Agric Insurance	**Mean Score**	**Rank**
High premiums making it unaffordable	4.57	4th
False claims	1.30	19th
High loss ratio	2.07	17th
Lack of policies supporting agricultural insurance development	4.47	6th
Lack of agricultural legislation	4.63	3rd
Limited knowledge making farmers unaware of its benefits	4.17	9th
Negative perceptions about insurance in general	4.03	10th
Low agricultural production	2.30	16th
High administrative costs	4.10	11th
Small size of market	1.97	18th
Lack of knowledge on how to purchase insurance	3.17	12th
Lack of knowledge about product development	4.47	6th
High marketing cost	4.83	1st
Lack of knowledge on marketing channels	4.30	8th
Lack of education on the benefit of agricultural insurance	4.40	7th
Basis risk	2.57	14th
Limited demand	2.33	15th
Low collaboration with Financial Institutions	4.67	2nd
Scarcity of data for determining actuarially fair premium through sound underwriting	4.47	6th
Lack of qualified personnel in the area of agricultural insurance	4.50	5th
Believe that insurance companies are only interested in collecting premium and not paying claims	2.80	13th
N	30	
Kendall's W	0.616	
Chi-Square	384.884	
df	20	
Asymp. Sig	0.000	

Source: Field Survey, 2014

This implies that National Insurance Commission and Parliament should come out with legislation on agricultural insurance and also enact laws aimed at enforcing agricultural insurance contracts in the country. High premiums making agricultural insurance products unaffordable was ranked as 4th highest constraint with a mean score of 4.57, while lack of qualified personnel in the area of agricultural insurance in the Ghanaian insurance industry was viewed as the 5th highest constraint with a mean score of 4.50. Yusufu (2010) in a similar study of Zimbabwe observed lack of qualified agricultural insurance personnel in Zimbabwe. This is a call for Ghana Insurance College and other tertiary institutions to inculcate agricultural insurance into their insurance curriculum to address this labour or human resource constraint. The sixth most pressing constraints was found to be scarcity of data for determining actuarially fair premium through sound underwriting as well as Lack of knowledge about product development with a mean score of 4.47, while lack of education on the benefit of agricultural insurance was ranked the seventh highest constraint mean scores of 4.40. The issue of scarcity of data has also been reported by Stutley (2010) in his Crop Insurance feasibility studies in the Ghana. Moreover, Lack of knowledge on marketing channels, Limited knowledge making farmers unaware of its benefits, Negative perceptions about insurance in general were ranked 8th , 9th and 10th perceived constraints respectively with means scores of 4.30,4.17 and 4.03 respectively. Wenner (2005) also identified lack of knowledge about product development and marketing channels as constraints to the development of agricultural insurance markets in Caribbean and Latin America. Again, the perceived negative perception about insurance in general is supportive of the study done by Abdulmalik, *et al.* (2012) in the Nigerian agricultural insurance set up.

It is instructive to note that the perceived constraints to the development of agricultural insurance can be grouped under financial, marketing, technical, data, human resource or labour and legal constraints.The Kendall's (W) coefficient of 0.616 implies that there is 62% agreement among respondents in ranking the constraint.In order to overcome the perceived constraints so as to establish a vibrant agricultural insurance system for cashew crop farmers in the study area, suggestions to overcome the key constraints are revealed in Table 5.12.

Table 5.12: Suggestions for Agricultural Insurance Uptake in the Study Area-Supply Side Perspective

Suggestions to improve uptake	Mean Score	Rank
Improve farmers awareness on the importance of insurance through education and marketing	4.97	1st
Aggregators to purchase insurance on behalf of farmers	3.90	5th
Insurers to locate close to farmers	3.13	6th
Increased agricultural production that provides an agricultural pool to form the basis for affordable premium	1.43	8th
Research and development to develop insurance products that are affordable to farmers	4.60	3rd
Law on agricultural insurance contract enforcement	4.43	4th
Simplification of the claim process	2.83	7th
Government intervention	4.43	4th
Cooperation with financial institutions	4.70	2nd
N	30	
Kendall's W	0.642	
Chi-Square	153.995	
df	8	
Asymp. Sig	.000	

Source: Field Survey, 2014

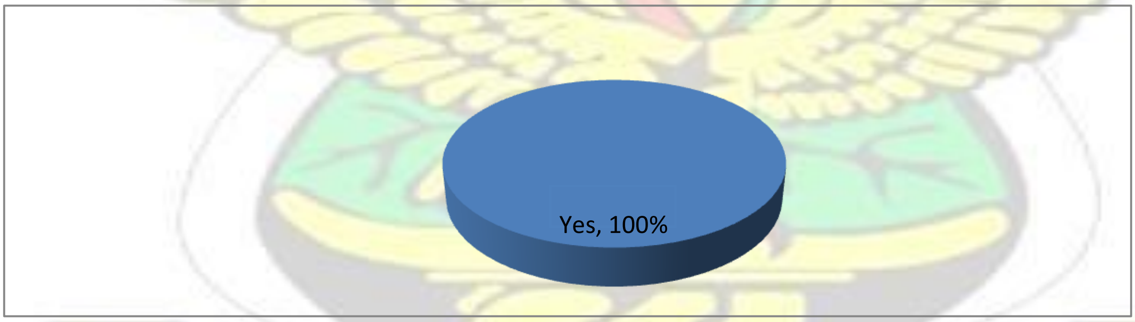
Improve farmers' awareness on the importance of insurance through education and marketing ranked highest with a mean score of 4.97, also consistent with recommendation made by Qingshui, and Xuewei, (2010) to improve agricultural insurance system in China. The next suggestion was cooperation with financial institutions with a mean score of 4.70. Undoubtedly, this reflects the need to develop bancassurance as indicated earlier on in the model for supplying agricultural insurance in the study area. The third suggestion to improve insurance uptake is the need for pool stakeholders to leverage on research and development to develop insurance products that are affordable to farmer, with a mean score of 4.60. Law on agricultural insurance contract enforcement and aggregators to purchase the insurance on behalf of farmers in addition to Government intervention was ranked as 4th and 5th highest suggestion for insurance up take with means scores of 4.43 and 4.60 respectively. Insurers to locate close to farmers in the study area consistent with the full service model preferred by cashew farmers as model that should be used for supplying agricultural insurance to them in the study area. Moreover, simplification of insurance process were ranked as 6th and 7th suggestions for increasing insurance penetration in the study area with mean scores 3.13 and 2.83 respectively.

From the foregoing, agricultural insurance penetration could be increased through research, education, strategic alliance with financial institutions and aggregators and finally Government intervention and enactment of agricultural insurance laws to enforce agricultural insurance contracts. The Kendall's (W) coefficient of 0.642 implies that there is 64% agreement among respondents in terms of ranking the suggestion for agricultural insurance uptake in the study area.

5.1.10. Government Support for Agricultural Insurance

With regard to government support for agricultural insurance for cashew crop farmers in the area, all the stakeholders of GAIP responded in the affirmative when asked if government support is necessary. This corroborate the findings of Wenner,(2005); Mahul,(2010); IFAD (2011) and FAO(2011) who reports of government support for agricultural insurance programmes in Canada, USA, Latin America, Carribean, Asia and Pacific. This implies that just as health insurance gained political support to thrive in Ghana, agricultural insurance also needs it to thrive as captured in Figure 5.6

Figure 5.6 Stakeholders in GAIP interest in Government Support for Agricultural Insurance

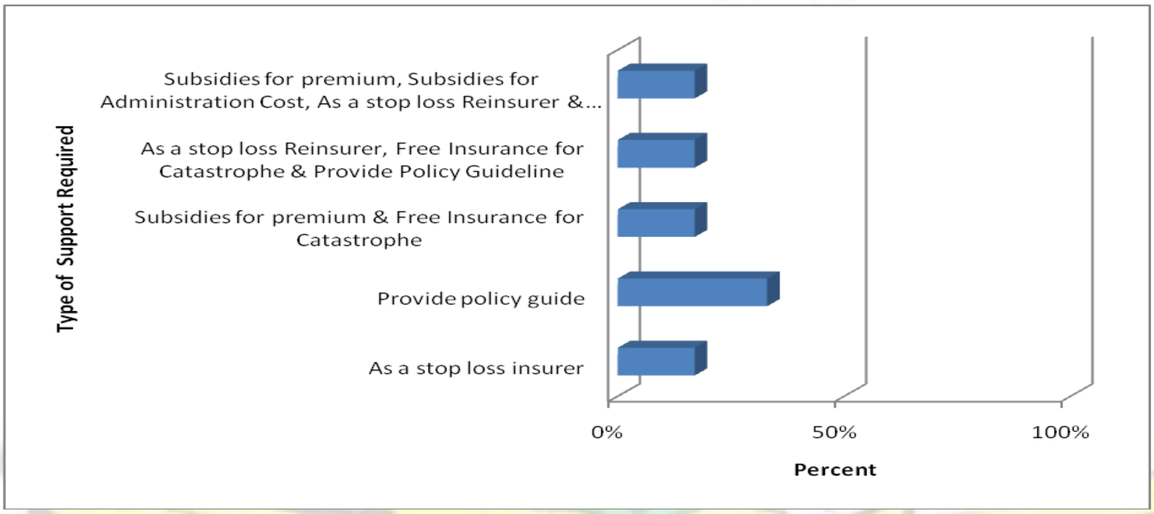


Source: Field Survey, 2014

However, musing over the kind of support government should provide in order to develop and sustain agricultural insurance in the study area, 33 % of stakeholders of the Ghana Agricultural Insurance Pool were of the view that that government should provide policy guidelines, while 17% were of the view that government should act as a stop loss insurer and 17% were of the view that government should subsidize premiums and provide free insurance in event of catastrophe. Again, 17% of the pool stakeholders were of the view that government should provide subsidies for premium consistent with

IFAD(2011);Wenner(2005) who reports that government provide subsidies for agricultural insurance in China, India, Carribean and Latin America.They also wants government to subsidize administrative cost, provide free insurance for the poor and also act as a stop loss

Insurance (TMU, TCAI, and SC)



Source Field Survey, 2014

It is clear that many of the respondents want government to be involved in formulation of policies on agricultural insurance, which should be part of Ghana's agricultural development policy and should also necessitate the drafting of agricultural insurance bill for Parliament's approval. These stakeholders of the pool should collaborate with NIC and MOFA and lawyers specialised in drafting of laws to come out with agricultural insurance laws to enforce agricultural insurance contracts.

5.2 Empirical Results of the Willingness to Pay (WTP) Survey

This section presents the insurance approaches or strategies preferred by farmers for their cashew crop insurance, willingness to pay estimates for the preferred insurance approaches, and determinants of willingness to pay for agricultural insurance scheme in the study area.

reinsurer, while the last 17% contended that government provide free insurance for catastrophe and also provide policy guideline. This is revealed in Figure 5.7.

Figure 5.7 How Stakeholders of GAIP Want Government to Support Agricultural

Table 5.13 and Figure 5.8 present the descriptive statistics of the attributes considered in the mixed logit and latent class models. The dependent variable (*choice*) which represented 1 if a farmer chooses any of the choice alternatives and 0 otherwise if none of the options were chosen.

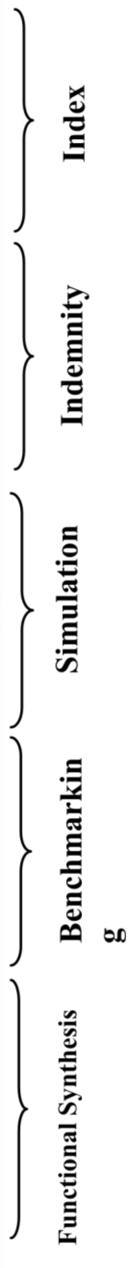
Attributes	Frequency		Percentages	
	Chosen (1)	Not chosen (0)	Chosen (1)	Not chosen (0)
Quarterly	71	312	18.5	81.5
Annually	184	199	48.0	52.0
Cash mode	184	199	48.0	52.0
Bank mode	71	312	18.5	81.5
Choice	345	38	90.0	10.0

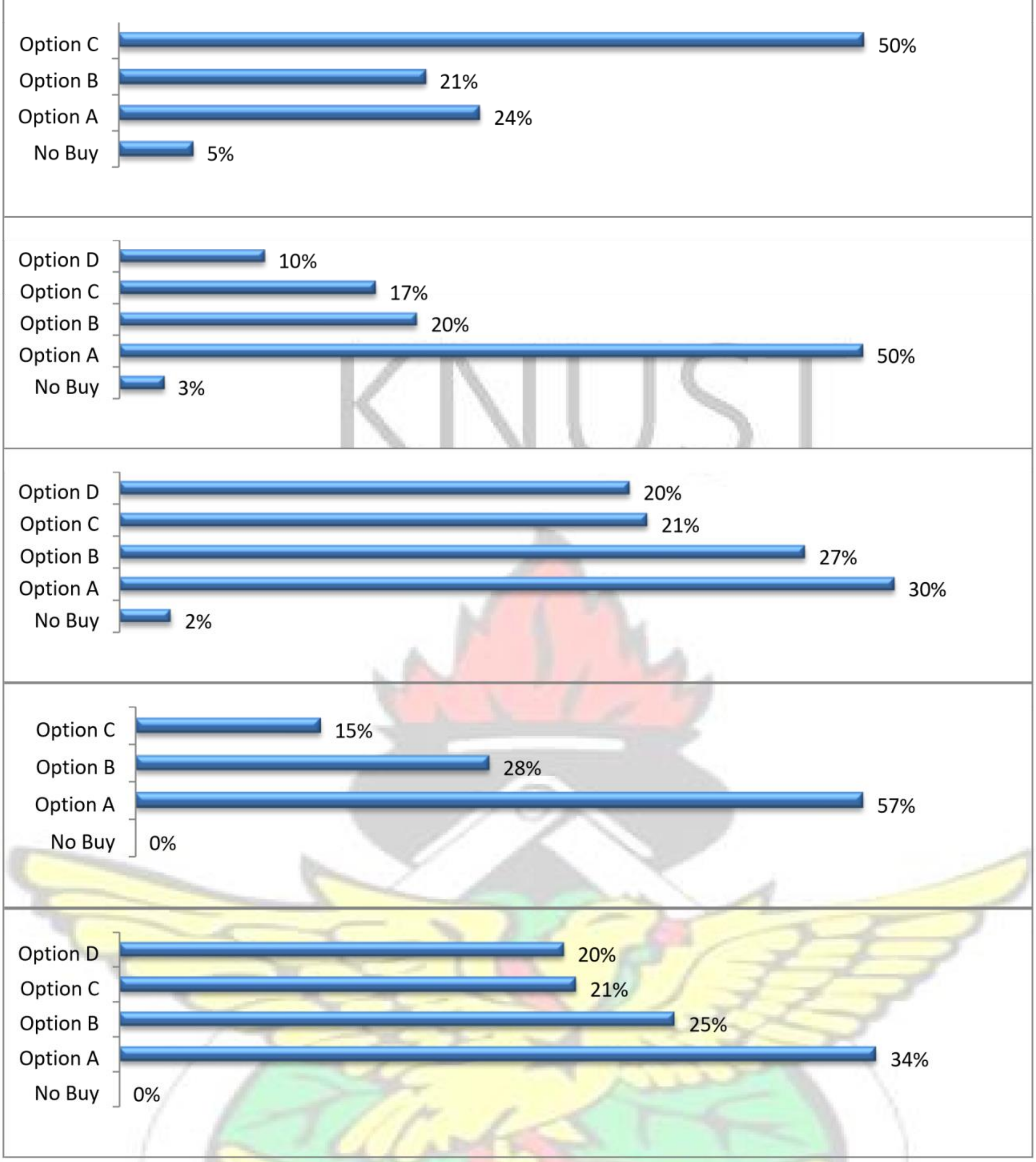
Table 5.13 Descriptive statistics of attributes in the mixed logit and latent class models

Source: Field Survey, 2014

In terms of mode of payment, most of the farmers prefer to pay insurance premiums through cash mode as indicated by 48% of the farmers, compared with 18.5% who prefer to pay it through bank mode. Similarly, 48% of the farmers prefer to pay insurance premiums on annual basis, relative to 18.5% who prefer to pay it on quarterly basis.

Figure 5.8Farmers interest patronizing agricultural insurance product options





Source: Field survey, 2014

The results indicated that 50% of the farmers had preference for option C of Index which is Area Yield Index, and 24% had preference for option A which is Weather Index, while 21% had preference for Option B which is Satellite Index insurance products.

With regards to Indemnity product options, 50% had preference for option A is named or single peril for fire but insurers were not willing to design products to cover one key peril. 20% also had preference for option B which is named peril damaged base for high wind speed 17% were also willing to pay for option C, which is also named peril damage base product for excess rain fall, and only 10% were willing to pay for option D which is multiperil crop insurance product for fire, high temperature, excess rainfall and high wind speed. With regards to Simulation Approach

Product Options 30% of cashew farmers were willing to pay for option A which is Simulated Weather Multiperil Product for fire, high temperature and excess rainfall and high wind speed, while 27% were willing topay for option B which is Simulated Satellite Multiperil Product for fire, high temperature and excess rainfall and high wind speed. 21% and 20% were willing to pay for option C and D which are Simulated Area Yield index Multiperil product for fire, high temperature and excess rainfall and Indemnity and Benchmarking Simulated product for fire, high temperature and excess rainfall and high wind speed respectively. Functional synthesis approach also had the highest utilitiy among all the farmers, since the wasn't any case of no buy, meaning farmers had preference for all the modelled hypothetical agricultural insurance products under functional synthesis approach.The results indicated that 34% preference for option A, which is Weather Synthesized Simulated Multiperil Insurance for damage and yield-based for fire, high temperature and excess rainfall and high wind speed. 25% had preference for option B which is Satellite Synthesized Simulated Multiperil insurance for damage and yield base for fire, high temperature and excess rainfall, while 21% had utility for option C which is Area Yield Synthesized Multiperil Insurance for Damage and Yield-based for fire, high temperature and excess rainfall and high wind speed and 20% of D which is Aggregate loss of investment Synthesized Simulated product for damage and yieldable for fire, high temperature and excess rainfall and high wind speed.

