UPTAKE OF INDEX-BASED CROP INSURANCE AMONG SMALLHOLDER FARMERS: THE CASE OF RICE PRODUCERS IN MVOMERO- MOROGORO

BY

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CERTIFICATION

This is to certify that I have read this dissertation and found it to be in acceptable form of the Institute of Finance Management. I hereby recommend for acceptance of this dissertation titled Uptake of Index-based Crop Insurance Among Smallholder Farmers, the case of Rice Producers in Mvomero-Morogoro.

Dr Nassoro H .

Supervisor's Name

Signature

DECLARATION

I declare that this dissertation is my original work and that it has not been and will not be presented to any other Institute/University for any other degree award.

Venance Michael Mpunde Date 09/11/2022

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DEDICATION

This thesis is dedicated to my family for their absolute support, love and affection through my studies. May the almighty God make us live together and enjoy the fruits of our efforts.

LIST OF ABBREVIATIONS

ADBs- Agricultural Development Banks

AGRA-Alliance for Green Revolution in Africa

AYII- Area Yield Index Insurance

ASDP- Agricultural Sector Development Programme

BLRM- Binary Logistic Regression Model

FFE- Framed Field Experiment

GDP-Gross Domestic Product

IFC- International Financial Corporation

IFRC- International Federation of Red Cross and Red Crescent Societies

IBCI- Index Based Crop Insurance

IBLI- Index Based Livestock Insurance

KIIs- Key Informant Interviews

MPCI- Multi Peril Crop Insurance

NPCI- Named Peril Crop Insurance

NAICO- National Association of Insurance Commissioners

NBS- National Bureau of Statistics

NMB- National Microfinance Bank

NBC- National Bank of Commerce

NIC- National Insurance Corporation

NGOs- Non-Governmental Organizations

PSM- Propensity Score Matching

SHF- Smallholder Farmer

SID- Simpsom Index of Diversification

TZS- Tanzanian Shillings

TDV- Tanzania Development Vision

URT- United Republic of Tanzania

UNDRR- United Nations Office for Disaster Risk Reduction

VAT- Value Added Tax

VIF- Variance Inflation Factor

WB- World Bank

WTP- Willingness To Pay

WIBI- Weather Index Based Insurance

ABSTRACT

In spite of agriculture being source of livelihood in Tanzania, yet the sector is faced by various production risks including climate change and variability. Since crop insurance is an important strategy against natural hazards and risks, farmers are encouraged to adopt it in order to intensify farm productivity. Therefore, this study sought to determine drivers for uptake of index based crop insurance and inform ways of making crop insurance work for the smallholder producers. Data were collected using questionnaire from 102 rice-producing households where weather index-based insurance had been promoted. A total of 5 insurance companies were also selected for KIIs to determine their distribution models and challenges they face in implementing IBCI. BLRM was used to assess the drivers to adopt IBCI, Content and descriptive analyses measured distribution models and challenges insurers face to implement IBCI respectively. The results show that age of the household(p=0.098), farming experience with IBCI (0.000), distance to the paved road (p=0.014), and household income (0.010) had significant influence to farmers' participation in IBCI. The content analysis from insurance companies showed that selling covers through local agents was dominant method they use in reaching their clients, quality and availability of weather data (37.5%) and capacity building to stakeholders (29.17%) were serious challenges to implement the programme. These findings therefore highlight the need to create more awareness to farmers on the principles of crop insurance and different products that exist. Similarly, developing good channels that will adequately suit the farmers needs and designing of crop insurance products basing on the need of clients, by doing so the uptake of crop insurance in Tanzania will increase.

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CHAPTER 1: INTRODUCTION

1.1 Background Information

Agriculture in sub-Saharan Africa (SSA) has been a controlling sector in the economy as it acts as a major economic indicator in evaluating the components of economic development like national gross domestic product (GDP), exports, imports and employments for the purpose of improving living standards of people. Most of the agricultural activities in SSA remain vulnerable to adverse weather events that can rigorously impact the quality and yield of a crop (Dick et al., 2011). Traditionally, smallholder farmers (SHF) in SSA have managed these risks by diversifying production activities on-farm and income generating activities off-farm. These mechanisms of adopting risks were seen to work well for low magnitude losses and being inadequate for severe and infrequent risk (Hazell, 1992; Aidoo et al., 2014). In Tanzania, agricultural sector is among the major sectors contributing in the economy. It contributes about 26.5% of the GDP and provides employment for almost two third of the employed population. The agricultural sector is essential source of income and investment opportunities for both large and smallholder farmers. The government has put much emphasis on the sector by promoting issues like irrigation and extension service officers its contribution to the GDP has been declining among other reasons due to the climate change as the major risk (Omambia et al., 2010; NBS 2019).

Given the over-dependence of farmers on rain-fed agriculture, climate variability and change are quickly frightening constant agricultural productivity, food security as well as economic development (Njue et al., 2018). Managing risks arising from

climate variability and change, it is imperative to use crop insurance for sustainable production.

Crop insurance is a mechanism which offers protection against losses caused by adverse events which in turn affect the agricultural value chain in one way or another, crop insurance offers loss compensation incurred by a farmer and hence a farmer is enabled to continue with agricultural activities even after occurrence of the losses (Hazell, 1992; URT, 2019). Index-based crop insurance has been sold as apart of adaptation towards mitigating climatic risks among smallholder farmers (Dougherty *et al.*, 2020).

Crop insurance has been advocated as apart of adaptation towards mitigating climatic risks among farmers (Dougherty et al., 2020). The insurance offers protection against losses caused by adverse events, and thus it enhances sustainable agricultural production. The crop insurance offers loss compensation to farmers and hence they are enabled to sustain with agricultural production even after occurrence of losses (URT, 2019).

Apart from protection against losses, crop insurance provides an advantage to farmers in accessing credits from banks and other micro finance companies because the insurance itself is used as a collateral in offering loans to farmers. Crop insurance for public is usually tied to credit from Agricultural Development Banks (ADBs) that is, a borrower is supposed to purchase an insurance to qualify for a loan in most of the developing countries (Hazell, 1992; URT, 2019).

An important issue for capitalizing in weather insurance for agriculture arises due to the clear existing relationship between crop yield level and weather. The weather insurance products are there to address a high-level portion of variability in

production, by doing so the risks or weather shocks in agriculture will be adequately covered.

The concept of agriculture insurance was initiated in Europe over 200 years ago to offer protection against livestock mortality and losses resulting from crop-hail (Smith and Glauber, 2012). This insurance spread to other non-European country like United States of America where the insurance scheme was largely provided by small companies offering covers with either single or named perils (Smith and Glauber, 2012). Agriculture Insurance is a veritable tool utilized by agricultural producers to mitigate and even copy the risks arising from adverse natural events (Nnadi *et al.*, 2013). Categories of agriculture insurance are divided into two products which are traditional insurance products and index-based insurance products (Ntukamazina *et al.* 2017). Further division of the agricultural insurance products is shown in the figure 1 below.

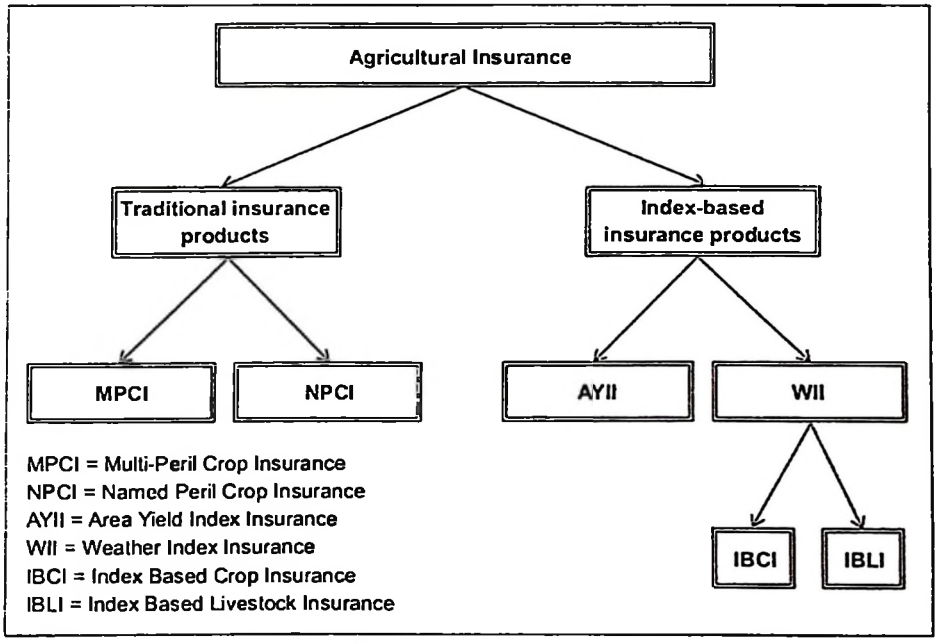

Figure 1: *Agricultural Insurance models*: Source: (Hatch, 2008)

The types of index-based insurance include area yield index insurance (AYII), weather index insurance (WII) which is presented as index-based livestock insurance (IBLI) and index-based crop insurance (IBCI).

There also a number of literatures which suggest that index-based agriculture insurance provide indemnity to farmers basing on an objective index as a workable and cost-effective solution of the climate related risks (Dougherty et al., 2020). However, the agricultural index-based insurance is seen to reduce concavities in consumption and sale of productive assets, besides that, index insurance enables farmers to increase investment and access to credit (Kazianga & Udry, 2006; Miranda & Farrin, 2012; Janzen & Carter, 2019; Karlan et al., 2014). Given potentiality of index based crop insurance many efforts are needed to be done especially in designing innovative insurance products which have potentials in mitigating the agricultural risks facing smallholder farmers, for the purpose of improving the agricultural production and livelihood of farmers (AGRA, 2018). Despite government's initiatives in advocating agriculture insurance as a solution against systemic risks in agriculture production, yet there is low uptake of agriculture insurance among farmers and this has made many insurance companies not to capitalize much in crop insurance (URT, 2019). Therefore, this study finds to inform ways of making index-based crop insurance work for smallholder famers.

1.2 Problem statement

Agriculture is biological in nature and exceedingly dependent in weather conditions and the natural environment which are typically beyond human ability to control (Hardaker et al., 2010; Akyoo et al., 2013). There are number of risky events which have occurred in the past few years and their effects have been significant. For instance, On January 2020, there was a heavy rainfall which occurred in Ruangwa, Liwale and Kilwa districts in Lindi region in south-eastern Tanzania. This resulted in flash floods which led to fatalities and major damage, where more than 18,000 people were affected, 13 deaths, 5 people missing, damage to local infrastructure as well as more than 495 acres of farmland were destroyed (IFRC, 29 Jan 2020). Moreover, in 2005 the community around Lake Tanganyika were also affected by earthquake. In 2011-2012 there was drought in the central regions, landslides and floods in 2011 particularly for Kilimanjaro, Arusha and Mbeya regions (UNDRR, 2018).