5.2.1 Farmers' Preferences and WTP for Insurance Products

Prior to the mixed logit estimation, conditional logit was first estimated and the loglikelihood ratio test results indicated that the data can be best explained by assuming heterogeneity (See Appendix XII for Conditional Logit Estimates). Thus, the homogeneity hypothesis was rejected suggesting that farmers are heterogeneous in their preference for agricultural insurance approaches and products; hence the mixed logit model was specified.

Table 5.14 presents the mixed logit estimates for cashew farmers' preferences and willingness to pay for insurance products to cover their cashew farms. The size of the coefficients for the attributes is used in determining the preferences for the attributes in the choice design. The willingness to pay estimates was derived by finding the negative ratio of the coefficient of the attribute and the price coefficient. The results show that the price coefficient is negative: which implies that as the price of the insurance product increases, farmers' preferences and WTP estimates decreases. This is consistent with economic theory. Bierer and Eling (2012) reports that high premium is a major impediment to micro insurance uptake. The results indicated that, functional synthesis has the highest and significant coefficient estimate of 1.1057 at 1% significant level. It has a significant standard deviation estimate of 1.4729 at 1% level. This suggests that functional synthesis attributes significantly influence farmers willingness to pay for insurance products. However, the significant standard deviation estimation indicates that preference heterogeneity exists for functional synthesis. Farmers had a willingness to pay estimate of GH¢102.38 per year/acre.

The index approach had a statistically positive and significant coefficient and standard deviation estimates 0.7705 and 0.8756 respectively at 1% level of significance. This implies that index insurance product has significant influence on farmer's preferences and WTP for agricultural insurance to cover their cashew farms. The significant standard deviation shows the existence of preference heterogeneity among farmers for index insurance product. More importantly, farmers were willing to pay GH¢71.34 for this product.

The indemnity approach had a statistically positive and significant coefficient and standard deviation estimates of 0.8245and 0.6262 respectively at 1% level of significance. This implies that indemnity insurance products have significant influence on farmers' preferences and WTP for agricultural insurance to cover their cashew farms. The significant standard deviation shows the existence of preference heterogeneity among farmers for indemnity insurance product. Farmers were willing to pay GH¢76.34 for this product. Similarly, benchmarking attributes had a positive and statistically coefficient estimate and standard deviation estimates of 0.7096 and 1.6394 at 1% level respectively. This suggests that benchmarking attributes significantly influence farmers in their preferences and WTP for insurance products. The significant standard deviation estimates also implies that farmers are heterogeneous in their preferences for this attribute or insurance approach. The willingness to pay estimate for this insurance product is GH¢67.70. It must be emphasised that this amount cannot be said to represent the entire group but rather belongs to a specific class of farmers. The study further revealed that simulation insurance products had a significantly positive coefficient estimate of 1.0146, with significant standard deviation estimate of 0.6826. This means that farmers are heterogeneous in their preferences for simulation approach or product, Farmers placed a value of GH¢93.94 per acre annually. In summary, farmers' preferences for insurance products are as follows; functional synthesis followed by simulations followed by indemnity, index and then benchmarking.

Table 5.14 Mixed Logit Estimates for Farmers Preference for Insurance Approaches

Attribute	Coefficient estimates (standard errors)	Standard deviation estimates (standard errors)	WTP (GH¢)/ year/acre
Price	-0.0108*** (0.0006)		
Functional	1.1057*** (0.1909)	1.4729***(0.1566)	102.38
Index	0.7705***(0.0870)	0.8756*** (0.1232)	71.34

Indemnity	0.8245***(0.0833)	0.6262***(0.1185)	76.34
Benchmarking	0.7096 ***(0.1819)	1.6394*** (0.1293)	67.70
Simulations	1.0146 ***(0.0924)	0.6826*** (0.1141)	93.94
Quarterly	-0.0299 (0.0745)	-0.0055 (0.1734)	
Cash mode	0.0655 (0.0998)	1.3782*** (0.1099)	
Number of observation		10341	
LR chi2(6) 826.56***	Log likelihood	3151.93	

Source: Field Survey, 2014

The duration of payment and the mode of payment attributes were not found to be significant but had significant standard deviation estimates at 1% implying that farmers' preferences for insurance are not mainly affected by these attributes. This is consistent with the findings of Muewissen and Molnar (2010), Stutley (2010); Swiss-Re(2013),Herbold(2012) who identified Benchmarking, Simulation and Indemnity as approaches for developing agricultural insurance scheme in Ghana, Australia and developing countries including Ghana. The heterogeneous preference of farmers in the results has defied the Status- quo- bias theories, which view individuals as preferring status quos they are familiar with, instead of adoption of a new technology or product such as agricultural insurance which is non existent for cashew crop.

5.2.2 Latent Class Utility and Parameter Estimates for Heterogeneous Preference for Insurance Approaches

Following the evidence of preference heterogeneity among farmers for the insurance products, willingness to pay estimates could not be interpreted as being a representative of the whole sample. Hence a latent class approach was adopted to determine the number of classes and the class specific utility estimates for the sampled farmers. Table 5.15 presents the latent class estimates for determining the number of optimal classes in the sampled respondent.The results show for each model the maximized log likelihood, the total number of estimated parameters, the Bayesian Information Criterion (BIC), the Akaike Information Criterion (AIC) and the Consistent Akaike Information Criterion (CAIC). As shown in the Table, the 4-class model is optimal according to the AIC and BIC since it has the minimum BIC and AIC statistics noticeably associated with this class model. Therefore, four latent classes were observed in the model.As the BIC and AIC values increase when additional classes beyond 4 are added.

Table 5.15 Latent Class Estimates for Determining Number of Classes

Classes	Log Likelihood	No. Parameters	AIC	CAIC	BIC
2	-2969.114	15	5968.229	6042.449	6027.449
3	-2822.857	23	5691.714	5805.519	5782.519
4	**-2637.285**	**55**	**5384.57**	**5656.712**	**5601.712**
5	-2650.494	63	5426.988	5738.714	5675.714
6	-2681.127	70	5456.255	5688.812	5641.812

Source: Field survey, 2014

The results onTable 5.16 shows that the utility estimate for price is negative and significant at 1% in class one as expected with a coefficient of -0.06. This suggests that as price increases for insurance products, member of class one reduce their preference for insurance products by the estimated coefficient. Bierer and Eling (2012) noted that high premiums impede micro insurance uptake. Members of this class prefer functional synthesis with the highest utility estimate of 6.49 followed by benchmarking with 6.42 significant at 1%. The higher utility estimates for these insurance approaches indicate that farmers in group one are willing to pay more for such insurance products. However, members of class do not prefer index but do not preferred simulation insurance approaches but have positive preference for indemnity insurance product. The result is contrary to the preference observed by Muewissen and Molnar (2010), in their study of Australian farmers who preferred the simulation approach under the name yield shied insurance for hail, fire and water stress.

The results further show that members of this class do not prefer insurance premiums to be paid quarterly relative to annual payments and require the payments to be done through physical cash mode rather than going to the bank to pay as indicated by the significantly negative utility estimate of 3.74 for quarterly and positive estimate of 2.18 for cash at 1% level of significance. This is in agreement with the observation made by Chankora *et al*. (2008) who report that yearly payment schedule is not suitable for low income clients. Members of this class account for 22.10% of the respondents, representing about 85 respondents out of the sample.

In class 2, price variable was significantly negative at 5% as expected. The utility estimates show that members of this class also prefer functional synthesis with the highest utility estimate of 2.22 but contrary to class one, they have preference for index approach with a utility of 1.34 both significant at 1% and prefer annual payments for insurance contrary to the findings of Chankora *et al.*(2008). However, members of this class do not have preferences for mode of payment as indicated by the insignificant utility estimate for cash mode.
Members of this class account for 26.70% of the respondents.
In class 3, price was significantly negative at 1% level as expected. The utility estimates show that class 3 members have higher utilities for functional synthesis with significant estimate of 12.44 at 1%. This is followed by simulation approach which was significantly positive at 1% with an estimate of 5.93, followed by index approach with significant utility estimate of 4.24 at 1% as well as indemnity insurance product, consistent with the results of the study of

Muewissen and Molnar (2012), Herbold (2012), Stutley (2010) and Wenner (2005) who also reports of Simulation, Index and Indemnity based products in their studies. However, the utility estimate for benchmarking approach was significantly negative, indicating that members of class have negative preference for benchmarking approach. Members of the class prefer paying for insurance quarterly and in cash mode with significantly positive estimates at 1% level. Members of this class accounts for 32.50% of the respondents. This shows that majority of the respondents belong to class three.

Lastly, in class four, price had a significantly negative estimate of 0.09. The utility estimates show that members of class 4 have higher preference for functional synthesis with an estimated coefficient of 23.38 significant at 10%. This is followed by simulation approach with an estimated coefficient of 12.81 significant at 1% level, followed by indemnity and index approaches respectively. Members of this class do not prefer annual and cash mode of payments as indicated by the negative utility estimates and they account for 18.7% of the respondents. The heterogenous preference among farmers in their choice of hypothetical agricultural insurance products defied the status- quo bias theory and rather supports the random utitility theory developed by Lancaster (1966) which view consumers as rationalizers and will choose product options that maximize their utilities subject to their income constraints.

The parameter estimates help to identify the characteristics of respondents under each latent class estimated. The interpretations of the variables follows that, if a variable is positive then it means that particular variable pertains to that specific class. For continuous variables, positive estimate implies that a unit increase in that variable will increase the probability of the respondent belonging to that particular class by the estimated coefficients and vice versa. For dummy variables, positive estimate implies that the particular category coded as 1 belongs to class of interest compared to the reference category and negative implies that the category coded as 1 do not belong to the class compared to the reference category. It must be emphasized that the class 4 was set as the reference class and as such parameter estimates were not predicted for that class.

Sherrick *et al*.(2004) noted that insurance users in general are expected to be more experienced and better educated.In class 1, the parameter estimates show that,years of farming (F_years) and schooling (years school) were statistically significant with positive parameter estimates. This implies that as years of farming and education increases, the probability of cashew farmers belong to this class increases. Farmers of this class have trust in insurance companies; this is indicated by the significantly positive parameter estimate of 3.02 at 1% level. This suggests that members of class one are experienced farmers and that a one year increase in farming and schooling result in 2.21 and 1.04 increases in the chance of the farmer to be in class one compared to class four.Brugiavani and Pace found literacy to be a determinant of health insurance enrolment just as Chankova*et al.* (2008) who succinctly opined that there is a positive correlation between health insurance uptake and education.

In class 2, the parameter estimates show that the variables such as farm size, male, insur_trust and Insur_h_prem were statistically significant and positive with 0.22*, 0.24**, 0.14*** and 0.32*** respectively. This means that members of class 2 have large farm sizes and mostly males with coefficients equivalent to 0.22 and 0.24, consistent with the results obtained by Akter and Brouwer (2007) who found out that respondents with larger farm sizes were willing to buy crop insurance. This is reinforced by Enjoras *et al.* (2011), who noted that insurance uptake has a positive relationship with farm size. These class members have trust in insurance companies and disagree that insurance premiums are high compared to class 4. This implies that members of this class are large scale male cashew farmers, who have trust in insurance companies; therefore, they see insurance premiums as reasonable since they perceive premiums not to be high, as reinforced by Jehu Appiah *et al*. (2000) who found out that households perception of price and benefits influence the enrolment on NHIS scheme. On the other hand, the variables such as age, years of schooling, insurance fire, and insu_c_delay were statistically negative with estimates of -0.06**, -0.50*, -1.02***, -1.04* and -3.18*** respectively. This suggests that a unit increase in a farmer's age reduces his or her chances of being in class 2 compared to class 4 contrary to the finding of Jehu-Appiah (2011b) who observed that the greater an individual's age, the more likely he or she would enrol on insurance scheme.Members in the class are less likely to be highly educated and are of the perception that insuring your farm means inviting fire and that insurance companies delay in paying claims comparative to members of class 4.

Table 5.16 Latent Class Utility and Parameter Estimates

Utility Estimates	Class 1	Class 2	Class 3	Class 4
Price	-0.06***(0.02)	-0.02**(0.01)	-0.21***(0.05)	-0.09***(0.03)
Functional	6.49***(1.34)	2.22***(0.56)	12.44***(1.99)	23.38*(9.67)
Index	- 0.01(0.03)	1.34***(0.10)	4.24***(0.57)	9.33**(2.25)
Indemnity	3.56***(1.01)	0.85(1.12)	5.53***(0.79)	11.81***(2.23)
Benchmarking	6.42***(1.32)	1.07(1.14)	-8.22***(1.23)	6.92***(1.68)

Simulations	3.55(3.01)	0.88(1.12)	5.93***(0.79)	12.81***(2.23)
Quarterly	-3.74***(1.03)	0.03***(0.01)	3.06***(4.50)	-1.08***(0.03)
Cash mode	2.18***(0.40)	-0.48(0.10)	3.50***(5.20)	-12.39***(2.07)
Class Membership Parameter Estimates				
Age	0.03(0.14)	-0.06**(0.03)	0.04(0.03)	Reference class
Ag_training	1.95(1.59)	3.23(3.00)	0.20(0.21)	
Hhead	-0.55 (0.40)	-0.79(0.65)	0.96*(0.56)	
Hsize	-0.28(0.19)	0.09(0.06)	-0.18(0.13)	
F_years	2.21**(1.02)	4.48(2.35)	0.53**(0.24)	
Farm_size	-1.81(1.79)	0.22*(0.12)	-4.15*(2.36)	
Farm_age	0.06(0.04)	0.09(0.06)	-0.05**(0.02)	
Male_du	-0.06(0.05)	0.24**(0.12)	-0.93(0.56)	
Years_ school	1.04***(0.35)	-1.02***(0.35)	-1.02(1.45)	
Family_land	0.60(1.23)	0.10(0.07)	0.40**(0.20)	
Family_labor	0.123 (0.07)	-0.41 (0.51)	-0.04 (0.05)	
Insurance_fire	-0.08 (0.05)	-1.04* (0.63)	-0.09 (0.05)	
Insu_c_delay	0.15 (0.21)	-3.18***(1.49)	0.03 (0.05)	
Insur_trust	3.02***(0.05)	0.14*** (0.03)	0.05 (0.05)	
Insur_h_prem	-1.12 (0.81)	0.32*** (0.11)	-0.69 (0.91)	
Class share	**22.10%**	**26.70%**	**32.50**	**18.70**
Log likelihood = -3149.1126 **Number of obs. = 10341** **LR = 832.21*** **				

Source: Field survey, 2014

In class 3, the results show that variables such Hhead, F_years and Family_land were statistically significant with positive parameter estimates of 0.96*, 0.53** and 0.40**, consistent with the results of Akter and Brouwer (2007) who noted that landowners were significantly more willing to buy crop insurance scheme than landless farmers. The results implies that member of class 3 are household heads with more farming experience compared to members of class 4. Members of this class operate on family land compared to those farming on hired land. The variables farm age and farm size were statistically significant with negative estimates of 4.15* and 0.05** respectively. This means that a unit increase in farmer's age and farm size reduces the possibility of the farmer belonging to class 3 by the estimated coefficients of 4.14 and 0.05 at 5% and 1% respectively. Members of this class are not influenced by any of the perception variables compared to members of class 4, contrary to the observation made by Atim and Sock (2000) who identified community perception as the cause of low uptake of health insurance. This means that perception of respondents should not be assumed to influence all respondents, but its impact on different respondent segments must be studied. More importantly, the presence of latent classes with different preference forms the basis of market segmentation, positioning and targeting. Finally, the influence of various socio economic characteristics in their choice of insurance product has reinforced the state dependent utitility theory, which indicates that consumer utility levels are influenced by their state depended state which is determined by their socio economic characteristics.

5.2.3 Class Specific Willingness to Pay Estimates for Insurance Products and Key Perils

Class specific willingness to pay estimates has been estimated for the insurance products as well as key perils prevailing in the study area. Table 5.17 shows the latent class models estimated for the key perils to gauge each class' specific willingness to pay for key perils. The results show that functional synthesis insurance product is highly valued among respondents in class one, with an estimated WTP amount of GH¢108.17 per acre annually.

Table 5.17 Latent class estimates for key perils

Perils	Utility function estimates			
	Class 1	Class 2	Class 3	Class 4
High temperature	4.20***(1.22)	4.03***(1.02)	5.56**(2.35)	6.64***(2.05)
Excess rainfall	1.93***(0.24)	2.93***(0.56)	3.03***(0.55)	5.40***(1.23)
High wind speed	6.95*** (1.23)	9.51***(2.85)	16.23***(3.33)	12.04***(4.00)
Bush fires	17.34***(4.89)	18.64***(4.33)	30.56***(6.44)	25.34***(5.07)
Price	-0.34***(0.12)	-0.31***(0.11)	-0.55***(0.16)	-0.36*(0.20)

Values in parenthesis are standard errors

Source: Field survey, 2014

This is followed by benchmarking, which was valued at GH¢107.00 per acre whiles indemnity was least valued among the insurance products. This implies that members of class one prefer functional synthesis and benchmarking insurance products. It is worth recognising that, members of this class place higher value on bush fire as the key peril they will be willing to pay to insure against. Specifically, they were willing to pay a higher amount of GH¢50.99 for bush fire, followed by high wind speed, with the least valued peril being excess rainfall. This suggests that bush fires and high wind speed are important risks facing class one farmers in the study area.

Table 5.18 Class specific willingness to pay for insurance approaches and key perils in (GH¢)/ year/acre

Insurance Approach				
Attributes	**Class 1**	**Class 2**	**Class 3**	**Class 4**
Functional	GH¢108.17	GH¢111.00	GH¢59.24	GH¢259.78
Index	NS	GH¢67.00	GH¢20.19	GH¢103.67
Indemnity	GH¢59.33	NS	GH¢26.33	GH¢131.22
Benchmarking	GH¢107.00	NS	GH¢-39.14	GH¢76.89
Simulations	NS	NS	GH¢28.24	GH¢142.33
Key Perils				
High temperature	GH¢12.35	GH¢13.00	GH¢10.11	GH¢18.44
Excess rainfall	GH¢5.67	GH¢ 9.44	GH¢5.50	GH¢15.00
High wind speed	GH¢20.45	GH¢30.66	GH¢29.50	GH¢33.45
Bush fires	GH¢50.99	GH¢60.12	GH¢55.56	GH¢70.40

NS: Not significant **Source: Field survey, 2014**

Members in class two were willing to pay for functional synthesis and indemnity insurance products with significant preferences. The remaining products were insignificantly preferred. The WTP estimates show that functional synthesis was highly valued at GH¢111.00, whereas index insurance product was valued at GH¢67.00. This suggests that members of class 2 prefer and are willing to pay for only functional synthesis and index insurance products. Among the key perils, the results reveal that bush fire is the most valued, with an estimated WTP value of GH¢60.12, followed by high wind speed GH¢30.66. This suggests that members of class 2 are also very particular about bush fires and high wind speed yet place less value on excess rainfall. This is probably due to the fact that rainfall patterns have changed in recent years and as such excess rainfalls are hardly experienced.

In class 3 however, members have preferences for all the insurance products. The estimates show that functional synthesis is still highly valued among all the products, followed by simulations, indemnity and index insurance products with WTP amounts of GH¢59.24, GH¢28.24, GH¢26.33 and GH¢20.19. Interestingly, members of this class are willing to accept an amount of GH¢-39.14 in order to choose benchmarking insurance product. Like classes 1 and 2, class 3 members are willing to pay more for bush fire and high wind speed.

Lastly, class 4 members' WTP estimates for class four members were higher for all the insurance products and perils with the exception of benchmarking where class 1 members placed higher value. Specifically, members of this class were also willing to pay higher amounts for functional synthesis but with higher amount of GH¢259.78 per acre annually. The next high valued product was simulation, where farmers in the class were willing to offer GH¢142.33 per acre, followed by indemnity product with an amount of GH¢131.22. Benchmarking was least valued in this class with an amount of GH¢76.89 per acre. In terms of key perils, bush fire and high wind speed were still highly valued like in other classes with estimated WTP values of GH¢70.40 and GH¢33.45 respectively. The different prices attached to the various preferences for insurance approaches as well as their attributes for each class is consistent with observation made by Jehu Appiah *et al*. (2000) who found out that households perception of price and benefits influence the enrolment of NHIS scheme.

In summary, the willingness to pay estimates confirm the existence of preference heterogeneity in willingness to pay among cashew farmers as shown by the differences in magnitude and significance of WTP estimates across different classes. The results indicate that functional synthesis is highly preferred and valued but the WTP amounts vary from one class to another depending on their socioeconomic and perception factors. Higher willingness to pay exists for bush fire and high wind speed. Farmers heterogeneous preference and willingness to pay different prices for key perils supports the Cumulative Prospect theory, which combines prospect and state dependent theories to suggest that individuals assign weights to probability of occurance of an event and make choices between prospects by weighing the probabilities between loss and gain (Kahnemann and Tversky,1979). These individuals willingness to pay higher is influenced by higher weights assigned to the insured event.

5.2.4. Determinant of Preferences and WTP for Insurance Approaches

Following the determination of the class membership estimates, a multinomial logit model was estimated to find out the factors that influence farmer's choice of a particular insurance approach and the results are presented in Table 5.16. There were five insurance approaches for the farmers to choose from and out of this the simulation approach was used as the reference category because that was the reference category combines both index and indeminity approaches. Empirical literature from the works of Ben-Housa (2010) shows a positive relationship between household size and Precautionary savings, while Jehu -Appiah (2011b) and Sherrick *et al*. (2004) show a positive relationship between age, education and insurance uptake. Similarly, the results for the index approach shows that age, agric training (Ag_training), household size (Hsize) and trust in insurance companies (Insur_trust) were statistically significant with positive coefficients of 0.118, 2.159, 0.331 and 3.559 at five and ten percent levels. This means that if farmer's age increases by one, it will result in an increase in the farmers' preference for index approach of insurance by 0.118 at 1% significant. Farmers who have received agricultural training before are 2.159 more likely to prefer index approach at 1% level of significance compared to simulation method. Household size was significant at 5%, suggesting that a unit increase in household size will result in 0.331 increases in farmers' preference for index approach of insurance compared to simulation approach. Farmers who trust in insurance companies are more likely to prefer index approach of insurance at 5% with an estimated coefficient of 3.559. The above results indicate that farmers who prefer index approach of insurance are older farmers, with agric training, large household and have trust in insurance companies.

However, the variables such as years of farming (Farming years), age of the farm (Farm age), education, family labour and farmers who perceive that insurance means inviting fire (Insurance fire), insurance companies delay in payment of claims (Insu_c_delay) and insurance premiums are high (Insur_h_prem) were statistically significant with negative estimates at the conventional levels. The results imply that farmers with more years of farming and older farms are 0.117 and 0.111 less likely to prefer index approach of insurance at 1% and 10% levels compared to simulation approach of insurance. Farmers who prefer index approach of insurance are less likely to be highly educated because an increase in educating reduces the chances of a farmer to choose index approach by 0.144 at 5% level of significance. Farmers who operate on family lands are less likely to choose index insurance approach, as indicated by the significantly negative estimate of 1.825 at 5% level, consistent with the observation made by Akter and Brouwer(2007), who noted that crop insurance demand varies significantly along land ownership and landowners are significantly inclined to buy crop insurance schemes than landless farmers. The results further reveal that farmers who perceive insuring farm as inviting fire, insurance companies delay in payment of claims and insurance premiums as high are less likely to prefer index approach of insurance, as evidenced by the significantly negative coefficient estimates.

For policy purposes, the marginal effects were estimated along with the coefficients. The marginal effects show that a unit change in the farming years will still reduce farmers preferences for index approach by 0.005 all things being equal. Similarly, a change from family land to hired land will increase farmers' preference for index insurance compared to simulation approach. Atim and Sock (2000) identify community perception as the cause of health insurance uptake. Changes in farmers' perception to understand that insurance companies do not delay in payment of claims and insurance premium is not high were found to result in a decline in farmers preferences for index approach, all things being equal. About 16.5% of the sampled respondents are predicted to prefer index insurance.

The estimates for the indemnity approach shows that farmers' characteristics such as age, agric training, household size and trust in insurance companies have positive influence on cashew farmers' choice of indemnity insurance approach. The results show that as the age of the farmer increases, the probability that the farmer will choose indemnity insurance approach increases by 0129 at 1% significance level, contrary to observation made by Black and Dorfman (2000) who observe a negative correlation between age and crop insurance purchase. Farmers who have received agricultural training before are 1.584 more likely to prefer indemnity approach at 1% level of significance compared to simulation method. Household size was significant at 1%, suggesting that a unit increase in household size will result in 0.513 increases in farmers' preference for indemnity approach of insurance compared to simulation approach. Farmers who trust in insurance companies are more likely to prefer indemnity approach of insurance at 1% with an estimated coefficient of 3.093. The above results indicate that farmers who prefer indemnity approach of insurance are older farmers, with agric training, large household and have trust in insurance companies. However, years of farming, age of cashew farm, farming on family land and perceptions that insuring farm is like inviting fire and insurance companies delay in payment of claims have significantly negative influence on farmers' preference for indemnity approach relative to simulation insurance approach. The marginal effect shows that a unit increase in farmers' age will result in 0.007 increases in the farmers' likelihood of choosing indemnity insurance. A change in agricultural training will reduce farmers' chances of choosing indemnity approach by 0.035 at 5% significance level. The marginal effect shows that an increase in household size will result in 0.064 increases in farmers' chances of choosing indemnity approach at 1% significance level compared to simulation approach. This implies that indemnity approach is preferred by farmers with large household sizes. On the other hand, an increase in farming years will decrease farmers' chances of preferring indemnity insurance by 0.005 at 1% level of significance. The marginal effects for the education variable show that an increase in farmers' education will result in 0.042 increases in farmers' probability of choosing indemnity approach of insurance all things being equal. This suggests that as farmers' education increases their preferences for indemnity insurance approach, contrary to the observation made by Raju and Chand (2008), who did not find any significant difference relations between education and insurance uptake in their study area in India. A shift from operating on family land to hired land will decrease the farmers' chances of preferring indemnity insurance relative simulation insurance. A change in farmers trust in insurance companies will lead to a decline in preference for indemnity insurance, all things being equal.

This implies that trust in insurance companies plays vital role in influencing decision of farmers regarding insurance. Similarly, a change in farmers' perception to accept that insurance premiums are not high is still less likely to reduce preference for indemnity approaches of insurance compared to simulation approach, consistent with the observation made by Jehu-Appiah *et al*.(2000) who reports that perception of price and benefits influenced the enrolment of NHIS schemes. About 29.8% of the respondents have the predicted probability to prefer this insurance approach.

The estimates for the benchmarking insurance approach reveal that as the age of the farmer increases, the probability that the farmer will choose benchmarking insurance approach increases at 1% significance level compared to simulation approach. The marginal effect was not significant hence the effect of a change in age on the farmers' probability cannot be determined. Access to agricultural training (Ag-training) has a positive influence on farmers' choice of benchmarking approach and increases the probability of farmers to choose benchmarking insurance approach at 1% level of significance all things being equal. However, the marginal effect revealed that a change from access to agricultural training will reduce farmers' probability of choosing benchmarking approach by 0.128 at 10% significance level. This implies that access to agricultural training plays a vital role in farmers' choice of benchmarking insurance approach compared to simulations approach.

Years of farming has negative influence on farmers' choice of benchmarking approach compared to simulation approach. This implies that experienced farmers are less likely to choose benchmarking approach of insurance all things being equal. Trust in insurance companies has significantly positive influence on farmers' choice of benchmarking approach of insuring cashew farms at 1% level. Education has a negative marginal effect of 0.163 at 1% significance level compared to simulation approach. This suggests that as education of farmers' increases, their preference for benchmarking approach reduces compared to simulation approach, contrary to the finding of Brugiavani and Pace (2011), who found out a correlation between literacy to be a determinant of health insurance uptake. Farmers who believe that insuring farm is like inviting fire (Insurance fire) and insurance companies delay in payment of claims are less likely to prefer benchmarking approaches of insurance compared to simulation approach. A change in farmers' perception that insurance companies delay in payment of claims (Insu_c_delay) reduces farmers' chances of choosing benchmarking approach by 0.348 at 1% significance level. The marginal effects for farmers' perception that insurance premiums are high (Insur_h_prem) reveal that a change in this perception will increase farmers' probability of choosing benchmarking approach of insurance by 0.593 at 1%

significance level compared to simulation method. The predicted probability of benchmarking approach is 35.3%. Lastly, the estimates for the functional synthesis approach reveal that significantly positive determinants of preference for functional synthesis approach include household size and trust in insurance companies. The results revealed that an increase in household size will result to 0.027 increases in the likelihood of a farmer to choose functional synthesis approach compared to simulation approach at 10% level. However, Ben-Houassa (2010), found a large household to be positively correlated with the use of precautionary savings. Similarly, farmers who have trust in insurance companies are 2.237 more likely to choose functional synthesis approach.

A change in farmers trust to mistrust will reduce preference for functional synthesis by 0.087 at 1% level of significance. The results further reveal negatively significant determinants of preference for functional synthesis to be household head, farm size, family land, family labour and perception variables such as belief that insuring farm is like inviting fire, insurance companies delay in payment of claims and high insurance premiums. This suggests that those who prefer of functional synthesis are likely to be non-household heads, with small farm sizes, operating on hired lands and using hired labour in their farming business.

However, the marginal effects show that a change in farmers' age will result in 0.007 decreases in the probability that the farmer will choose functional synthesis insurance approach at 1% significance level compared to simulation approach. Enjolras *et al*. (2011) noted that insurance is positively linked to the size of the farm; however, farm size was not a significant variable in a study by Smith and Baquat (1996).

The results further revealed that household head (Hhead), farming years (F_years), farm size (Fsize) and family labour (Family_labor) have negative influence on farmers' choice of functional synthesis approach of insurance compared to simulation approach. The marginal effects show that only family labour was significantly negative. Suggesting that, a change in family labour reduces the probability of farmers' choosing functional synthesis approach by 0.086 at 5% significance level. The rest of the variables had insignificant marginal effects.

A change in perception that insurance premiums are high will result in an increase in farmers' choice of functional synthesis approach by 0.180 at 1% significance level compared to simulation insurance approach.This suggests that a change in perceptions related to the above is very important in influencing farmers' choice of functional synthesis approach of insurance.

Variable	Index Approach		Indemnity		Benchmarking		Functional synthesis	
	Coefficient	**Marginal effects**	**Coefficient**	**Marginal effects**	**Coefficient**	**Marginal effects**	**Coefficient**	**Marginal effects**
Age	0.118*** (0.030)	0.002 (0.002)	0.129*** (0.029)	0.007* (0.004)	0.119*** (0.028)	0.005 (0.004)	0.048 (0.033)	-0.007*** (0.003)
Ag_training	2.159 *** (0.538)	0.078 (0.055)	1.584*** (0.482)	-0.035** (0.064)	2.059*** (0.472)	0.128* (0.076)	0.981 (0.617)	-0.072 (0.038)
Hhead	-0.339 (.588)	0.008 (0.054)	-0.166 (0.533)	0.062 (0.068)	-0.469 (0.476)	-0.029 (0.070)	-0.890* (0.527)	-0.066 (0.052)
Hsize	0.331** (0.172)	0.005 (0.018)	0.513*** (0.144)	0.064*** (0.021)	0.082 (0.156)	-0.076*** (0.027)	0.536*** (0.166)	0.027* (0.014)
Farming_years	-0.117*** (0.027)	-0.005** (0.002)	-0.106*** (0.025)	-0.005* (0.003)	-0.090*** (0.026)	-0.001 (0.004)	-0.037 (0.028)	0.006** (0.003)
Farm_size	-0.053 (0.063)	-0.004 (0.006)	-0.084 (0.058)	-0.003 (0.009)	-0.070 (0.059)	0.001 (0.010)	-0.141** (0.061)	-0.007 (0.005)
Farm_age	-0.111* (0.071)	-0.005 (0.006)	-0.096** (0.049)	-0.006 (0.007)	-0.067 (0.049)	0.004 (0.009)	-0.061 (0.056)	0.002 (0.005)
Male_du	-0.039 (0.789)	-0.032 (0.054)	-0.027 (0.723)	-0.055 (0.079)	0.455 (0.750)	0.111 (0.104)	0.069 (0.779)	-0.011 (0.045)
Education	-0.144** (0.078)	-0.011 (0.008)	0.069 (0.076)	0.042*** (0.012)	-0.163** (0.069)	-0.032*** (0.012)	-0.099 (0.073)	-0.003 (0.006)
Family_land	0.030 (0.406)	0.081* (0.042)	-1.076*** (0.389)	-0.179*** (0.059)	-0.195 (0.363)	0.096* (0.064)	-0.748* (0.406)	-0.031 (0.031)
Family_labor	-1.825** (0.922)	-0.121** (0.048)	-0.912 (0.688)	-0.057 (0.101)	-0.234 (0.700)	0.198 (0.127)	-1.883** (0.839)	-0.086** (0.035)
Insurance_fire	-16.059*** (1.932)	-0.196 (0.206)	-14.994*** (1.791)	0.058 (0.140)	-15.288*** (1.804)	-0.022 (0.211)	-14.848*** (1.685)	0.034 (0.065)
Insu_c_delay	-4.408* (2.346)	-0.143** (0.062)	-2.927** (1.223)	-0.114 (0.169)	-5.517*** (1.907)	-0.348*** (0.046)	-3.373*** (1.263)	-0.069 (0.052)
Insur_trust	3.559*** (0.792)	0.039 (0.053)	3.093*** (0.789)	-0.061** (0.069)	3.876*** (0.811)	-0.224** (0.089)	2.237*** (0..846)	-0.087*** (0.033)

Insur_h_prem	-2.813*** (1.007)	-0.242*** (0.037)	-0.674 (0.457)	-0.162*** (0.051)	1.493*** (0.395)	0.593*** (0.057)	-3.075*** (1.056)	-0.180*** (0.029)

T insurance approach

Constant	14.815*** (2.129)		10.681*** (2.153)		14.009*** (2.118)		14.789*** (2.097)	
Predicted Prob.		Pr=0.165		Pr=0.298		Pr= 0.353		Pr= 0.114
Number of obs Log pseudo likelihood Wald chi2(60) Pseudo R2		383 -469.92 790.10*** 0.2229						

Source: Field survey, 2014 (Values in parenthesis are standard errors)

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The predicted probabilities show that about 11.4% of the respondents have the chances of preferring functional synthesis approach. The estimated model has significant wild chi-square estimate of 790.10 at 1% significance level, indicating that the variables included in the model jointly and significantly influences cashew farmers' choice of a preferred insurance approach.