In a bid to protecting farmers against all these adverse events, the government of Tanzania has taken several initiatives such as provision of trainings to sensitize farmers on agriculture insurance and exempting VAT in premium paid by farmers from all agricultural insurance products and therefore farmers are encouraged to expand crop production area (Smith and Glauber, 2012)

Despite all what the Government has provided to farmers so far, uptake or adoption of crop insurance remain low(Giné & Yang, 2009; Dick et al. 2011; Clarke et al. 2016; Cole et al., 2012; Doherty et al., 2021; Lambregts et al., 2020; Takahashi et al., 2016; Mensah et al., 2017; Dercon et al., 2014; Nshakira-Rukundo et al., 2021). While this is the case, there is very limited information on what motivates certain

farmers to adopt crop insurance. This forms a basis of designing this study to fill an existing knowledge gap. therefore, study aims at determining on why there is low adoption of crop insurance among smallholder farmers and eventually suggest the possible ways to enhance utilization of index-based crop insurance (IBCI) for sustainable production in Tanzania.

1.3 Justification of the study

The proposed study is in line with the current government initiatives on national insurance policy of 2014, Tanzania Development Vision(TDV) of 2025 and Agricultural Sector Development Programme Phase II (ASDP II) which have all put much emphasis on agricultural Insurance through subsidizing premiums paid by farmers, and providing priority on agricultural transformation. The findings of this study will inform the policy makers and strategists to formulate policies which will stimulate insurance industry through addressing the challenges towards increasing demand for index-based crop insurance among farmers and also inform insurers to design innovative and demand driven insurance products. The study has also provided the recommendations on the modality for designing crop insurance products that will suit the demand of smallholder farmers, the idea is to increase the uptake of crop insurance which will eventually increase productivity and hence livelihood of farmers.

1.4 Research Objectives

1.4.1 General Objective

The main objective of this study is to assess the drivers of crop insurance uptake among smallholder farmers in Mvomero

1.4.2 Specific objectives

The specific objectives are;

i. To analyze the drivers of adopting Index based crop insurance?

ii. To identify challenges faced by insurers in the implementation of Index based crop insurance

iii. To analyze the distribution model of crop insurance product

1.5 Research questions

i. What are the drivers of adopting index-based crop insurance?

ii. What challenges do insurers face in implementing index-based crop insurance?

iii. What is the distribution model used in crop insurance product?

1.6 Significance of study

The findings obtained from this study will determine number of issues to be considered;

The study will help to identify the main causes of low uptake of IBCI and recommend the lasting feasible solution to address the identified challenge. Given that farmers search for crop insurance in Tanzania is not new nevertheless and traces its relatively long history back to 1986 when the first feasibility study was conducted by the NIC, and from many literatures, it is recommended that crop insurance is the significant mechanism for farmers to manage their production risks.

The findings will also enable policy makers to make policies/government interventions based on the recommendations for the purpose of promoting smallholder farmers participation in IBCI, this will help to have better understanding on possible reasons/factors influencing high uptake of IBCI which will assist in attracting more actors and stakeholders to venture into the insurance industry. On the other hand, the findings from this study will help the insurers to have enough knowledge on the constraints associated with the low uptake of IBCI and hence be in a position to design good products which will meet the needs of consumers. Lastly but not least, the study will identify distribution modality of crop insurance cover and hence informs the insurers to revisit their distribution modality if necessary.

1.7 Limitations of the study

The study was conducted only in one region (Morogoro) among some other regions(Njombe and Rukwa) of Tanzania where promotion of microinsurance study was done. In addition to that Morogoro is chosen among other regions because it is one of the leading region in rice production (URT, 2019). The other regions have been left because of insufficient resources (time and fund) to cover all of them in which microinsurance promotion and feasibility study was performed, so this would have given a complete picture of the uptake of index-based crop insurance in Tanzania.

1.8 Delimitations of the study

The challenge of not covering all regions where index-based crop insurance was promoted will be addressed by employing KIIs from insurance companies which offer crop insurance. The key informant officers from insurance companies will provide a short summary of the crop insurance countrywide.

1.9 Definitions of key concepts

1.9.1 Index-Insurance: Is an insurance whereby the indemnification payments is not based on the assessment of loss incurred by an individual policyholder but rather it bases on the measures of an index which is assumed to proxy the actual losses, this can take several forms like AYII or WIBI (Mahul & Stutley, 2010). Index Insurance provides payments based on the objective and independent index which operates as proxy for significant losses to crops (Seeks, 2008). According to Osumba and Kaudia (2015) Index-based insurance is an insurance in which the payout depends on a variable or a set of variables like weather variables.

1.9.2 Policyholder: Refers to any person or a company specifically designated by name as the one protected by an insurance policy.

1.9.3: Insurance: Is a contractual relationship that occurs when the insurer for a consideration (the premium) agrees to indemnify the insured for loss to a detailed subject (the risk) caused by nominated contingencies (hazards or perils). The term "assurance," normally used in England, is considered synonymous with "insurance."(IRM, 2021).

1.9.4 Premium: Is the amount of money the policyholder pays to the insurer in order to have a right of being protected in case of a loss (NAICO, 2012).

1.10 Organization structure of the thesis

This thesis is organized into five chapter. Chapter one comprises background information, problem statement, research objectives and research questions, Chapter two reviews the previous studies done in relation to the objectives of this study, the chapter touches on the empirical and theoretical frameworks as well as research gaps. Chapter 3 summarizes the methodology employed by the study, this includes

research design, study population, sample size, sampling procedures, , model specification and data analysis. Chapter four presents detailed finding of the study and discuss the analytical results given from descriptive, econometrical and content analyses. The last chapter reviews the key findings, conclusions and recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1Theoretical Framework

This study is established under random utility theory. The theory hypothesizes that a farmer's choice to participate in Index based crop insurance is determined by the level of utility s/he expects to get from that participation (Up). Since utility theory for decisions under risk is characterized by the assumptions of maximizing pleasure, and minimizing pains, farmers will always participate where their expected utility is satisfied.

Consequently, farmers will simply participate in IBCI scheme if the anticipated utility of participation (U_{ip}) is greater than that without (U_{in}) participation (Ali and Abdulai, 2010). Moreover, the decision to participate in IBCI scheme is a dichotomous one in the way that t a farmer chooses participate or not in the scheme based on his/her individual preferences as well as on-farm characteristics. Participation sometimes depends on self-selection of each farmer behaviour rather than on a random assignment to the intervention. Symbolizing the difference between the net utility of non- participation and participation for each farmer *i* gives:

$$I_i^* = (U_{ip}) - (U_{iN}) > 0$$

The equation above shows that farmer *i* will participate in a IBCI scheme if the perceived utility of participation beats that of non-participation, under *ceteris paribus*.

Utility normally depends on a number of variables, and among them, wealth is being the most important one. Therefore, the study describes utility as a function of wealth. Meanwhile wealth is a random variable, the utility function is as well a random variable, and maximizing the expected value of utility is frequently taken as the objective of an individual. So, the following equation shows the expected utility an individual is expected to gain from a list of various weights of variables (W*i*) influencing utility and the likelihoods of those variables (P*i*) as shown below.

$$E(Wi) = \sum_{i=1}^{n} Wi * Pi$$

Utility theory aims to describe abehaviour of an individual under indeterminate conditions, and the critical content is the utility function.

In general, utility is described as a satisfiaction level that a consumer obtains when buying products. Decision-makers have various responses from a particular event, some of the decision makers may be interested in the expected return, and others may care more about circumventing losses than the chance to gain. Mathematically, this can be represented through a utility function u(w), and assume every individual finds to maximize his/her utility expected which is basically determined by risk perception.

2.2 Conceptual Framework

Based on the study conducted by Tsikirayi et al. (2013), their study was looking on the uptake of agriculture insurance in the entire agricultural sector in Zimbabwe (See figure..). The authors grounded their framework on what determine the demand

of agriculture insurance products. The framework highlighted factors like socio demographic characteristics, Individual household characteristics and market and institutional characteristics to the decision of farmers to purchase agricultural insurance. In this study, factors such as age, sex, education, income, land ownership, farm size, distance to the main road, distance to the market, experience with IBCI, awareness in IBCI, Credit access are used to measure decision to adopt crop insurance among farmers

Household farmers with higher level of education are assumed to have high awareness and understanding on crop insurance and hence are likely to avail for insurance. The same to land owners, this is because land owners are assumed to own a stable income compared to the tenants, therefore they have sufficient funds to adopt insurance. The study also considers that credit access has positive influence to the uptake of crop insurance because farmers are assumed to have several sources of money for paying premiums. Distances to main roads and market are also considered to have negative influence to the uptake because as the distance increases the farmers' access to insurance services decreases and the risks of taking produce to the market increases, therefore, it affects the uptake. Based on the available literature, this study assumed that awareness with crop insurance is positively associated with farmers' decision to adopt crop insurance. On the other hand, older farmers with longer farming experience with index based crop insurance are assumed to have less likelihood to purchase crop insurance because they seem to be risk takers who have been exposed to several agricultural risks for a long period of time. As a result, these farmers are less likely to copy for innovations.