The influence of education and socio economic characteristics in the choice of a particular insurance approach or philosophy is supported by the random utility, human capital, and state dependent utility theories. It also reinforces the Traditional insurance theory which stipulates that risk adverse cashew farmers will purchase insurance when offered at an actuariary fair premiums. The results however, defied the status-quo bias theory. The individual products options under each philosophy chosen by the farmers are revealed in figure 5.8 and discussed below:

5.2.5 Constraints of Cashew Development

The development of cashew in Ghana is faced with many constraints that need to be identified and tackled for the betterment of the cashew sector. The results of constraints to cashew development identified in the study area were ranked in terms of the severity and presented in Table 5.13. The results show that Government lack of focus on cashew promotion is the highest constraint identified in the study area with the highest mean score of 17.32. The second highest constraint was found to be the lack of cashew board with a mean score 17.19. This suggests that a cashew board should be established to regulate the cashew industry like that of the cocoa industry in Ghana. The third most pressing constraint was lack of credit facilities/loans from financial institutions with a mean score of 16.73. This implies that credit facilities should be made available if the cashew sector is to be developed. Aside this, the study found that lack of financial institutions attached to cashew crop farmers in general tends to create problem for cashew development in the study area. This seems to reinforce the finding of Osei-Tutu (2012) who reported that lack of credit is one of the major constraints in the study area. The respondents also revealed that lack of representation of farmer groups in MOFA's decisions on cashew development hinders the development of the cashew sector in the area, since most of the policies from MOFA do not favour cashew farmers. Ashitey and Nicely (2012) rightly pointed out that weak extension services and inactive farmer associations are constraints to cashew development. The sixth and seventh most pressing constraints were found to be inadequate processing business and inadequate training for cashew crop farmer respectively with mean scores of 13.70 and 12.23 respectively. The next key constraint was land tenure system/access to land followed by lack of knowledge about cashew crop farming. This suggests that farmers need training on their cashew production system in order for them

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to be efficient and productive. The tenth constraint was fou nd to be market liberalization followed by lack of intermediaries in the marketing of cashew. The last constraint was found to be lack of availability planting materials. This implies that planting materials is not a very big issue among cashew farmers in the study area, and this contradicts the findings of Osei - Tutu (2012) who reports limited access to input in the study area. Consequently, it would not affect the behavioural approach to marketing cashew since availability of input can help farmers adapt to the excess demand of cashew nut and its allied products on the international markets, what is needed is access to credit , which will be made possible with the advent of agricultural insurance.

The Kendall's (W) coefficient of 0.77 implies that there is 77% agreement in the ranking of the constraints. In general, the main constraints can be summarised as institutional constraints, marketing constraints, technical constraints and financial constraints. From the results, constraints 1,2,5,8 are institutional constraints, while 3, 4 are financial constraints, with 8,6,10 being marketing constraints, while 7 and 9 are technical constraints.

Table 5.13 Kendall's ranking of constraints of cashew development

Constraint	Mean score	Ranking

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Land tenure system/Access to land	10.24	8th
Material/Input Availability	5.77	17th
Promotion of cocoa with lack of focus on cashew promotion	17.32	1st
Lack of credit facilities/loans from financial institutions	16.73	3rd
Lack of knowledge about cashew crop farming	9.38	9th
Lack of financial institutions attached to cashew crop farmers in general	16.33	4th
Cultivation of food crops in the region	5.79	16th
Society's attitude towards cashew crop farmers	5.24	18th
Lack of cashew Board	17.19	2nd
Lack of storage systems	6.24	12th
Lack of intermediaries	7.56	11th
Lack of representation of farmer groups in decision making of MOFA	13.97	5th
Lack of knowledge on the use of cashew	5.95	15th
Market liberalization	9.06	10th
Availability of planting materials	5.16	19th
Inadequate training for cashew crop farmer	12.23	7th
Inadequate processing business	13.70	6th
Lack of transport systems	6.06	14h
Post-harvest loses through packaging	6.09	13th
N	381	
Kendall's W	0.770	
Chi-Square	5280.42	
df	18	
Asymp. Sig.	.000	

Source: Field Survey, 2014

Consequently these key constraints must be addressed using public, private partnership approach and value chain financing of which agricultural insurance must play a key role in order to foster cashew development.

5.3. Chapter Summary

This chapter analyzed and discussed the results obtained from primary data from the Insurane development and choice experiment survey. The next chapter looks at the summary of findings, conclusions and recommendations for policy implications in order to provide sustainable agricultural insurance scheme for cashew crop farmers in the study area to enhance their access to credit for cashew development with a positive extenality effect on agricultural insurance development.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

This chapter gives the summary of the main findings of the study. It is also devoted to the presentation of conclusions, recommendations as well as suggested area for further research.

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6.1 Summary

Literature synthesis has shown that agricultural insurance will enhance cashew crop farmers' acess to credit and also mitigate the effect of climate change the will affect cocoa production in 2030 and beyond (CIAT, 2011). Yet, the perception that the agricultural sector is risky still lingers on the mind of potential financiers due to the absence of agricultural insurance -a risk mitigation and management instrument that will provide an ex-ante and ex-post risk management instrument in the sector. It is in this vein that Awunyo-Vitor (2011), Stutley (2010) and Hazell *et al.* (2010) amplified the need for research to build capacity for insurers on product development and distribution channels since insurers lack knowledge on appropriate distribution channels to market agricultural insurance products to farmers in Ghana. In view of the aforesaid, this study sought to assess the risk perception of farmers, financial institutions and insurers with the aim of developing agricultural insurance for cashew farmers to enhance their access to credits for cashew development. In order to achieve these objectives, tools such as semi structured questionnaires, in-depth interviews and focus group discussions were employed for risk perception, agronomic and meteorological survey was done in addition to insurance development and choice experiment survey. Analysis of data was done using both descriptive statistics and inferential statistics such as percentages, pie charts and bar charts for the descriptive analysis while factor analysis mix logit, multinomial logit and latent class were employed in the empirical analysis.

The results which were fascinating are summarised below.

6.1.1 Sources of Perceived Risk and Insurance Preference in the Study Area

Out of the sixty nine risk factors identified from literature and focus group discussions with insurers and financiers of agriculture as well as cashew farmers, the results after data collection from the study having employed descriptive statistics and inferential statistics such as factor analysis and principal component analysis revealed that excess rainfall, high temperature, high wind speed, pest and disease, bush fires, constitute cashew crop farmers residual risk that needed a modern risk mitigating tools such as agricultural insurance to handle it.

Moreover, employing the relative frequency approach dubbed the frequentist approach the probabilities of their residual risk were estimated as : 0.75 for fire, 0.99 for high temperature, 0.93 for excess rainfall and 0.98 for high wind speed, and was used in estimating the technical premium of the modelled hypothetical insurance product for the choice experiment utilized in this study to gauge cashew crop farmers, financial institution, and insurers preference and utilities for the insurance products modelled under five insurance philosophies through stated preference approach.

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6.1.2 Farmers' preference, Awareness and Willingness to pay for Agricultural Insurance

6.1.2.1 Awareness of Agricultural Insurance and Media for Promoting Agric Insurance

From the results, 97.1% of the farmers have heard about insurance before and 81.1% of them knew of health and motor insurance. However, about 93.5% of the respondents are farmers were not aware of agricultural insurance and only 0.3% claimed they had heard about agricultural insurance before; reflecting the fact that agricultural insurance penetration as well as low education would necessitate sensitization as indicated by the results from GAIP stakeholders' suggestion for insurance uptake. However, the most preferred sources of information in the study area were local radio stations (99.7%) and televisions (100%) meaning that promotion of agricultural insurance can be channelled through these sources. In this regard, stakeholders of GAIP can partner marketing communication firms to promote agricultural insurance on television and local radio stations.

6.1.2.2 Preference and Willingness to Pay –Financial institutions Pespective

With regard to willingness to pay from the financial institutions' perspective, both descriptive and inferential statistics were used. The results of the descriptive statistics revealed that about 76% of the sampled institutions were willing to pay for agricultural insurance. However, 40% of them wanted the cost to be passed unto the farmer whereas 40% wanted to buy the product to cover the loan portfolios. 20% of them also wanted cost sharing by the farmer and the institution. With regard to preference for an approach or philosophy pertinent in providing insurance to financiers, 61% of the sampled institutions preferred indemnity approach, followed by functional synthesis approach at 30.8%, while preference for index and simulation were 23.1% each and the least was bench marking.

6.1.3 Model for Agricultural lending with insurance

The results showed that financial institutions were willing to expand their loan portfolio to the cashew sub-sector if they have agricultural insurance products to cover farmers' residual risk. Furthermore, it was realised that value chain financing model was the best way to lend to farmers to make agricultural insurance sustainable to financial institutions, insurers and famers. This requires that farmers be trained to eliminate institutional constraints such as lack of FBOs in MoFA decision making process, and lack of a cashew board as well as financial, market and technical constraints while establishing links between various stakeholders and institutions in the value chain such as GAIP, FBOs, input dealers, agencies and the farmers. Here again, each

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stakeholder would have a different role: MoFA provides training to farmers and also helps develop cropping calendars to help stakeholders of GAIP develop sowing windows and triggers for insurance contracts, G.Met, SRID and satellite agencies would supply data, input dealers supply inputs while financial institutions and credit officers give cash and disburse loans, and subsiding agencies would subsidize the interest rate and administration cost on insurance premium so that FBOs and NGOs will act as guarantors, with insurers insuring the residual risks and key perils along the value chains.

The value chain financing or lending approach would be useful in helping farmers gain access to credits, while insurer will provide cover for farmers and financial institutions residual risk at each stage of the chain.

6.1.4. Willingness to pay from Farmers' Perspective

Descriptive results in Table 5.8 shows that 90% of farmers were willing to pay for agricultural insurance, while 10% were not willing to pay. Also, the empirical results using mixed logit approach showed that cashew farmers were willing to pay for insurance based on the various insurance philosophies. Firstly, functional synthesis approach had the highest willingness to pay estimate of ***GH¢102.38***, followed by simulation approach with a premium of ***GH¢93.94***, followed by indemnity approach with a premium of ***GH¢76.34,*** followed by Index and benchmarking approaches with a premium of ***GH¢71.34 and GH¢ 67.70*** per year,per acre respectively. Apart from farmers' willingness to pay, the empirical results from the latent class model also revealed **four (4) latent classes** among farmers which would undoubtedly form the bases of market segmentation. About 22.2% of the respondents which constitutes **class one (1)** of the farmers had preference for functional synthesis approach, followed by benchmarking approach, whereas **class 2** is constituted of 26.70% of the farmers. They had preference for functional synthesis followed by Index and preferred annual payment. **Class 3** constitutes by 32.50 % of the respondents and they had preference for functional synthesis approach, followed by simulation, index and indemnity approaches respectively and prefer quarterly payment with cash. **Class 4 constitutes** 18.70% of the sample, and prefers functional synthesis approach revealed by it highest utility estimate followed by simulation, indemnity and index respectively and does not prefer annual payment with cash. Apart from the philosophies, the results for the product options were as follows: under the index approach 5% of the farmers were interested in option A which is weather index with a premium of ***GH¢100.46,*** while 50% were interested in option C which is area yield index product with a premium of ***GH¢64.03.*** For indemnity, 62% were interested in option A which is named peril damage-based indemnity product for fire with a premium of ***GH¢53.46.*** For simulation, 30% of the farmers had interest in option A,

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which is simulated weather multiperil product for fire, high temperature, excess rainfall and high wind speed with a premium of ***GH¢116.97.*** However, 100% of the farmers had preference for benchmarking products with only 57% having preference for option A, which is named peril and yield base multiperil benchmarked products with a premium of ***GH¢119.46,*** while 34% prefer option C of functional synthesis product, which is Weather synthesized simulated product for fire, high temperature, excess rain, and high wind speed.

Regarding the factors that influence the cashew crop farmers' willingness to pay for agricultural insurance approaches, the results from the mix logit and multinomial logit models suggest that years of schooling, type of labour, year of farming, household size, farm size, gender, tenure and level of trust in insurance companies in the study area influenced the farmers willingness to pay for agricultural insurance.

6.1.5 Willingness to Design Insurance Products by Insurance Pool Stakeholders' (TMU, SC, TCAI of GAIP)

The results from the study indicated that insurers had preference for designing index, indemnity and simulation products, as 50% of the stakeholders of Ghana agricultural insurance pool were willing to design product Area Yield Index products at GH¢64.03, while 33% had preference for Simulation and Indemnity approaches. Also, 17% of Ghana Agricultural Insurance Pool stakeholders had preference for designing benchmarking and functional synthesis approaches. With the product options in the choice experiment survey, they were willing to design the afore-mentioned products. However, they had low preference for option A, named peril damage based indemnity for fire, which had been chosen by the farmers and financial institutions since they contended that they do not want to design fire product(s) as stand alone policy. Moreover, 33% had preference for designing option D of simulation product which is Indemnity and Benchmarking Simulated Products for fire, high temperature, excess rainfall and high wind speed with a premium of ***GH¢107.29*** while 17% had preference for designing option A of the bench marked product which is named peril and yield base benchmark product at a premium of ***GH¢119.46.*** About 17% were also willing to design option A of functional synthesis products, which is weather synthesized simulated multiperil insurance for damage and yield based product at a premium of ***GH¢116.97.***

6.1.5.1. Dominant philosophy

From the results, the dominant philosophy approach preferred by farmers, financial institutions and pool members are: **indemnity**, followed by **functional synthesis** and **Index**, followed by

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simulation, with **benchmarking** being the least preferred among all, though highly preferred by farmers.

6.1.5.2 Utility for Product Options

The product options **Option C** of **index approach** which is **Area Yield index** had highest utility among **farmers, financial institutions and** insurance pool stakeholders **(insurers) at a premium of *GH¢,64.03,*** while option A which is weather index at a premium of ***GH¢100.46*** was preferred among farmers and financiers. For **indemnity** product options, **option A, named peril damaged-based product for fire** had the highest utility among financiers and farmers at a premium of ***GH¢53.40*** but insurers were not willing to accept it since they do not want to design stand-alone policy for fire. With regard to **Simulation** products, both **farmers and financial institutions** preferred **option A** which is **simulated weather multiperil product** at a premium of ***GH¢116.97,*** while **Insurance pool Stakeholders** preferred to design **option D** which is indemnity and Bechmarking Simulated Product fire, high temperature, excess rainfall and high windspeed at a premium of ***GH¢107.29.*** About 67% had no utility for **benchmarking** products. However, financial institutions, farmers and agricultural insurance pool stakeholders jointly preferred **option A** which is **yield base multiperil benchmark products** at a premium of ***GH¢119.46.*** For **functional synthesis approach,**both **financial institutions** and **pool members** had preference and utility for **option A** which is **weather synthesized simulated multiperil damage and yield based insurance product** at a premium of ***GH¢116.97.*** Pool Stakeholder members were willing to design products for financial institutions under blanket cover and were willing to distribute the product to farmers, individuals and groups depending on their farm sizes so that individuals with farm sizes above 20 hectares whiles individuals with farm sizes below 20 hectares would have to buy it in groups.

6.2. Farmers Perception of Agricultural Insurance

The results from the study area indicated that 88% of the respondents from the cashew subsector believed that insurance was not necessary if they could manage their own risk, and there was no need for compensation if the event does not occur. On the other hand, they were of the view that if you buy insurance, it was like inviting the problem and that insurance was not for the rich only. As a result, the overall perception about insurance was positive perception index of 0.24. However, Benefit perception Index was negative with a mean score of -0.15 which meant that insurers should embark on reputation risk management.

6.3 Distribution Channels for Marketing Agricultural Insurance

From the insurers' perspective, banks were termed by GAIP's Board as the Meso level Approach as the best marketing channel as well as targeting the individual farmer. However,

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86.0% of the farmers in the study area wanted to buy directly from insurers, while 86.4% did not prefer to buy from brokers i.e. 13.6% were willing to buy from brokers. Consequently, most farmers preferred buying directly while 36.8% wanted to buy from rural banks, MFIs and Commercial banks; while 20% preferred to buy from the pool marketing champions with 8% and 11% buying from extension officers and MOFA respectively; a trend which shows their low confidence with regard to the usage of MOFA as marketing channel.

6.4. Models for Supplying Agricultural Insurance

The most preferred model for supplying agricultural insurance from the farmers' perspective in the study area is the agency model. They did not want to buy from brokers with a mean score of 4.58, while the second most preferred model was the full service model; no wonder,

86.7% of the farmers wanted to buy directly from insurance companies with a mean score of 4.10, followed by partner-agent model, with a mean score of 3.87. This was followed by the bank assurance model with a mean score of 3.69.Community-based model were with the mean of 2.74, while brand assurance and composite models were least preferred with a mean score of 2.22 and 2.21 respectively.

6.5. Appropriate Frame Work for Designing, Underwriting and Implementing Agricultural Insurance Schemes

6.5.1. Philosophy

From the results, the dominant philosophy approach that should be used in providing insurance to the cashew subsector should be **Index, indemnity**, and **functional synthesis approaches.** However for product options, **Option C** of **index approach** which is **area yield index** and option **A** which is **weather index products** at premiums of ***GH¢64.03 and GH¢100.46*** respectively had highest preference and utilities among farmers, financial institutions and should be considered for product development by pool stakeholders. For **indemnity, option A** which is **named peril damaged-based product for fire,** at a premium of ***GH¢53.40*** had highest preference among farmers and financial institutions**,** but should be bundled with some allied perils such as excess rainfall, and high wind speed since pool stakeholders are not willing to design indemnity product for fire as stand-alone policy. For **functional synthesis approach, option A** which is **weather synthesized simulated multiperil damage and yield base insurance product** at a premium of ***GH¢116.97*** reflected farmers stated preference during the choice experiment and should be given attention by agricultural Insurance Pool stakeholders**.** **Option C** which is **area yield synthesized simulated multiperil damage and yield base product** at a premium of***GH¢80.***57 has the highest preference among farmers and their

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financiers and must also be considered for development by pool stakeholders**.** If **simulation products** would be designed, then **option A** which is Simulated Weather Multiperil Product for fire, high temperature and excess rainfall and high wind speed at a premium of ¢55.14 should be designed. For Benchmarking products, Option A which is Named peril damage based and yield based Multiperil benchmark product for fire, High temperature, Excess rainfall, and High wind speed at a premium of ¢119.46 has the highest preference among farmers and should be considered for development. For market segmentation purposes, attention should be paid to the 4 latent classes within the farmer groups. Moreover, value chain financing approach should be used, distribution of the product through financial institutions and the product should be sold to individuals with farm sizes 20 hectares whiles individuals with farm sizes below 20 hectares and the rest in groups of between 10-20.

6.5.2 Underwriting

To be able to distinguish good farmers from bad ones, the following information should be requested: the number of years they have been involved with the production of that crop, the yield per acre, the crop variety they grow as well as the soil conditions, and farmers' cropping system so that preference would be given to farmers who intercrop with maize. Other factors to be considered are the clients' risk mitigation and loss reduction which should be made conditions precedent to liability and suitability for crops in an ecological zone. Historical data on rainfall, wind speed and temperature should be obtained from G.met, SRID, and Satellite stations for de-trending in order to observe historical pay-outs with a 5 – 10% correction factor for error in data from government departments.

Also, maps of farms and GPS coordinates for farm should be taken in indemnity contracts and satellite data or data from SRID and cropping calendar used for index contracts. For yieldbased insurance schemes, attention should be paid to soil analysis and planting distance.

Weather index pay-out must be staggered as follows: 40% at germination stage since farmers can replant, 100% at growth stage since farmers have invested their money and 70% at flowering and fruiting stages. Sum assured or insured at the request of the client may be calculated on input cost, production cost or market value of their produce or farms while the sum assured and the premium should be generated following an emergence report produced by a specialist such as an agronomist, and the long term average yield and mid-season report should be produced to determine crop growth. Also, potential claim that may arise as well as practices that may void the policy must be determined before imposing conditions and warranties. Finally, the insurance should be provided in phases for immature plants, i.e. from

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planting to the fourth year when it starts fruiting. The triggers should be set for high wind speed at the flowering, and fruiting stages of the plants life cycle, while excess rainfall should be at the flowering, and fruiting phases. It is recommended that index programmes be at the early stage of the plant that is for the first 10 years.

6.5.3 Conditions, Warranties Franchise, and Deductibles

Conditions should include the creation of fire belts, intercropping with maize only, canals in flood-prone areas, separation of plants with different ages into blocks, presence of qualified labour, farmer training, registration of farmers and data management, farmers should have at least five years' experience and those with less than 20 hectares should belong to a group. Also, the Modified Taungya System (MTS) approach, where cashew is intercropped with other food crops, should be encouraged only for the first five years. Abolishing the slash and burn system must be a warranty, as it was one of the causes of bush fires in addition to hunters' activities in the study area and must be replaced with slash and char to reduce the fuel loads on their farms. Intercropping with crops that may serve as a vector for pest and disease to cashew crop should be abolished and warranties should be imposed on such crops under insurance contract. The deductibles should depend on an average loss over the years and be subject to premium payment warranty so that those who do not pay on time do not get certificates. For franchise, farmers should cover losses less than 10%.

6.6. Key Constraints to Agricultural Insurance and Cashew Development

The results of this study made it explicit that key constraints to the development of agricultural insurance for cashew crop farmers in the study area include lack of data, lack of agricultural insurance legislation, lack of knowledge on product development lack of personnel with knowledge in agricultural insurance as well as lack of knowledge on marketing channels among others. These constraints can be grouped under financial, marketing, technical, institutional, data, human resource or labour and legal constraints. To overcome these constraints, apart from education and sensitization of farmers on the benefits of agricultural insurance, the results also indicated that collaboration with financial institutions and other aggregators in addition to government intervention is key. The results also revealed the need to embark on research for agricultural insurance product development. In this regard, agricultural insurance should be inculcated into tertiary institutions insurance curriculum and these key constraints must be addressed using the public-private partnership approach. To overcome the constraints in cashew development which were identified as institutional, financial and marketing constraints, the value chain financing or lending model that involves collaborations of stakeholders from government institutions, Rural and Community Banks, other financial institutions, Satellite agencies, GAIP,

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Input dealers, NGOs, FBOs, MoFA extension officers, insurers, financial institutions and research institutions would be most appropriate.

6.7 Government Support for Agricultural Insurance

In order to overcome the key constraints to agricultural insurance with a spill over effect on cashew development, government support is imperative.
From the results of the study, many of the respondents want governent to be involved in the formulation of policies on agricultural insurance such as in the development of agricultural insurance laws to enforce agricultural insurance contracts, with the provision of policy guidelines and on administration cost subsidies and acting as a stop loss reinsurer when the need arises.

6.8. Conclusions

The results of the study showed that farmers operated an average farm size of 6 acres with an average age of plantation as 15 years, meaning the sector can be expanded, and cashew farmers can enter into agricultural insurance contract based on index, indeminity and functional synthesis approaches.The mean age in the community is 49 years and it means the community is poised for insurance since that age is suitable for insurance contracts though it also demands an exit strategy for older farmers. Also, the prevalence of Christians in the study area would mean that Takaful agricultural insurance would only be needed when the Muslim community grows. Moreover, since most farmers in the study area had preference for insurance, it means they are risk-averse but females are known to be more risk-averse and so more should be encouraged to engage in cashew processing through gender response programmes. Furthermore, for cashew development, farmers must be registered and FBOs and CBOs must be formed in the study area since majority of the farmers do not belong to a group. Also, full services, agency partner-agent model, and bank assurance model were perceived as appropriated models that should be used in supplying agricultural insurance in the study area. Again, programs aimed at registering farmers for formation of groups and FBOs in order to access credits, insurance and training would be rewarding. Moreover, programmes aimed at curbing fire outbreaks from slash and burn, and hunters' activities in the area must be encouraged in the study area. Finally, collaboration with MOFA and other agencies to develop strong extension services, and farmer education on agric insurance schemes would have a positive externality effect on cashew development in order to mitigate the effect of climate change by 2030 and beyond.

6.9. Recommendation for Policy Implications

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This section presents recommendations for policy directions towards sustainable agricultural insurance schemes for cashew crop farmers in the study area. They are grouped under the following sub-headings: Regulatory policies, Product development Policies, Reinsurance policies, Marketing policies, Financing Policies, Claims and Loss adjustment Policies, Soft Policies and Knowledge Policies

6.9.1 Regulatory Policies

Policies on agricultural insurance contracts, insurance claims, agricultural insurance laws, treatment of basis risk, laws on forestry governance to regulate smokers and hunters' activities, and also management of fuel loads through slash and chars should be reinforced. Other policies related to the registration of all farmers in the area to provide training, the creation of a cashew development fund to subsidize bank interest rate and a gender response policy to attract women and young people into cashew farming are recommended. Also, MoFA should oversee the formation of cashew boards which should ensure that Brizillian variety of Cahew should be cultivated to meet the ISO standards. They must also oversee the formation of FBOs while government forms a cashew development council to oversee and regulate the activities of buyers through pricing policies and to promote cashew like cocoa is being promoted. Agricultural insurance should be given government support and should be inculcated into Ghana's agricultural development policy and Pool stakeholders should collaborate with the National Insurance Commission to provide agricultural insurance education to farmers in the study area since awareness of agricultural insurance in the study area is low. The MTS model in the forestry system should be encouraged where cashew crop farmers intercrop with maize at the initial stages instead of other food crops since GAIP has insurance for maize and will be able to insure both maize and cashew till insurance is developed for other products cultivated in the study area.

6.9.2 Product Development Policies

Insurers should look at index, indemnity and functional synthesis approaches as philosophies for providing insurance to the cashew sub-sector, and should use these product options as guidelines for product development. **Option C** of **index approach** which is **Area Yield index** and Option **A** which is **weather index products** should be designed. For **indemnity, option A** which is **named peril damaged based product for fire must be bundled with allied perils** such as excess rainfall, high temperature and high wind speed. For F**unctional synthesis approach, option A** which is **weather synthesized simulated multiperil damage and yield base insurance product should be developed. Option A** which is Simulated Weather Multiperil Product for fire, high temperature and excess rainfall and high wind speed should be designed. Also C which is Simulated Area Yield index Multiperil product for fire, high temperature and excess rainfall and high wind speed should also be designed since it has preference insurers, farmers and financial institutions. For market segmentation purposes, attention should be paid to the **4 latent classes** within the farmer groups and their WTP amount various insurance philosophies and their key perils. Value chain financing approach should be used for distribution of the insurance products through financial institutions. The product should be sold to individuals with farm sizes of 20 hectares whiles individuals with farm sizes below 20 hectares and the rest in groups of 10-20. This would require MOU with G.Met and SRID of MOFA, NOAA and TAMSAT satellite stations, who supply data for index insurance contracts.

6.9.3 Reinsurance policies

Collaboration of local and international reinsurers for risk sharing, learning and fronting purposes should be formed, but the pool must be formed with reinsurers that are not exploitative to avoid opportunism in alliancing.

6.9.4 Marketing Policies

Insurers themselves, rural banks, microfinance institutions, commission agents, commercial banks, and pool marketing champions in full service, agency, and bancassurance and partneragent models should be used as distribution channels and supply models. Formation of FBOs should be encouraged and insurers must extend their networks to the study area by forming alliances with community banks, microfinance institutions, rural banks and other financial institutions with good reputation to distribute the product. Also, marketing champions should be trained to sell the product and a commission payment methodology should be agreed upon for agents and stakeholders in the pool. For sensitisation purposes, local radio stations and televisions should be used to promote agricultural insurance scheme to farmers in the study area by relating agricultural insurance products to health and motor insurance. The results from the benefit perception index of agricultural insurance was -0.15 reflecting the fact that insurers in general must embark on reputation risk management, which is an intangible asset that drives sales and marketing. Promotional activities must also aim at changing the negative perception on insurance

6.9.5 Financing Policies

A value chain lending and financing model should be developed and collaboration between insurers, financial institutions and stakeholders in GAIP should be able to create linkages with input dealers, G.Met, SRID, Satellite Agencies, FBOs, Processors, both domestic and international markets, subsidizing agencies, MoFA, Warehouse, and Storage Operators and

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farmers. Financial institutions should finance farmers by giving them input from the input dealers with some amount of cash, and the subsiding agency would subsidize the interest rate and administration cost on insurance premium; whereas G.met, SRID and Satellite Agency would supply data, and MoFA would help train farmers and help all intuitions to come out with a cropping calendar to help credit officers and input dealers to disburse loans, while FBOs and NGOs act as guarantors and insurers to insure the residual risk along the chains. Again, MOFA should register all farmers in the region to know their exact number and divide them into groups and where government want to subsidize the premium farmers should be encouraged to pay retroactive premium to instil in them the habit of paying insurance premium before exiting.

6.9.6 Claims and Loss Adjustment Policies

Claims should be reported within 24 hours and loss adjustment should be done by professionals, research institutions and universities. Witnesses should be used when the risk is systematic.

6.9.7 Soft Policies

National insurance commissions should collaborate with stakeholders of Ghana Agricultural Insurance Pool (GAIP) to enact laws aimed at managing the reputation of the industry and also changing the perceived negative benefit perception about insurance among stakeholders in the cashew sector**.**

6.9.8 Knowledge Policies

From the result, farmers had a negative perception of the benefits of insurance; hence, the national insurance commission and other insurers as well as pool members should collaborate with MoFA to educate them on the benefits of insurance as well as the benefits of enrolling in an agricultural insurance scheme. Loan and agricultural insurance scheme in a value chain lending should go with education on cashew development and training on farm management techniques such as slash and chars systems, production and marketing of bio char, MTS, preparation of enterprise budget and records keeping. Soil management, ISM – Integrate-soil management, planting time and agronomic practices should be inculcated into conditions precedent to insurance contracts to avoid basis risk.

6.10 Theoretical Implications and Contribution to Knowledge

This study contributes to the global intellectual discourse on agricultural insurance and for cashew in particular. Furthermore, it has filled a knowledge gap by using the interdisciplinary approach of developing insurance recommended by Awonyo-Vitor, as little or no empirical study has used this approach as a conceptual framework to conduct a study among cashew crop farmers with an aim of developing agricultural insurance strategy for them. Also there is no

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documentation on functional synthesis approach as a philosophy for any agricultural insurance study; it is a novelty that emerged from this work. Happily functional synthesis as a an approach or philosophy for providing agricultural insurance, based on the empirical results from mix logit and latent class models, show that that approach has the highest mean willingness to pay and utitility among cashew crop farmers in the study area. Moreover, the study ironed out a controversy on the need for cashew insurance between Stutley (2010) who posited the lack of demand for cashew insurance and Osei-Tutu (2012) who was of the opposing view. Furthermore, this study based on system approach provides technical guidance on product development, distribution channels and models for supplying agricultural insurance and offers insurance practitioners a framework for developing and underwriting insurance products for farmers in the cashew subsector in Ghana, since Stutley (2010) made it explicit that there is lack of knowledge and skills on product development, distribution channels for marketing insurance. Additionally, this study serves as a blue print or guidelines for GAIP and just as Hazell *et al.* (2010) also brought to the fore that research is required to build capacity for insurers and also develop delivery channels.

6.11 Contribution to Practice

Practically, this study offers a framework for product development and marketing. It also gives evidence based insights to stakeholders of GAIP and NIC to design products for cashew subsector in study area. It also offered a framework or a model which is a collaborative PPP value chain financing model involving financial institutions and insurers to enhance cashew farmers' access to credits to foster cashew development.

6.12 Limitations and Suggestions for Future Research

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This study was done in two parts in two separate years, risk perception and agronomic and meteorological survey 2013 followed by insurance development and choice experiment survey in 2014. Though the study was done in the same study area, it was not possible that the same respondents participated in the study in the two years; however, efforts was made to include majority of the respondents in 2013 in the 2014 survey. Also this study looked at the BrongAhafo region only and has given insight on agricultural insurance development strategy for cashew crop farmers in the study area. In this regard, research institutions in Ghana and the

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world over should also replicate this study in order to provide conclusive evidence based risk mitigation strategies in the cashew subsector in order to boost cashew production, processing and marketing so as to reverse the downward trends anticipated downward trends of Government revenue in the Cocoa subsector in 2030 and beyond due to climate change.

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APPENDIX 1

QUESTIONAIRES FOR IDENTIFYING RISK, AGRONOMIC AND METEOROLOGICAL SURVEY FOR IDENTIFYING INSURANCE PREFERENCE AND MODELLING HYPOTHETICAL INSURANCE PRODUCTS WITH THEIR PREMIUM, ESTIMATES

<u>KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY-FACULTY OF AGRICULTURE</u>

<u>DEPARTMENT OF AGRICULTURAL ECONOMICS AND AGRI BUSINESS AND EXTENTION</u>

<u>QUESTIONNAIRE FOR FARMERS-RISK ,AGRONOMIC AND METEOLOGICAL SURVEY</u>

This questionnaire is aimed at collecting data about the “Agricultural Insurance Development Strategy for Cashew Crop Farmers in the Brong Ahafo Region of Ghana” The information collected would be used for academic purpose only.

:

You are humbly invited to complete this questionnaire as fully as possible, please kindly answer the questions below:

Your response will be part of my data analysis for a PhD thesis report - so no individual responses will be identifiable within any reports produced.
When the study has completed a copy of the report can be made available to you.

If you should have questions regarding our study, please do not hesitate to contact the Lead Supervisor:

Prof.S.C.Fialor

Department of Agricultural Economics and Agri Business

KNUST, Kumasi-Ghana

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A. IDENTIFIYING THE DOMINANT RISK FACTORS IN THE

Name…………………….. Age……………………………………..
Region…………………….. District………………………………….
Community………………………… Variety………………………..

SECTION A PERSONAL AND HOUSEHOULD CHARACTERISTICS

Gender: Male: [ ] Female: [ ]
Region: Christian [ ] Muslim [ ] Africa Traditional [ ]
Other Specify: ....
What is your Marital Status: Single: [ ] Married: [ ] Other Sepcify…………..
Level of education

a. No Formal Education
b. Primary
c. JSS/MSLC
d. SHS
e. Tertiary Education
f. Other Specify.

Have you received any kind of Agricultural training? Yes [ ] No [ ] If Yes, from whom?

a. MOFA
b. NGO
c. Input Supporters
d. Outgromers Organisation
e. Farmer Associations.
f. Other specify…………………………………………

SECTION B: HOUSEHOLD CHARACTERISTICS

Are you the Head of your Household? Yes [ ] No [ ]
. How many are you in your household? .... What is your main occupation?

A. Cashew Crop Producer
B. Cocoa farmer
C. Salary Worker
D. Trading
E. Craftsmanship
F. Labourer
G. Other Specify…………………………..

:
How long have you been farming? ……………………………………………….
Are you part of any farmer association? Yes [ ] No [ ]
If yes, what is the name of the Association? ....
What is your role? .... Do you take a loan/ credit for farming cashew? ....
If Yes from which source(s)

A. Friends
B. Relatives
C. Bankers
D. Microfinance
E. Farm based organizations
F. Community Banks
G. Credit Union

SECTION C: FARM LEVEL CHARACTERISTICS

What is your farm size……………………………………acres……………
. What is the age of your cashew plant……………………………………….
What is the distance from your farm to your home? ....
Do you know a weather station? ....
What is the distance of your farm to a weather station?....................mm/km.
Are there any mountains between the nearest weather station and your farm? Yes [ ] No [ ]
Are there any forecast between the nearest weather station and your farm? Yes [ ] No [ ]
Which villages have similar rainfall to your village? What is the distance from your place to an insurance company………………… How did you acquire your farm land?

A. Family B. Purchased C. Leased D. Rented E. Inherited F. Gift tenure Others Specify…………………...……… Which of the following do you practice?

A. MonocultureB.Mix croppingC. Others Specify………………………………
Where do you get Inputs for your cashew?

A. Purchased
B. Own Farm
C. Relatives
D. Friends
E. Others Specify…………………………………..

Do you know the yield potential of your variety? Yes [ ] No [ ]
What was your expected yield………………………..in bags
What is your potential yield…………………………..in bags
What is your actual yield……………………………..in bags
Which form (s) of labour do you use for farming?

A. Family labour
B. Hired
C. Both
D. Noboa E. Other Specify…………………………..

Are they the same labour used for other farms? Yes [ ] No [ ]
Are they available during the critical periods of the crop production cycle? Yes [ ] No [ ]
If Yes, what was your expected revenue per bag………………………
What is your potential revenue per bag……………………
What is your actual revenue per bag……………………….
Approximately how much cashew land sizes do you cultivate each year? ....