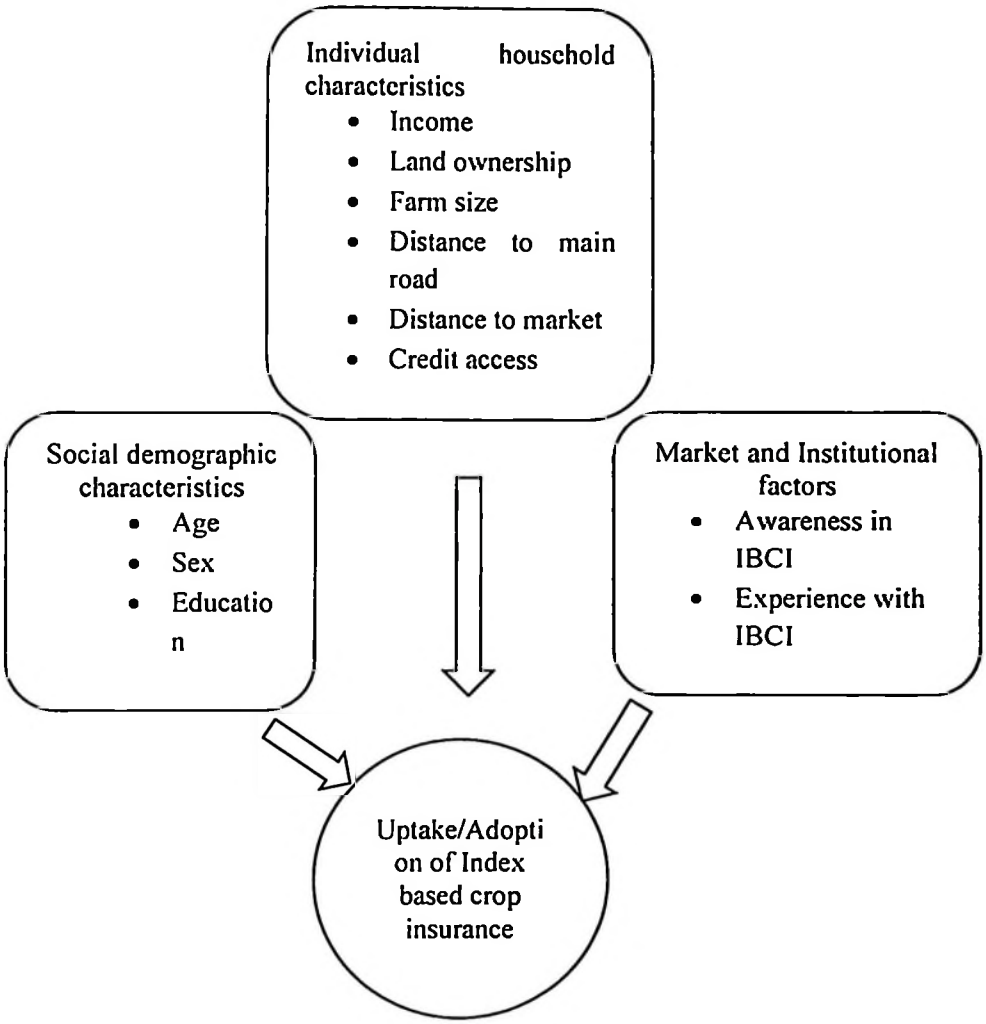

Figure 2: ***Conceptual framework for IBCI drivers for its uptake***

Source: Modified version of Tsikirayi et al., (2013)

Household income (on-farm and non-farm) among the farmers was assumed that It has a positive relationship with crop insurance adoption. As explained above, farmers with higher levels of income are more likely to adopt insurance because they have stable and sufficient funds to purchase insurance. . This is in acknowledgement of the fact that agriculture insurance programs in Tanzania are all partially subsidized by the government. The amount of premium subsidy exempted from VAT and hence

lowers the amount of premium a farmer is supposed to pay. Hence, this study assumed that the higher the premium subsidy, the higher the chance that the farmer will avail rice crop insurance. Finally, this study has taken into account the effect of other risk management practice on crop insurance uptake like crop diversification this study assumed that farmers who are engaged in other risk management practices are less likely to uptake rice crop insurance.

2.2.1 Relationship between crop yield and weather

Under ceteris paribus, a crop yield function is explained by weather which includes several environmental variables including the following;

Precipitation: This is a fundamental variable which determines the crop production, because of its significance, precipitation do appear almost in all models to explain weather-crop yield. Both excessive and inadequate precipitation affects the plant growth through erosion and runoff, crop endorsement which is caused by inadequate moisture which eventually leads to low yield, and delayed harvest and planting (Geigel & Sundquist, 1984)

Temperature: It is a variable which is also included in in some weather-crop yield models to determine the crop productivity, usually temperature is measured to record loss of water in form of vapor from the plants and soil surfaces (Geigel and Sundquist, 1984).

2.3 Empirical Literature

Since the study is on uptake or adoption of crop insurance, it is important to capture firstly literature in that area, and then the impact of crop insurance will come later on.

According to Varadan and Kumar (2012) conducted a study on the impact of crop insurance on rice farming in India, the authors usedSID to determine the crop diversification extent practiced by farmers. The findings have shown that crop insurance has effectively absorbed the production risks and encourage farmers to focus more on fewer number of profit-making crops instead of broadening their energy and resources to cover many crops. Crop insurance has also influenced the application of high-value inputs like fertilizers, seeds, and chemicals for plant protection which contribute to the increase of returns from rice farming. It was also realized that factors such as education, access to loan, religion and off-farm income had significant influence on the uptake of crop insurance, however the study did not look at other variables like age, land ownership and distance from the weather station.

Smith and Glauber (2012) assessed the evolution of agricultural insurance in developed countries, the study found that government intervention through subsidies have enabled the agriculture insurance to evolve from single or named peril products to multi-peril crop insurance. The study expressed that now days most of the agricultural insurance products are heavily subsidized by the governments, the study also examined evolution of the supply and demand of agricultural insurance markets, political economy, economic welfare, , and trade implications of public and private agriculture insurance in high income countries. However, the study never explicitly explained the underlaying factors for evolution.

Hussain et al. (2022) assessed the willingness to pay for index-based crop insurance among farmers in Pakistan , for cash and food crops of rain-fed areas using two

econometric models which are Gustafsson-Wright (2009) model and Propensity Score Matching (PSM) model. The PSM model showed that farmers were satisfied with the index based crop insurance and willing to increase the area under food and cash crops, for the case of participation, the findings obtained indicated that economic status, household assets, and membership of community organization have significant influence on the farmers' willingness to pay(WTP) for higher insurance premium, also the coefficients of age and education had significant influence, these results were in line with other studies such as those of McCarthy (2003) and *Sarris et al.* (2006) on the WTP for crop insurance in developing countries. Since this study used a combined sample of small and large household farmers, the current study is going to base on smallholder farmers of rice.

Ntukamazinaet al. (2017) evaluated the challenges, opportunities and prospects for uptake of index-based agriculture insurance in sub-Sahara Africa (SSA), the study focused on four key issues which are insurance products available for farmers, factors which effect farmers to purchase insurance covers, challenges farmers face in accessing insurance products, and opportunities to enhance the uptake in SSA. The findings were as follows; the study revealed that index-based crop insurance, area yield index insurance and index-based livestock insurance were implemented in the region, the uptake of insurance product was found to be positively influenced by on-farm income/savings, family size and literacy, the study also revealed the challenges towards accessing insurance products as quality and availability of weather data, capacity building to stakeholders, weakness in financial facilities and regulatory environments and lack of innovation for local adaptation and scalability. The findings of the study done generalized all sub-Sahara African countries, so for

specificity, the current study will analyze the factor affecting uptake of index-based crop insurance in Tanzania.

Njue *et al.* (2018) estimated the uptake of crop insurance among smallholder farmers in Kenya, the study employed descriptive analysis to determine frequencies and trends of insurance uptake over several years, also Heckman model was used to examine the households' decisions to utilize crop insurance and its intensity. The findings showed that there is a very low and declining uptake of crop insurance, this was caused by lack of understanding of insurance concept among smallholder farmers, basis risk also hindered the uptake of crop insurance because most of the farmers showed high level of dissatisfaction with the payment of claims, inadequate training and awareness on crop insurance, automated density of weather stations and ownership of saving account were also the integral factors to enhance crop insurance uptake.

Dougherty et al. (2020) examined climate change and the demand of index insurance in Tanzania, the study employed method of framed field experiment (FFE) to collect data from a sample of 471 smallholder farmers and measure willingness to pay (WTP) for insurance, a study estimated a structural learning model based on a Bayesian change point inference method and singly identified the effect of expectations, learning, ambiguity and recency bias on insurance demand, also the study simulated the supply side of the insurance market and findings obtained showed that reduced uptake rates were mostly caused by climate change however the demand may increase if the seriousness of climate change is adequately low

CHAPTER 3: METHODOLOGY

3.0 Introduction

The purpose of any research is to generate knowledge, either by theory testing or formulation. To attain this, the methodological choices that the researcher has to follow must be transparent, so that the reader can clearly see the position of the researcher during the development of knowledge. This chapter introduces the area of study, explaining the methodology approach which was taken and discuss why such approach was considered as appropriate one. The chapter also outlines the methods and designs used as well as explaining how data were handled and analyzed.

3.1 Study Area

The study was conducted in Morogoro region (Mvomero district) as one among the regions where feasibility study on index-based insurance was conducted and is one among the leading rice producers in the country (URT,2019). The region has a population of about 2.2 million people according to national census of 2012, and it is located in the eastern zone of Tanzania. This place was also chosen because it has significant number of farmers who have crop insurance compared to other places within the region.

3.2 Research design and sampling procedure

This study used a cross sectional research design whereby data were collected from a sample population at a specific point in time. The study was carried out in five villages purposely chosen which are Dakawa, Sokoine, Luhindo, Mtakuja and Milama from Mvomero district, to capture the diversity of farmers who use index based crop insurance, the mentioned villages were selected basing on the number of

farmers using IBCI. Purposive sampling is defined as a sampling type whereby the researcher selects sample based on the need of the study (Sandelowski, 2000).

The participants of the study were chosen using random sampling technique. Random sampling was used to selected farmers who embraced crop insurance from the list of farmers given by the ward agricultural officer. then after the same technique was employed to select farmers who don't participate in IBCI from the long list of farmers without crop insurance. Random sampling gives an equal chance for an individual to take part in the study. The target respondents of the study were the farmers who benefit from using IBCI as well as those who do not.

A total of 102 farmers households were selected to participate this study. 50 farmers were randomly chosen from a list of 120 farmers who participate in IBCI in all of the five villages mentioned, and 52 farmers were randomly selected from a long list of farmers in each village without crop insurance. A total of 10 farmers in each village were randomly selected from the list of farmers in each particular village and then 2 more farmers were purposively selected as leaders from the farmers groups, making a sum of 52 farmers without IBCI. Since this study based both in demand and supply sides, 5 managers from five insurance companies which offer crop insurance were purposely selected as key informants. The overall sample size of the study was determined basing on the availability of farmers who have adopted IBCI and the equivalent number of those who haven't adopted was selected.

3.3 Data Collection

A semi structured questionnaire and Key informant interview (KIIs) were used during the interviews, a questionnaire contained closed ended questions as well as questions that need probing(Appendix I) along the way if further information was

required. Semi structured interviews are flexible compared to structured interviews and the aim was to explore the topic more flexibly and to allow the respondents to express their thoughts and ideas in their own words so allowing for a much freer exchange of information between researcher and respondents (Warren, 2002). The questionnaire was divided into two main themes; it is important to note that two or more objectives were falling under one theme. Theme one had questions that mostly targeted households characteristics, while the other theme targeted the information about weather index based insurance. Furthermore,, Key informant interviews were taken sing a check list of questions (Appendix II) used to collect data from insurers which offer agriculture insurance products for the purpose of knowing challenges encountering the implementation of IBCI.

3.4 Data Analysis

This study used a combination of approaches in its analytical framework. This included descriptive statistics analysis, econometric analysis and content analysis to depict challenges faced by insurers in implementing IBCI, drivers for adopting IBCI and distribution modalities respectively, then SPSS was used to clean and analyze data.

3.4.1 Drivers of adopting Index based crop insurance

This objective was analyzed using binary logistic regression model, this model is a special form of linear regression analysis used when there is binary response and not continuous, and the explanatory variables are qualitative or quantitative variables (Hair et al., 2010). It was primary proposed in the 1970s to overcome difficulties of ordinary least squares OLS regression in dealing with binary outcomes (Peng et al., 2002). BLRM uses the binomial probability theory which represents to

have only two values to predict the probability (p) whereby 1 is for adopter and 0 for non-adopters of IBCI. Several factors as shown below influence the adoption of IBCI as specified in the model.

Model specification

Following the Gujarathi (2022), the model is specified as below:

$Ln (P_i/(1-P_i)) = ß0 + ß_1 X1 + ... + ß_i X_i + e_i$ ....(1)

Where,

P_i = Probability of adopting index-based crop insurance.

$1-P_i$ = Probability of not adopting index-based crop insurance.

ß0 = Intercept

ßi =Regression coefficient

Xi =Independent variable

ei =Error term

The model can be written as follows including variables

Yi = ß0 + ß Agehh + ß Eduhh + ß Dist_market + ß Dist_road + ß Cred acces + ß Cropdiv + ßIncome + ßExpinIBCI + ...(2)

The independent variables are identified as factors affecting adoption of crop insurance are: Access to credit, Awareness of IBCI, Years of education (years), distance from the main road, Income (Annual household income), Age of the respondents (years), Membership in cooperatives/association, Farming experience (years), Land ownership, Experience in IBCI, Farm size, Gender, and Crop diversification.