:
Give reasons if cultivated land size is less than the total farm size. Give reasons……………………………………………………………………………………….
....

How would you classify your soil?

A. Sandy
B. Loamy
C. Clayey
D. Other Specify…………………………………….

How would you rate your soils water holding capacity?

A. Dries quickly after rainfallB. Dries gradually after rainfall C. Remain water logged for long periods after rainfall

:

How do you control weeds?

A. Manually
B. Intercropping
C. Chemically

How do you control pest?

A. Introduction of organism (Biological)
B. Pesticide (Chemicals)…………………………..
C. Other Specify……………………………………..

CASHEW CROP SECTOR RISK FACTOR IDENTIFICATION

1. Could you please indicate which of these risks factors have affected your income in the past five years?

Risk Factors	Extremely Unlikely < 1%	Very Unlikely 1- 10%	Unlikely 10-33%	Medium unlikely 33-66%	Likely 66-90%	Very Likely 90-99%	Virtually certain	Affect Me	Affect Us	Can be Managed	Need Insurance
Environmental and Natural risk factors	Code 1	2	3	4	5	6	7				
1. Hamattan 2. Lighting 3. Excess rainfall 4. Excess moisture 5. Soil type 6. High temperature 7. Windstorms 8. Flooding 9. Evapo-transpiration 10. Earth quake 11. Climate change 12. High wind speed 13. Soil population											
Biological risk factors	1	2	3	4	5	6	7				
1.Black pinacle syndrome(BPS) 2.Power Mildew Disease (PMD) 3.Helopelticle attack (cashew mosquito) 4. Pest and Disease											

:

Political/risk factors							
1.Ivorian crises 2.Policy dynamics 3.Closure of Boarder towns.							
Social risk factors	1	2	3	4	5	6	7

:

1.Civil commotion 2. Grazing, 3. Bushfire/fire 4.theft, 5.vandalism, 6.stray-animals 7.Maliciousdamage, 8.Arson, 9.Hunting 10.land litigation 11. Land tenure system							
Labour risk factors	1	2	3	4	5	6	7
1.Lack of labour at critical times 2.Inadequate labour supply at all times							
Institutional risk factors	1	2	3	4	5	6	7

:

1.Lack of cashew marketing board 2.Lack of regulation of the activities of buyers							
Transportation risk factors	1	2	3	4	5	6	7
1.Lack of transport to the selling points 2.Inadequate system to the selling point							

Marketing risk factors	1	2	3	4	5	6	7				
1.Lack of common pricing policy 2.Price at sales 3.Lack of market for produce 4.Low price as a result of excess products on the market											
Financial risk factors	1	2	3	4	5	6	7				
1.Lack of credit facilities 2.High cost of credit facilities 3.Difficulty in accessing loans from financial institutions 4.Inability to pay wages for labour 5.Rising cost of labour and inputs											

:

Personal risk factors	1	2	3	4	5	6	7				

:

1.Lack of knowledge 2.Health problems 3.Poor attitude towards work 4.Adoption of New technology 5.Ageing 6.Disability 7.Death											
Production risk factors	1	2	3	4	5	6	7				

:

1..Low yields 2.Late planting 3..Late pest control 4.Seed quality 5.Unreliable rainfall Poor farming techniques 6.Excess rainfall 7.Dry spells 8.Improper spacing 9.Pest damage 10.Crop damage 11.Poor harvesting 12.Poor packages 13.Poor drying 14..Lack of fertilized at critical forms											
Economic risk factors											
1.High cost of fertilizer 2.High cost of pesticide 3.High cost of labour 4. High cost of planting materials.											

B MEASURING FARMER'S RISK ATTITUDE

On a scale of 1, 3 and 5 where 1 means strongly disagree and 5 means strongly agree, to what extent you agree with the following statements.

	1= Strongly disagree	2=Not sure	3=Strongly agree
I like experimenting with new ways of doing things			
I take more chances than others			
I am willing to take higher financial risk than others			
I have to take higher risk in order to be successful in business			
Am willing to try new technology and production methods even before others try them			

:

In selling my cashew, I prefer higher credit sales than lower cash sales			
I usually don't like "playing it safe"			

C.RISK MANAGEMENT STRATEGIES

Could you please indicate to which extent you apply risk management strategies?

Farming Strategies	**NA**	**Very little**	**Sometimes**	**Very Much**	
1. Pest Control using Chemical	1	2	3	4	5
2 .Pest Control using Biological Methods	1	2	3	4	5
3. Growing other crops besides cashew	1	2	3	4	5
4. Farm fragmentation	1	2	3	4	5
5. Producing at the lowest possible Cost	1	2	3	4	5
6. Working together with other farmers	1	2	3	4	5
7. Other--------------------------------	1	2	3	4	5

Financial Strategies

8. Personal Insurance 1 2 3 4
5
9. Holding Stock 1 2 3 4
5
10. Property Insurance 1 2 3 4
5
11. Contract farming 1 2 3 4
5
12. Holding Stocks 1 2 3 4
5
Other------------------------------ 1 2 3 4 5

Croping Systems

1. What is your cropping system in your cashew enterprise?
   a. Mono Culture B. Mix cropping 2.What
type of crops to you intercrop with?
a. Maize b. Groundnut/Maize c. Maize and Cassava c.Maize and Yam D. Tomatoes and Maize

Tenure

1. Sources of Acquisition of Land for Cashew Production
   a. Family b. Purchased c. Inherited d. Gift tenure

Sources of Labour

a. Family b. Hired c. Family and Hired d. Other specify…………………

:

D.CASHEW FARMERS CROP PRODUCTION BUDGET PER ACRE

3. Please give us the actual cost for each section and periods if applicable over the past five years.

Item	Unit Cost Per Acre	Timing if Applicable e.g (May-June)	Total Cost
a. Land clearing/wedding			
b. Pruning			
c. Fertilizer Application			
d. Pesticide Application			
e. Weed control			
f. Labour cost			
g. Harvesting			
h. Drying			
i. Sorting and bagging			
TOTAL			

E.CASHEW CROP FARMERSANNUAL PRODUCTION HISTORY

4. Given your farming expenses, how many bags did you harvest each year for the past five years.

Year	Cashew variety	Best Harvest	Worst Harvest	Size of Harvested plot	Price per kilo
1.					
2.					
3.					
4.					
5.					
Total					

2. What accounted for the differences for the best and worst harvest? ....
3. How Much Total Farm Land Do You Have?

   Hectares…………………………………………………………………………........................

   Acres……………………………………………………………………………........................

:

4. How much of the total farm land to you use for cashew cultivation…………..........……...

F. AGRONOMIC PRACTICES

5. Please answer the questions below

Questions	Day	Month	Year
When do you start your land preparation			
When do you create a fire belt			
When do you do your grafting			
Which plants do you intercrop			
What is the transplanting period			
When do you intercrop at the growth the growth stage			
How long does it take for a transplanted plant to get acclimatised			
When do you do your first weed control			
When do you do your second weed control			
When do you do your first pest control			
Second pest control			
When do you do your first pruning			
When do you do your second pruning			
When do you do Harvesting			
When do you do drying			

How many rainfall events do you expect before Nursing /planting transplanting?

How long does it take for a transplanted plant to get acclimatised ----------------------

G. ESTABLISHING THE DURATION, TRIGGERS AND INDEMINITY OF EACH PHASE IN THE CASHEW CROP LIFE CYCLE

6. Please complete the section below

No	Questions	Growth Phases						
		Nursing	Germination Vegetative	Grafting	Transplanting	Flowering	Fruity	Harvest

:

1	How long is each phase in days/weeks/moment							
2	How much money do you invest in each phase per acre							
3	How many consecutive dry days can be tolerated by each phase?							
4	How many consecutive raining days can be tolerated by each phase							
5	What stage(s) can be affected by wind speed							
6	What stage(s) can be affected by excess rainfall							
7	What phases can be affected by disease							
8	What phase can be affected by high temperature							

H. ESTABLISHING THE PARAMETERS FOR INDEX CONTRACTS

5. By your estimation which of these stages is affected by these parameters

Stage	Moisture	Excess Rainfall	Drought	Wind Speed	High temperature	Pest and disease
Germination						
Seedling						
Grafting						
Vegetation						
Flowering						
Fruiting						
Harvesting						

I. METEOLOGICAL SECTION

1 .Do you know what and where a weather station is? 1. Yes 2. No

2 Are there Mountains between your farm and the weather station known to you?
1. Yes 2. No

3 Are there forest between the known weather station and your farm?
1. Yes 2. No

Thank you for your time!

:

Appendix II

QUESTIONAIRES FOR ESTABLISHING STATED PREFERENCE FOR HAPOTHETICAL AGRICULTUAL INSURANCE PRODUCTS, WILLINGESS TO PAY AND FACTORS THAT INFLUENCE THE WILLINGNESS TO PAY

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY-FACULTY OF AGRICULTURE.DEPARTMENT OF AGRICULTURAL ECONOMICS AND AGRI BUSINESS AND EXTENTION

QUESTIONNAIRE FOR FARMERS _THE WILLINESS TO PAY(WTP) SURVEY

This questionnaire is aimed at collecting data about the “Agricultural Insurance Development Strategy for Cashew Crop Farmers in the BrongAhafo Region of Ghana” The information collected would be used for academic purpose only.

You are humbly invited to complete this questionnaire as fully as possible, please kindly answer the questions below:

Your response will be part of my data analysis for a PhD thesis report - so no individual responses will be identifiable within any reports produced.

When the study has completed a copy of the report can be made available to you.

If you should have questions regarding our study, please do not hesitate to contact the Lead Supervisor:

Prof.S.C.Fialor

Department of Agricultural Economics and Agri Business

KNUST, Kumasi-Ghana

Tel: 0208168438

QUESTIONNAIRE FOR CASHEW CROP FARMERS
GENERAL INFORMATION

Name of Interviewer: …………….......... Date if interview: …………………………..

Date: ……………………………….... Questionnaire No: …………………………..

Enumerator: ……………………… Region: ………………………………………

:

Town/Village/Community: ……………………………

SECTION A PERSONAL AND HOUSEHOULD CHARACTERISTICS

6. Name of farmer: ……………………………………….
7. Age: …………………..
8. Gender: Male: [ ] Female: [ ]
9. Region: Christian [ ] Muslim [ ] Africa Traditional [ ]
   Other Specify: ....
5. What is your Marital Status: Single: [ ] Married: [ ] Other Sepcify…………..
6. Level of education
   g. No Formal Education
   h. Primary
   i. JSS/MSLC
   j. SHS
   k. Tertiary Education
   l. Other Specify.
7. Have you received any kind of Agricultural training? Yes [ ] No [ ] 8. If Yes, from whom?
   g. MOFA
   h. NGO
   i. Input Supporters
   j. Outgromers Organisation
   k. Farmer Associations.
   l. Other specify…………………………………………

SECTION B: HOUSEHOLD CHARACTERISTICS

9. Are you the Head of your Household? Yes [ ] No [ ]
10. How many are you in your household? ....
11. What is your main occupation?
   H. Cashew Crop Producer
   I. Cocoa farmer
   J. Salary Worker
   K. Trading
   L. Craftsmanship
   M. Labourer
   N. Other Specify…………………………..
12. How long have you been farming? ……………………………………………….
13. Are you part of any farmer association? Yes [ ] No [ ]
14. If yes, what is the name of the Association? ....
15. What is your role? ....
16. Do you take a loan/ credit for farming cashew? ....
17. If Yes from which source(s)
   H. Friends
   I. Relatives
   J. Bankers
   K. Microfinance
   L. Farm based organizations
   M. Community Banks
   N. Credit Union
18. How are the loan granted?
   A. Inputs
   B. Cash
   C. Both
   D. Other Specify……………………………
19. What are some of your challenges in taking a loan, credit from a bank?
   A. Interest rate

:

B. Process of appraisal

C. Time of disbursement

D. Time of supply of the input

SECTION C: FARM LEVEL CHARACTERISTICS

20. What is your farm size……………………………………acres……………

21. What is the age of your cashew plant……………………………………….

22. What is the distance from your farm to your home? ....

24. Do you know a weather station? ....

25. What is the distance of your farm to a weather station?....................mm/km.

26. Are there any mountains between the nearest weather station and your farm? Yes [ ] No [ ]

27. Are there any forecast between the nearest weather station and your farm? Yes [ ] No [ ]

28. Which villages have similar rainfall to your village? 29. What is the distance from your place to an insurance company………………….

30. How did you acquire your farm land?

B. Family B. Purchased C. Leased D. Rented E. Inherited F. Gift tenure

Others Specify…………………..………

31. Which of the following do you practice?

A. MonocultureB.Mix croppingC. Others Specify………………………………

32. Where do you get Inputs for your cashew?

F. Purchased

G. Own Farm

H. Relatives

I. Friends

J. Others Specify…………………………………..

33. Which cashew variety (ies) do you cultivate?

A. Brazilian type

B. Cote Divoire type

C. Benin type

D. Other Specify…………………………………….

34. Do you know the yield potential of your variety? Yes [ ] No [ ] 35. What was your expected yield………………………..in bags

36. What is your potential yield…………………………..in bags

37. What is your actual yield……………………………..in bags

38. Which form (s) of labour do you use for farming?

F. Family labour

G. Hired

H. Both

I. Noboa

J. Other Specify…………………………..

39. Are they the same labour used for other farms? Yes [ ] No [ ]

40. Are they available during the critical periods of the crop production cycle? Yes [ ] No [ ]

41. If Yes, what was your expected revenue per bag………………………

42. What is your potential revenue per bag…………………… 43. What is your actual revenue per bag………………………

44. If No what crops do they involved in at those times.

A. Cocoa

B. Cassava

C. Maize

D. Yam

E. Vegetable………………………………………………………

:

45. Approximately how much cashew land sizes do you cultivate each year? .... 46. Give reasons if cultivated land size is less than the total farm size. Give reasons……………………………………………………………………………………….
....
47. How would you classify your soil?
    E. Sandy
    F. Loamy G. Clayey
    H. Other Specify…………………………………….
48. How would you rate your soils water holding capacity?
    B. Dries quickly after rainfallB. Dries gradually after rainfall C. Remain water logged for long periods after rainfall

49. How do you control weeds?
    D. Manually
    E. Intercropping
    F. Chemically
50. How do you control pest?
    D. Introduction of organism (Biological)
    E. Pesticide (Chemicals)…………………………..
    F. Other Specify……………………………………..
51. Have you hearedabout Insurance before?
    Yes [ ]
    No [ ]
52. If yes what what insurance products have you heared of?
....
53. Do you have any insurance package for
    A. Yourself Yes [ ] No [ ] B. House Yes [ ] No [ ]
    C. Other properties Yes [ ] No [ ]
    Other Specify………………………………………………………..
54. Do you have access to public help in times of disaster? Yes [ ] No [ ] 56. Are you aware of agricultural insurance products? Yes [ ] No [ ]
57. If yes; what are some of the insurance products you are aware of...
58. Do you have off farm income? Yes [ ] No [ ]
59. Do you have income from other crops on your farm? Yes [ ] No [ ]
60. Do you seek support from any source in times of disaster? Yes [No [ ]
61. If so what is it? ....
62. Is your farm in drought or flood prone zone? Yes [ ] No [ ]
63. If yes sate whether is a drought or flood prone area …………………………………….
64. Are you willing to pay for crop insurance for your cashew? Yes [ ] No [ ]
65. How do you want to pay the premium? Annually [ ] Semi-annually [ ] Quartely [ ] 66. What mode of payment do you prefer? Cash [ ] Cheque [ ] Kind [ ]

CONSTRAINTS IN CASHEW CROP FARMING

67. Could you please put in order of importance the constraints affecting the development of the cashew sub sector in the Region?