3.4.2 Identifying challenges faced by insurers in the implementation of Index based crop insurance

The second objective was analyzed using content analysis, where managers from each insurance company described how the crop insurance market operate, challenges they face in dealing with it and suggest measures to improve the crop insurance products in the future.

3.4.3 Analyzing the distribution model of crop insurance product

This objective was analyzed by descriptive statistics such as frequency tables, percentages and means, this was done together with the analysis of social-economic and demographic characteristics of farmers households using SPSS software. Below is the description of the variables hypothesized to influence a farmer adoption in IBCI in Mvomero district.

Table 3.1: Variables used in the analysis

Variable name	Description	Unit of measurement	expected sign
Insure	If participants are in crop insurance scheme or not	Dummy: 1= yes, 0 = no	
Hheadage	Age of the household head	Number of years	+
Hheadgender	Gender of the household	Dummy: 1= Male, 0 = Female	-
Creditaccess	Access to credit		+
Landowenership	Land owned by the household head	Dummy: 1= yes, 0 = no	-
Expwith IBCI	Years of experience with IBCI	Dummy: 1= yes, 0 = no	+
Income	Household income	Earned amountfrom household activities	+
Distancetoroad	Ditance to the main road	Km	-
Hheadeducation	Years of education of household head	Years	+
Farmsize	Farm size		+
Distancctomarket	Distance to the market	Km	-
Awarenessininsurance	Household head awareness in crop insurance	Dummy: 1= yes, 0 = no	+

3.5 Diagnostic Test

Prior to regression modelling, some diagnostic tests were caried out on the independent variables to assess the fitness for their inclusion in the model. The following diagnostic tests were undergone.

3.5.1 Test for multicollinearity

The presence of multicollinearity indicates that there is a perfect relationship among or all independent variables of the regression model (Wooldridge, 2000). When there

is multicollinearity, regression coefficients are unknown and their standard errors are infinite or, if definite they are exposed to commit type one error (Green, 2003). This implies that it is hard to estimate the coefficients with accuracy they might have smaller t values and even incorrect signs. This study examined multicollinearity in the independent variables using Variance Inflation Factor (VIF). One of the importance VIF rule is that if VIF is greater than 5 for all independent variables, it means that linear relationship among the variables was negligible therefore they can be included in the logistic model. Additionally, , the results from Pearson correlation matrix (See Appendix IV& V) indicated that no strong linear relationship between the variables because none of them was close to 1 or -1.

3.5.2 Testing for heteroskedasticity

Heteroskedasticity is essential hypothesis in classical linear regression, it means that the disturbance term has a constant variance (Gujarati and Sangheeta, 2007). When there is heteroscedasticity, Ordinary Least Square (OLS) estimates inefficient asymptotically. Heteroskedasticity was tested using Breusch-Pagan test. The chi-square was 0.32 with one degree of freedom and statistically significant (p=0.000)

3.5.3 Goodness of fit test

The goodness of fit test shows how good the probabilities produced by the model perfectly reflect the actual behavior of how well the regression model fits the data (Hosmer et al., 2013; Gujarati and Sangeeta, 2007). A good fit test for the logistic regression model is shown by a statistically insignificancy of Hosmer-Lemeshow chi-square value (See Appendix V)

3.6 Research Ethics

Since the research involved interview with people, it is necessary that ethical issues to be considered. In this research several steps were taken to make sure that ethical issues are observed. In this regard, a consent form was (See appendix III). This form was translated in Swahili so as to make respondends easily read and understand, this was done so as to ensure they are fully aware of the consents. The respondents were required to sign the form in order to show their consent to participate in the study, and then one copy remained to the participant and another one was taken by a research for a record.

CHAPTER 4: RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents the findings of the study, the questions in the questionnaire as well as KIIs checklist were grouped into two themes with all objectives of the study containing in these themes. The first theme was about household characteristics describing socio-economic and demographic profiles of the farmers who participate or not participating in IBCI. The second theme was about general information about index-based insurance, challenges in its implementation and the modality in the distribution of its products.

4.1 Socio-Economic Characteristics of the households

Tables 4.1 and 4.2 present various social economic characteristics of the farmers in Mvomero district of Morogoro region. The sample size used for this study was 102 farmers among them males are 51% and females are 49% while those who participate in IBCI were 50% the same number as those who do not participate. The mean age of the farmers interviewed is 40.23years with a minimum of 29 years and maximum of 62 years, this means that young people are risky averse compared to old ones, so as the age goes, the likelihood to buy insurance cover decreases, this might be due to the reason that older people have higher experience with agricultural risks compared to young one, so they are capable of handling the risk in other local ways. The average number of years a farmer to have an experience in the participation of IBCI is 1.0588 years with a minimum less than a year for new entrants and a maximum of 4 years for those with the highest experience in the IBCI participation.

This implies that, those who have experience in adopting the IBCI scheme for some years have higher likelihood to continue buying insurance covers compared to those with less years of experience in IBCI. The study also found that an average distance from farmers farms to the nearest market is 2.53km with a minimum distance of 1km and 4km for maximum distance which means that, farmers tend to adopt insurance covers if their farms are situated far away from the nearest market in order to protect themselves from risks involved in taking produce to market compared to those located nearest to the market. For the case of distance from home to the paved road, it was found that the average distance is 2.68km with a minimum of 1km and a maximum of 4km. As the distance from home to the paved road increase, the adoption of IBCI decreases for participants, farmers located near paved roads have better access to insurance agents which are the ones selling covers to the farmers than those who are far away from the main roads.