Factor	**1–not important at all, 2–not very important, 3–somewhat important, 4–important, 5–extremely important**
A. Land tenure system/Access to land	
B. Material/Input Availability	
C. Promotion of cocoa	
D. Lack of credit facilities/loans from financial institutions	
E. Lack of knowledge about cashew crop farming	

:

F. Financial institutions attached to cashew crop farmers in general	
G. Cultivation of food crops in the region	
H. Society's attitude towards cashew crop farmers	
I. Lack of cashew Board	

:

J. Lack of storage systems	
K. Lack of intermediaries	
L. Lack of representation of farmer groups in discussion making of Mofa	
M. Lack of knowledge on the use of cashew	
N. Market liberalization	
O. Availability of planting materials	
P. Inadequate training for cashew crop farmer	
Q. Inadequate processing business	
R. Lack of transport systems	
S. Post harvestlooses through packaging	

CHOICE EXPERIMENT BASED ON INSURANCE PHILOSOPHIES

Cashew Crop farmers Residual Risk Classification, Probabilities and Cover

Residual Risk	Classification	Probabilities	Stages of Cashew crop life covered
Excess Rainfall	Systematic	0.94	Flowering, fruiting and harvesting
High Wind speed (Windstorm)	Systematic	0.98	Flowering and fruiting
High Temperature	Systematic	0.99	Germination, seedling, Flowering and fruiting
Bush Fires	Idiosyncratic	0.75	All phases

CASHEW CROP FARMERS WILLINGNESS IN AGRIC INSURANCE

68 Would you be willing to pay something to insure your cashew farm against any loss?

Yes [ ] No [ ]

ii) If yes, which of the following crop insurance policy do you prefer? Choose **only one option for each choice set.**

Index Approach

Attribute	**Choice set A**	**Choice set B**	**Choice set C**
Method of loss Assessment	Weather Station	Satellite data	District Average yield
Risk covered (payout triggers)Or insured perils	High Temperature Excess rainfall High Wind speed (Windstorm)	High Temperature, Excess rainfall, High Wind speed (Windstorm)	High Temperature Excess rainfall High Wind speed (Windstorm)
Administrative premium in GH¢ and Technical Premium in GH¢	***GH¢100.46***	***GH¢ 88.79***	***GH¢ 64.03***
I would purcahese	☐	☐	☐
No Buy			

:

	☐

Indemnity Approach

Attribute	Choice A set	Choice set B	Choice set C	Choice set D
Method of loss Assessment	Detailed f rm visit	Detailed farm visit	Detailed farm visit yield	Percentage shortfall in farmers annual production
Risk covered (payout triggers) Or insured perils	Bush fires	High Wind speed (Windstorm)	Excess rainfall	High Temperature Excess rainfall High Wind speed
Administrative premium in and GH¢Technical Premium in GH¢	***GH¢*53.46**	***GH¢*34.38**	***GH¢*33.46**	***GH¢*102.44**
I would purchase	☐	☐	☐	☐
No Buy		☐		

<u>Simulation Approach</u>

Attribute	Choice A set	Choice se t B	Choice set C	Choice set D
Method of loss Assessment	Detailed f rm visit and Weather Station	Satellite d ata and farm visit	District Average and farm visit	Detailed farm visit and triggers on selected farms in a homogenous area
Risk covered (payout triggers) Or insured perils	High Tem perature Excess rai fall d High Win peed Bush fires	High Tem perature Excess rai nfall High Win l speed Bush fires	High Temperature Excess rainfall High Wind speed Bush fires	High Temperature Excess rainfall High Wind speed Bush fires

:

Administrative premium in GH¢ and Technical Premium in GH¢	***GH¢*55.14**	***GH¢*54.21**	***GH¢*45.43**	***GH¢*107.29**
I would purchase	☐	☐	☐	☐
No Buy	☐			

Benchmarking Approach

Attribute	**Choice set A**	**Choice se : B**	**Choice set C**
Method of loss Assessment	Triggers on selected farm in a area homogenous	Triggers on selected farm in a homogenous area	Triggers on selected farm in a homogenous area
Risk covered (insured perils)	High Temperature Excess rainfall High Wind speed Bush fires	Bush fires	High Wind speed (windstorm)
Administrative premium in GH¢ and Technical Premium in GH¢	***GH¢*119.46**	***GH¢*17.03**	***GH¢*22.24**
I would purcahese	☐	☐	☐
No Buy	☐		

:

Functional Synthesis Approach

Attribute	Choice A set	Choice se t B	Choice s:t C	Choice set D
Method of loss Assessment	Weather S:ation. Selected f rm Triggers i a us homogeno area. Detailed f rm visit	Satellite d ata. Selected f arm triggers in homogeno us area. arm Detailed f visit	District Average. Selected farm Triggers in a homogen ous area. farm Detailed visit	Percentage of production, Farm visit Triggers on selected farms in a homogenous area
Risk covered (payout triggers) Or insured perils	perature High Tem fall, d Excess rai peed High Win Bush fires	High ure Temperat nfall Excess rai Bush fires	High Tempera ure Excess r infall High Wi d speed Bush fires	High Temperature Excess rainfall High Wind speed Bush fires
Administrative premium in GH¢ and Technical Premium in GH¢	**7** ***GH¢116.9***	**0** ***GH¢105.***	**4** ***GH¢80.***	***GH¢109.48***
I would purchase	☐	☐	☐	☐
No Buy	☐			

Will buy option …………………of……………………………………….Approach

Reason for your choice…………………………………………………………………………………..

Will not buy any............................ Resason………………………………………………………
……………………………………………………………………………………………………….

DISTRIBUTION CHANNEL(S) FROM CASHEW CROP FARMERS PERSPECTIVE FORSELLING AGRICULTURAL INSURANCE

69. **Where would you like to buyAgricInsurance**?

A. Insurance Agent

B. Broker

:

C. Direct from insurance company

D. From farm based organizations and corporative

E. From electricity companies

F. From Commercial Banks, MFI, Rural Bank G. Nucleus farmers

H. Input sellers (Fertilizer and material sellers)

:
I. Marketing champions of pool member
J. Companies church agents
K. MOFA
L. NGO's
M. Extention officers
N. Post office
O. Telecommunications(mobile Phones)
P. All of the above
Q. FBO…………….…………………………………………..
Other Specify…………………………………………

MODELS FOR SUPPLYING AGRICULTURAL INSURANCE TO CASHEW CROP

70.Models for supplying agricultural insurance to cashew crop farmers (Rating scale:1=Not preferred, 2=Least preferred, 3=Neutral, 4= Preferred , 5=Most preferred)

Supply Models	Model Description	Select the most preferred	Rate on a Scale 1-5
Partner-Agent Model	1) Insurance → Microfinance(MFI's) → Farmer Insurance 2) Rural banks → Farmer → 3) Insurance → MFI's/ Rural Banks → Farmer		
Agency Model	1) Insurance → insurance Agent → Farmer 2) Insurance → rural agent at door step → Farmer 3) Insurance → rural agent at village level → Farmer 4) Insurance → insurance broker → Farmer 5) Insurance → broker/agent of insurance at door step or village level → Farmer		
Community based Model	1) Insurance → NGO → Farmer 2) Insurance → Input dealer → Farmer 3) Insurance → FBO → Farmer 4) Insurance → Extension Officer → Farmer 5) Insurance → Corporative → Farmer 6) Insurance → Nucleus farmer → Farmer 7) Insurance → processor → Farmer 8) Insurance → Any Community → Farmer		

:

	9) Insurance → Church or Mosque Aggregator Farmer		
Full Service Model	1) Insurance → insurance Staff → Farmer 2) Insurance → Trained marketing champion of insurance pool → Farmer		
Bank Assurance Model	1) Insurance → Commercial Bank → Farmer		
Brand Assurance Model	1) Insurance → Kiosk → Farmer 2) Insurance → Radio station agent → Farmer 3) Insurance → GPRTU agent → Farmer 4) Insurance → Supermarket → Farmer		
Composite Model	1) Insurance → Marketing Board → Farmer 2) Insurance → MFI's, Banks, Input dealers, agents, brokers, telecoms, electricity corporation, NGOs, FBOs, Nucleus farmers, Churches and Supermarkets → Farmer		

MEDIA FOR PROMOTING AGRICULTURAL INSURANCE

71. Awareness for cashew crop insurance can best be done through:
   a. Television
   b. Local Radio Station
   c. News Paper
   d. NGO Activities such as Pre season events
   e. FBO meetings
   f. Corporatives meetings
   g. National Commission for civic education

72. Are you aware of Agricultural Insurance product(s) ? Yes [ ] No [ ]

73 Are you aware of Other Insurance product (s)? Yes [ ] No [ ]

If yes list the product(s) you are aware of
………………………………………………………………………………………………………
………………………………………………………………………………………………………

74. Insurance Knowledge Index

Item	**Answer**		**Result Answer**
	Yes	**No**	
Insurance is for free			
If someone has an insurance, he does not have to pay regularly: he can just pay when he wants			
If an insurance policy has a waiting period, it means you cannot make any claim during this period			
If someone pays for an insurance, his premiums might be used to pay claims for other people who are part of the same insurance schemer			
If someone dies from an accident, and he or she is part of an insurance scheme. Insurance will help his/her family			
If someone pays regularly for insurance and you never need to use it, he will get the money back			

:

If someone has insurance, he can go to the insurance company to get the money whenever he wants it.			
If someone has as an insurance policy and misses some of his payments, the insurance company will refuse to pay him in case something happens			

75. Insurance Attitude Index

Insurance Concept	Strongly Agree (%)	Agree	Undecided	Disagree	Strongly Disagree
Insurance is cheap relative to the loss which can occur					
Insurance is needed since I can not manage my risk					
Insurance is needed when farms are burnt					
I think is ok that if I pay for insurance for 1 year and nothing happens, I get pay-out in that year.					
Buying insurance against fire mean inviting the fire accident					
Insurance is about helping each other					

:

It is better to think about risks and emergencies in advance					
Insurance is for the poor people					
Insurance is necessary to protect your farm and family					

:

Insurance Companies	Strongly Agree (%)	Agree	Undecided	Disagree	Strongly Disagree
When it comes to paying claims, insurance companies will always try to delay and / make it difficult					
When it comes to making claims, Insurance companies will normally try to cheat you					
I can trust insurance to be fair to me					
Insurance Companies care more about saving money than about helping you.					

76 Benefit perception Index

1) Benefit perception Index	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Agricultural will give me peace of mind					
The insurance will enhance my assess to loans					
I have heard of benefit of insurance from other farmers					

:

77. **Premimium Perception Index**

Premimium Perception Index	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
The premiums attached to my chosen insurance product is high					
The premium attached to my chosen insurance product is low					
The premium attached to my chosen insurance product is reasonable					

Appendix III

QUESTIONNAIRE FOR FINANCIAL INSTITUTION-WILLINGNESS TO PAY(WTP) SURVEY KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY-FACULTY OF AGRICULTURE.DEPARTMENT OF AGRICULTURAL ECONOMICS AND AGRI BUSINESS AND EXTENTION

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Prof .S.C.Fialor

Department of Agricultural Economics and Agri Business

KNUST, Kumasi-Ghana

Tel: 0208168438

QUESTIONNAIRE FOR FINANCIAL INSTITUTION

1. Are you into Agri lending? Yes [ ] No[ ]
2. Do you perceive risk in cashew farming? If so what are the kind of risk do you perceive?

   ....

3. Which of these risks do you consider as original to your loan recounting…………………………………………………………………………………………………

   ………

4. Would you like to have agriculture insurance? Yes [ ] No [ ]
5. If yes, would you like to buy it to cover your loan portfolio, or pass it on to the farmer?

   ....

6. Which of these products would you like to buy or let the farmer buy?

Residual Risk	Classification	Probabilities	Stages of Cashew crop life covered
Excess Rainfall	Systematic	0.94	Flowering, fruiting and harvesting
High Wind speed (Windstorm)	Systematic	0.98	Flowering and fruiting
High Temperature	Systematic	0.99	Germination, seedling, Flowering and fruiting
Bush Fires	Idiosyncratic	0.75	All phases

:

7. Which of these hypothetical products are you willing to pay for?

Index Approach

Attribute	**Choice set A**	**Choice set B**	**Choice set C**
Method of loss Assessment	Weather Station	Satellite data	District Average yield
Risk covered (payout triggers) Or insured perils	High Temperature Excess rainfall High Wind speed (Windstorm)	High gh Temperature Excess rainfall Hi Wind speed (Windstorm)	High Temperature Excess rainfall High Wind speed (Windstorm)
Administrative premium and Technical Premium in GH¢	***GH¢*100.46**	***GH¢* 88.79**	***GH¢*64.03**
I would purcahese			
No Buy			

Indemnity Approach

Attribute	**Choice A set**	**Choice set B**	**Choice set C**	**Choice set D**
Method of loss Assessment	Detailed f rm visit	Detailed farm visit	Detailed farm visit yield	Percentage shortfall in farmers annual production
Risk covered (payout triggers) Or insured perils	Bush fires	High Wind speed (Windstorm)	Excess rainfall	High Temperature Excess rainfall High Wind speed
Technical Premium and Administrative premium in GH¢	***GH¢*53.46**	***GH¢*34.38**	***GH¢*33.46**	***GH¢*102.44**
I would purchase				
No Buy				

Simulation Approach

Attribute	**Choice A set**	**Choice se t B**	**Choice s et C**	**Choice set D**

:

Method of loss Assessment	Detailed f rm visit and Weather Station	Satellite d ıta and farm visit	District ıverage and farm ⁄isit	Detailed farm visit and triggers on selected farms in a homogenous area
Risk covered (payout triggers) Or insured perils	High Tem ›erature Excess rai ıfall d High Win peed Bush fires	High Tem perature Excess rai nfall d High Win ;peed Bush fires	High Te ıperature Excess r infall High Wi ıd speed Bush fire s	High Temperature Excess rainfall High Wind speed Bush fires
Technical Premium and Administrative premium in GH¢	***GH¢55.14***	***GH¢54.21***	***GH¢45.43***	***GH¢107.29***
I would purchase	☐	☐	☐	☐
No Buy	☐			

Benchmarking Approach

Attribute	**Choice set A**	**Choice set B**	**Choice set C**
Method of loss Assessment	Triggers on selected farm in a homogeno ıs area	Triggers on selected farm in a homogenous area	Triggers on selected farm in a homogenous area
Risk covered (insured perils)	High Temperature Excess rainfall, High Wind speed Bush fires	Bush fires	High Wind speed (windstorm)
Technical Premium and Administrative premium in GH¢	***GH¢119.46***	***GH¢17.03***	***GH¢22.24***
I would purcahese	☐	☐	☐
No Buy	☐		

Functional Synthesis Approach

Attribute	**Choice set A**	**Choice se t B**	**Choice s:t C**	**Choice set D**
Method of loss Assessment	Weather Station. Selected farm Triggers in a homogenous area. Detailed farm visit	Satellite d ıta. Selected f ırm triggers in ı homogeno us area. Detailed f ırm visit	DistrictAverage. Selected farm in Triggers a homogenous area. Detailed farm visit	Percentage of production, Farm visit Triggers on selected farms in a homogenous area
Risk covered (payout triggers) Or insured perils	High Temperature Excess rainfall High Wind speed Bush fires	High Tem perature Excess rai nfall Bush fires	High Te ıperature Excess r infall High Wi ıd speed s Bush fire	High Temperature Excess rainfall High Wind speed Bush fires

Technical Premium andAdministrative premium in GHS	***GH¢116.97***	***GH¢105. 30***	***GH¢80.54***	***GH¢109.48***
I would purchase	☐	☐	☐	☐
No Buy	☐			

8. Will buy option …………………of……………………………………Approach
9. Reason for your Choice………………………………………………………………….
10. Will not buy any..

Resason…………………………………………………………………………………..

11. What Percentage of your loan portfolio do you allocate to farmers……………………………
12. Do you have specific portfolio for cashew crop farmers? --------------- Yes [ ] No [ ]
13. If yes, what percentage………………………………………………………….
14. Would you like to increase the size of your loan, if any, to the cashew crop sector if the chosen insurance product is developed to cover risk the farmers have no control over?

    Yes [ ] No[ ] Give reasons……………………………………………………………..

    ……………………………………………………………………………………………

Appendix IV

QUESTIONNAIRES FOR GHANA AGRICULTURAL INSURANCE POOL (GAIP) STAKEHOLDERS-WTP SURVEY

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY-FACULTY OF AGRICULTURE.DEPARTMENT OF AGRICULTURAL ECONOMICS AND AGRI BUSINESS AND EXTENTION

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Your response will be part of my data analysis for a PhD thesis report - so no individual responses will be identifiable within any reports produced.

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KNUST, Kumasi-Ghana

Tel: 0208168438

QUESTIONNAIRES FOR AGRICULTURAL INSURANCE POOL STAKEHOLDERS

1. In situations Cashew farmers and their financiers need insurance for Cashew,
Would you be willing to design Agricultural insurance for cashew crop farmers and their Financiers? Yes [ ] No [ ]
Given the risk cashew farmers have no control over, their probabilities and the farmers crop budget per acre, which of the products would you be willing to design and why?

Cashew Crop farmers Residual Risk Classification, Probabilities and Cover

Residual Risk	Classification	Probabilities	Stages of Cashew crop life covered
Excess Rainfall	Systematic	**0.94**	Flowering, fruiting and harvesting
High Wind speed (Windstorm)	Systematic	**0.98**	Flowering and fruiting
High Temperature	Systematic	**0.99**	Germination, seedling, Flowering and fruiting
Bush Fires	Idiosyncratic	**0.75**	All phases
	Average crop budget per acre	***GH¢910.00***	

Index Approach

Attribute	**Choice set A**	**Choice set B**	**Choice set C**
Method of loss Assessment	Weather Sta ion	Satellite data	District Average yield
Risk covered (payout triggers) Or insured perils	High Tempe rature Excess rainf ll High Wind s peed (Windstorm)	High Temperatur : Excess rainfall High Wind speed (Windstorm)	High Temperature Excess rainfall High Wind speed (Windstorm)
Technical Premium and Administrative premium in GH¢	***GH¢100.46***	***GH¢88.79***	***GH¢64.03***
I would Design	☐	☐	☐
No Design			

:

	☐

Indemnity Approach

Attribute	Choice A set	Choice set B	Choice set C	Choice set D
Method of loss Assessment	Detailed f rm visit	Detailed farm visit	Detailed farm visit yield	Percentage shortfall in farmers annual production
Risk covered (payout triggers) Or insured perils	Bush fires	High Wind speed (Windstorm)	Excess rainfall	High Temperature Excess rainfall High Wind speed
Technical Premium and Administrative premium in GH¢	***GH¢*53.46**	***GH¢*34.38**	***GH¢*33.46**	***GH¢*102.44**
I would design	☐	☐	☐	☐
No Design	☐			

Simulation Approach

Attribute	Choice A set	Choice se t B	Choice set C	Choice set D
Method of loss Assessment	Detailed f rm visit and Weather Station	Satellite d ıta and farm visit	District Average and farm visit	Detailed farm visit and triggers on selected farms in a homogenous area
Risk covered (payout triggers) Or insured perils	High Tem ›erature Excess rai ıfall d High Win peed Bush fires	High Tem perature Excess rai nfall High Win 1 speed Bush fires	High Temperature Excess rainfall High Wind speed Bush fires	High Temperature Excess rainfall High Wind speed Bush fires
Technical Premium and Administrative premium in GH¢	***GH¢*55.14**	***GH¢*54.21**	***GH¢* 45.43**	***GH¢*107.29**
I would design	☐	☐	☐	☐

:

No Design	

Benchmarking Approach

Attribute	Choice set A	Choice set B	Choice set C
Method of loss Assessment	Triggers on selected farm in a homogenous area	Triggers on selected farm in a homogenous area	Triggers on selected farm in a homogenous area
Risk covered (insured perils)	High Temperature Excess rainfall High Wind speed Bush fires	Bush fires	High Wind speed (windstorm)
Technical Premium and Administrative premium in GH¢	*GH¢119.46*	*GH¢17.03*	*GH¢22.24*
I would design			
No Design			

Functional Synthesis Approach

Attribute	Choice set A	Choice set B	Choice set C	Choice set D
Method of loss Assessment	Weather Station. Selected farm Triggers in a homogenous area. Detailed farm visit	Satellite data. Selected farm triggers in a homogenous area. Detailed farm visit	District ιverage. Selected farm in a Triggers ous area. homoge farm n Detailed visit	Percentage of production, Farm visit Triggers on selected farms in a homogenous area
Risk covered (payout triggers) Or insured perils	High Temperature Excess rainfall High Wind speed Bush fires	High Temperature Excess rainfall Bush fires	High Te ıperature Excess r infall High Wi ıd speed s Bush fire	High Temperature Excess rainfall High Wind speed Bush fires
Technical Premium and Administrative premium in GH¢	*GH¢116.97*	*GH¢105.30*	*GH¢80.* 4	*GH¢109.48*
I would design				
No No Design				

2. Will design ………………….of……………………………………….Approach

:

3. Will not design..

:

4. Resason………………………………………………………………………………………..

………………………………………………………………………………………………

Would you like the farmers to buy it individually or as a group? ....

What terms, conditions, deductitibles, warranty (ies) or franchise would you accept insurance?

……………………………………………………………………………………..…………………

……………………………………………………………………...………………………………

………………………………………………………..………………………………………………

…………………………………….

7. Would you want the government to support the insurance scheme for cashew crop farmer?

8. If yes, how..

A. Subsidies for premium [ ]

B. Subsidies for Administration Cost[ ]

C. As a stop loss Reinsurer [ ]

D. Free Insurance for Catastrophe[ ]

E. Cover for the Poor [ ]

F. Provide Policy Guideline [ ]

G. Other Specify…………………..

PERCEIVED CONSTRAINTS TO THE DEVELOPMENT OF AGRICULTURAL INSURANCE SCHEME FOR CASHEW CROP FARMERS

Could you please put in order of importance the constraints affecting the development of the Agricultural Insurance for Cashew Farmers in the study area.

Constraint Factor Constraints to development of Agric insurance	**1–not important at all, 2–not very important, 3–somewhat important, 4–important, 5–extremely important**
A. High premiums making it unaffordable	
B. False claims	
C. High loss ratio	
D. lack of policies supporting agricultural insurance development	
E. lack of agricultural legislation	
F. Limited knowledge making farmers un aware of its benefits	
G. Negative perceptions about insurance in general	
H .low agricultural production	
I. High administrative costs	
J. Inadequate legal and regulatory frameworks,	
K. Small size of market	
L. lack of knowledge on how to purchase insurance	
M. Lack of knowledge about product development	
N. High marketing cost	
O. lack of knowledge on marketing channels	
P. Lack of data availability	
Q .Basis risk,	
R. Limited demand	
S. Low participation of commercial banks,	

5.

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6.

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T. Scarcity of data for actuarial determination of important underwriting	
U. Lack of qualified personnel in the area of agricultural insurance	
V. Believe that insurance companies are only interested in collecting premium and not paying claims	
W. Others (specify)	

:

SUGGETION TO IMPROVE AGRICULTURAL INSURANCE UPTAKE

Could you please put in order of importance suggetion to improve uptake of agricultural insurance for cashew farmers in the study area.

Uptake Factor Suggetion to improve uptake	**1–not important at all, 2–not very important, 3–somewhat mportant, 4–important, 5–extremely important**
A. Improve Farmers Awareness on the importance of insurance through education and marketing	
B. Contractors to purchase insurance on behalf of farmers	
C.Insurers to locate close to farmers	
D.Incread agricultural production that provides an agricultural pool to form the basis for affordable premium	
E.Research and development to develop insurance products tha are affordable to farmers	
F.Law on agricultural insurance contract enforcement	

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G.Simplification of the claim process	
H. Government intervention	
I. Cooperation with Financial institutions	
J. Others (specify)	

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Appendix V

Premium determination for index products

			Index Approach	
Attribute		**Choice set A**	**Choice set B**	**Choice set C**
Method of loss Assessment		Weather stations	Satellite data	Distrect Average yield
Risk covered (payout triggers or insured perils		High temperature Excess rainfall, High Wind speed (Windstorm)	High temperature, Excess rainfall, High wind speed (Windstorm)	High Temperature Excess rainfall High Wind speed (Windstorm)
Technical Premium in GH¢		26.48	26.48	26.48
Administrative Premium				
Loss Assessment	11/3	35.31	35.31	35.31
	1.052631579	27.87	27.87	27.87
	Average	**31.59**	**31.59**	**31.59**
Claims Notification Cost	3%	0.79	0.79	0.79
	12%	3.18	3.18	3.18
	Average	**1.99**	1.99	1.99
Administrative Charges	20%	5.30	5.30	5.30
	25%	6.62	6.62	6.62
	Average	**5.96**	**5.96**	**5.96**
Data Acquisition Cost		36.43	**24.76**	
Total Administrative Cost		37.55	62.31	37.55
Administrative premium and Technical Premium in GH¢		**100.46**	**88.79**	**64.03**
	SATELITE DATA (Historical)			
Cost per parameter	100			
Total cost for 30 years	3000			

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Unit cost per parameter	7.14			
	SATELITE DATA MONTH			
Total cost for all parameter	1400			
Cost per parameter	466.67			
Unit cost per parameter	1.11			

Appendix VI Premium determination for indemnity products

			Indemnity approach		
Attribute		**Choice set A**	**Choice set B**	**Choice set C**	**Choice set D**
Method of loss Assessment		Detailed farm visit	Detailed farm visit	Detailed farm visit yield	Percentage shortfall in farmers annual production
Risk covered (payout triggers) or insured perisl		Bush fires	High Wind speed (Windstorm)	Excess rainfall	High Temperature Excess rainfall High Wind speed
Technical Premium in GH¢		**6.83**	**8.92**	**8.55**	**26.48**
Administrative Premium					
Loss Assessment	11/3	9.11	11.89	11.40	35.31
	1.052631579	7.19	9.39	9.00	27.87

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	Average	**8.15**	**10.64**	**10.20**	**31.59**
Loss Adjustment	3%	0.20	0.27	0.26	0.79
	12%	0.82	1.07	1.03	3.18
	Average	**0.51**	**0.67**	**0.64**	**1.99**
Administrative Charges	20%	1.37	1.78	1.71	5.30
	25%	1.71	2.23	2.14	6.62
	Average	**1.54**	**2.01**	**1.92**	**5.96**
Data Acquisition Cost		36.43	12.14	12.14	36.43
Total Administrative Cost		46.63	25.46	24.91	75.96
Administrative premium and Technical Premium in GH¢		**53.46**	**34.38**		**102.44**

Appendix VII

Premium Determination for Simulation Products

			Simulation Approach		
	Attribute	**Choice set A**	**Choice set B**	**Choice set C**	**Choice set D**
Method of loss Assessment		Detailed farm visit and Weather Station	Satellite Data and farm visit	District Average and farm visit	Percentage shortfall in famers annual production

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Risk covered (payout triggers) or insured perils		High Temperature Excess rainfall High Wind speed Bush fires	High Temperature Excess rainfall High Wind speed Bush fires	High Temperature Excess rainfall High Wind speed Bush fires	High Temperature Excess rainfall High Wind speed Bush fires
Technical Premium in GH¢		**33.31**	**33.31**	**33.31**	**33.31**
Administrative Premium					
Loss Assessment	11/3	44.41	44.41	44.41	44.41
	1.052631579	35.06	35.06	35.06	35.06
	Average	**39.74**	**39.74**	**39.74**	**39.74**
Loss Adjustment	3%	1.00	1.00	1.00	1.00
	12%	4.00	4.00	4.00	4.00
	Average	**2.50**	**2.50**	**2.50**	**2.50**
Administrative Charges	20%	6.66	6.66	6.66	6.66
	25%	8.33	8.33	8.33	8.33
	Average	**7.49**	**7.49**	**7.49**	**7.49**
Data Acquisition Cost		**36.43**	**24.75**		**36.43**
Total Administrative Cost		83.66	71.98	47.23	83.66
Administrative premium and technical premium GH¢		**116.97**	**105.29**	**80.54**	**116.97**

Appendix VIII
Premium Determination for Benchmarking Products

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		Benchmarking Approach		
Attribute		**Choice set A**	**Choice set B**	**Choice set C**
Method of loss Assessment		Triggers on selected farm in a homogenous area	Triggers on selected farm in a homogenous area	Triggers on selected farm in a homogenous area
Risk covered (insured perils		High Temperature Excess rainfall High Wind speed Bush fires	Bush fires	High Wind speed (windstorm)
Technical Premium in GH¢		**33.306**	**6.83**	**8.92**
Administrative Premium				
Loss Assessment	11/3	44.41	9.11	11.89
	1.052631579	35.06	7.19	9.39
	Average	**39.73**	**8.15**	**10.64**
Loss Adjustment	3%	1.00	0.20	0.27
	12%	4.00	0.82	1.07
	Average	**2.50**	**0.51**	**0.67**
Administrative Charges	20%	6.66	1.37	1.78
	25%	8.33	1.71	2.23
	Average	**7.49**	**1.54**	**2.01**
Data Acquisition Cost		**36.43**	**0.00**	

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Total Administrative Cost		86.15	10.20	13.32
Administrative premium and Technical premium in GH¢		**119.46**	**17.03**	**22.24**

Appendix IX
Premium Determination for Functional Synthesis Products

		Functional Synthesis Approach			
Attribute		**Choice A**	**Choice B**	**Choice C**	**Choice D**
Method of loss Assessment		Weather station farm trigger in a homogenous area. Detailed farm visit	Satellite data. Selected farm triggers in a homogenous area. Detailed farm visit.	District average Selected farm triggers in a homogenous area. Detailed farm visit	Farm visit triggers on selected farms in a homogenous area
Risk covered (payout triggers) or insured perils		High Temperature Excess rainfall High Wind speed Bush fires	High Temperature Excess rainfall, Bush fires	High Temperature Excess rainfall High Wind speed Bush fires	High Temperature Excess rainfall High Wind speed Bush fires
Technical Premium in GH¢		**33.31**	**33.31**	**33.31**	**33.31**
Administrative premium					
Loss Assessment	11/3	44.41	44.41	44.41	44.41

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	1.052631579	35.06	35.06	35.06	35.06
	Average	**39.74**	**39.74**	**39.74**	**39.74**
Loss Adjustmet	3%	1.00	1.00	1.00	1.00
	12%	4.00	4.00	4.00	4.00
	Average	**2.50**	**2.50**	**2.50**	**2.50**
Administrative charges	20%	6.66	6.66	6.66	6.66
	25%	8.33	8.33	8.33	8.33
	Average	**7.49**	**7.49**	**7.49**	
Data Acquisition Cost		**36.43**			
Total administrative cost		83.66	71.99	47.23	76.17
Administrative pemium and technical premium in GH¢		**116.97**	**105.30**	**80.54**	**109.48**

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Appendix X hypothetical Insurance Products for the choice task based on five insurance philosophies or approaches

Choice Product for Index Approach

Attribute	**Choice set A**	**Choice set B**	**Choice set C**
Method of loss Assessment	Weather Sta ion	Satellite data	District Average yield
Risk covered (payout triggers) Or insured perils	High Tempe rature Excess rainf ll High Wind s peed (Windstorm)	High Temperatur : Excess rainfall High Wind speed (Windstorm)	High Temperature Excess rainfall High Wind speed (Windstorm)
Technical Premium and Administrative premium in GH¢	***GH¢*100.46**	***GH¢*88.79**	***GH¢*64.03**
I would purchase	☐	☐	☐
No Buy	☐		

Choice Products Indemnity Approach

Attribute	**Choice A set**	**Choice set B**	**Choice set C**	**Choice set D**
Method of loss Assessment	Detailed f rm visit	Detailed farm visit	Detailed farm visit yield	Percentage shortfall in farmers annual production
Risk covered (payout triggers) Or insured perils	Bush fires	High Wind speed (Windstorm)	Excess rainfall	High Temperature Excess rainfall High Wind speed
Technical Premium and Administrative premium in GH¢	***GH¢*53.46**	***GH¢*34.38**	***GH¢*33.46**	***GH¢*102.44**
I would purchase	☐	☐	☐	☐
No Buy	☐			

<u>**Choice Products for Simulation Approach**</u>

Attribute	Choice set A	Choice se t B	Choice set C	Choice set D
Method of loss Assessment	Detailed frm visit and Weather Station	Satellite data and farm visit	District average and farm visit	Detailed farm visit and triggers on selected farms in a homogenous area
Risk covered (payout triggers) Or insured perils	High Temperatu re Excess rai nfall High Wind speed Bus fires	High Temperat ure Excess ra nfall High Win d speed Bu h fires	High Tempera ture Excess r infall High Wi nd speed Bush fire s	High Temperature Excess rainfall High Wind speed Bush fires
Technical Premium and Administrative premium in GH¢	***GH¢*55.14**	***GH¢*54.21**	***GH¢* 45 43**	***GH¢*107.29**
*I*would purchase	☐	☐	☐	☐
No Buy	☐			

:

Choice Products for Benchmarking Approach

Attribute	Choice set A	Choice set B	Choice set C
Method of loss Assessment	Triggers on selected farm in a homogenous area	Triggers on selected farm in a homogenous area	Triggers on selected farm in a homogenous area
Risk covered (insured perils)	High Temperature Excess rainfall High Wind speed Bush fires	Bush fires	High Wind speed (windstorm)
Technical Premium and Administrative premium in GH¢	***GH¢*119.46**	***GH¢*17.03**	***GH¢*22.24**
I would purchase	☐	☐	☐
No Buy	☐		

Choice Products for Functional Synthesis Approach

Attribute	Choice set A	Choice set B	Choice set C	Choice set D

Method of loss Assessment	Weather S:ation. arm Selected f a Triggers i us area. arm homogeno visit Detailed f	Satellite data. Selected firm triggers in homogen us area. Detailed firm visit	District Average. Selected farm Triggers in a homogenous area. Detailed farm visit	Percentage of production, Farm visit Triggers on selected farms in a homogenous area
Risk covered (payout triggers) Or insured perils	High Tem erature Excess rai nfall d High Win peed Bush fires	High Temperature Excess rainfall Bush fires	High Temperature Excess rainfall High Wind speed Bush fires	High Temperature Excess rainfall High Wind speed Bush fires
Technical Premium and Administrative premium in GH¢	***GH¢*116.97**	***GH¢*105. 0**	***GH¢*80.54**	***GH¢*109.48**
I would purchase	☐	☐	☐	☐
No Buy	☐			

Source: Author's construt, 2014

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Appendix XI

Names of Hypothetical Agricultural Insurance Product Options for Each Approach or Philosophy

A. Names of Index Approach Products Options with their prices

A- Weather Index- ¢100.46
B- Satellite Index- ¢88.79
C- Area Yield Index- ¢64.03

B. Names of Indemnity Product Options with their Prices

A-Named Peril damage base for fire- ¢53.34
B-Named Peril damage base for high wind speed ¢34.38 C-

D-Multiperil Crop Insurance product for high temperature, Excess rainfall and High wind speed ¢102.44 **C.**

A-Simulated Weather Multiperil Product for fire, high temperature and excess rainfall and high windspeed¢55.14

B-Simulated Satellite Multiperil Product for fire, high temperature and excess rainfall and high windspeed¢54.21

C-Simulated Area Yield index Multiperil product for fire, high temperature and excess rainfall and high¢45.43

D-Indemnity and Benchmarking Simulated product for fire, high temperature and excess rainfall and high windspeed¢107.29

D. Namees of Benchmarking Approach Product Options with their prices

A-Named peril damage base and yield base Multiperil benchmark product for fire, High temperature, Excess rainfall, and High windspeed¢119.46
B-Named Peril damaged base benchmark product for fire¢17.03
C-Named peril damaged benchmark product for high wind speed¢22.24

E. Names of Functional Synthesis Approach Product Options with their prices A-Weather Synthesized Simulated Multiperil Insurance for damage and yield base for fire, high temperature and excess rainfall and high wind speed¢116.97
B- Satellite Synthesized Simulated Multiperil insurance for damage and yield base for fire, high temperature and excess rainfall ¢105.30
C-Area Yield Synthesized Multiperil Insurance for Damage and Yield base for fire, high temperature and excess rainfall and high wind speed¢80.54
D-Aggregate loss of investment Synthesized Simulated product for damage and yieldable for fire, high temperature and excess rainfall and high wind speed¢109.48

Named peril damage base for Excess rainfall ¢33.46

Names of Simulation Approach Product Options with their prices

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Appendix XII clogit choice price functional index benchmarking simulation quarterly cash_mode,
group(gp)

Iteration 0: log likelihood = -3592.3409
Iteration 1: log likelihood = -3565.4258
Iteration 2: log likelihood = -3565.2136
Iteration 3: log likelihood = -3565.2136

Conditional (fixed-effects) logistic regression Number of obs = 10341
LR chi2 (7) = 443.17
Prob > chi2 = 0.0000
Log likelihood = -3565.2136 Pseudo R2 = 0.0585

choice	Coef.	Std. Err.	Z	P>|z|	[95% Conf.	Interval]
Price	-.0002724	.0012634	-0.22	0.829	-.0027486	.0022039
functional	.5184572	.1415901	3.66	0.000	.2409457	.7959687
index	.5219312	.0581181	8.98	0.000	.4080218	.6358406
benchmarking	.2449718	.1334617	1.84	0.066	-.0166084	.5065519
simulation	.6136415	.0758607	8.09	0.000	.4649573	.7623257
quarterly	.0138898	.0563845	0.25	0.805	-.0966219	.1244015
cash_mode	.1153105	.0569011	2.03	0.043	.0037865	.2268345 --