The study also found that there is a high income variation of more than TZS 200,000 in terms of average monthly income among farmers as they differ in other sources of income apart from farming. The highest is TZS1,200,000 whereas the lowest is TZS 20,000 and the average monthly income is about TZS 244,676.47, this showed there is higher variation of income among the farmers and hence affect the uptake largely way in a negative.

In terms of land ownership, there are farmers who don't own the land and the ones who owns, the minimum number of acres land owners own is 1 acre and the maximum land owned is 15 acres with an average of 4.17 acres for every farmer. In the case of education level, as shown in the Table 2, 49.0% of farmers had primary school education, 31.4% had secondary education followed by 4.9% of respondents

with a certificate, 13.7% had a diploma and 1% had undergraduate degree, so this means that majority of farmers in Mvomero district have primary education

Table 4.1. **Summary Statistics**

Variables	Minimum	Maximum	Mean	Std. Deviation
Age of the respondent	29	62	40.23	13.643
Years of experience in farming	0.00	4.00	1.0588	1.16741
Kilometers from your farm to the nearest market	1.00	4.00	2.5294	.71346
Kilometers from your home to the paved road	1.00	4.00	2.6961	.83000
Do you own a land?	0	1	.59	.495
Size of the land owned in acres	1	15	4.17	2.203
Average monthly income	20000.00	1200000.00	244676.4706	209877.52967

Source: Survey data (2022)

Table 4.2: Distribution of sex, education level and Insurance status

Variables	Categories	Frequency	Percent
sex of respondent	Female	50	49.0
	Male	52	51.0
Education Level	Primary level	50	49.0
	Secondary level	32	31.4
	Certificate	5	4.9
	Diploma	14	13.7
	Undergraduate	1	1.0
	Postgraduate	0	0.0
Insurance adoption status	No	51	50.0
	Yes	51	50.0

Table 4.3 presents the findings of the factors influence participation in IBCI in Mvomero. The characteristics of insured householders were not statistically significant unlike from their counterparts with no insurance except in terms of age, farming experience with IBCI, distance to the nearest road, and income levels. The Hosmer and Lemeshow's chi-square testing the goodness-of-fit with p=0.000 at 14 degrees of freedom. The p-value of the test was insignificant showing that the model fitted well the data . Out of 9 variables, 4 were statistically significant two of which had unexpected signs.

Table 4.3 Description of the factors influencing participation in IBCI

Variables	Coef	S.E.	Wald	Df	Sig.	Exp(B)
Age of the respondent	-.0802	.0485	1.65	1	0.098*	.462
Education_level	-.265	.183	2.095	1	.148	.767
Farming Eperience_with_IBCI	2.275	.627	13.178	1	.000***	9.726
Distance_market	.440	.709	.385	1	.535	1.552
Distance_road	-1.323	.537	6.083	1	.014**	.266
Access_credit(1)	-1.313	1.032	1.619	1	.203	.269
Awareness_Insurance	.819	.570	2.069	1	.150	2.269
Problems_experienced	.122	.533	.052	1	.819	1.129
Land_ownership(1)	.948	.746	1.618	1	.203	2.582
Land_size	-.096	.217	.198	1	.656	.908
Crops_Diversification(1)	.258	.776	.111	1	.740	1.294
Monthly Income	.000	.000	6.601	1	.010**	1.000
Constant	.555	3.725	.022	1	.881	1.743

Source: Survey data (2022)

***sig@1%; **sig@5%; *sig@10%

Below is the discussion of several factors which affect adoption of IBCI among farmers

Distance was measured in kilometers as acontinuous variable travelled by farmers in order to get insurance services from the insurance agents, the average distance to the paved road was significant with negative influence to the adoption of IBCI. As the

distance from home to the nearby paved road increase, the adoption of IBCI decreases for adopters than non-adopters and statistically significant (p=0.014). This indicates that households located far from the road had a lower chance of joining in IBCI than those located next to the road. Farmers located nearby paved roads had better access to insurance agents which are the ones selling covers to the farmers than those who are far away from the main roads. This occurs when farmers are unwilling to travel longer distance following for insurance service providers (agents) which are normally located in town where there are main roads. This finding concides Birinci and Tumer (2006) who found that farmers living more than 10 kilometers from the paved road had a lower chance to join in agricultural insurance in Turkey. The authors clarified that, this was so because as the distance between the the paved road/town and village increased the number of farmers with agricultural insurance knowledge decreased. However, Ali (2013) found a positive relationship between participation in an insurance scheme and road access in Pakistan because access to roads helped farmers in making more income and gaining access to agricultural inputs more easily and therefore all the climatic risks associated in agricultural activities were diversified by their engagement in other non-farm activities.

Age was measured as a continuous variable in years. It was noted that farmer's age was influencing adoption of IBCI negatively. This implies that older farmers have gained enough knowledge in agricultural production and hence are more likely to accept risks than young farmers, this means that the negative influence of age is because of the effect of changing life cycle of the farmer, since as farmer growing

older, they achieve more experience in farming through learning by doing. This finding concurs that of implication of knowledge gained over time and plays an important part in assessing willingness to adopt an innovation (Feder et al., 1985; Baidu-Forson, 1999). Previously, studies reported contrary results on how age and insurance participation relate. Older farmers are expected to participate more in the insurance scheme compared to the young ones because the older farmers are likely to have more resources. Nevertheless, a decrease in participation is expected at an old age. Abdulmarik *et al.* (2013) found that farmers participation in agriculture insurance was significant and positively influenced by age in Nigeria. Sargazi *et al.* (2013) found that the older farmers in the households were willing to purchase crop insurance in Iran compared to young ones, and thus the age of the household head augmented participation in agricultural insurance schemes

Years of experience in IBCI was measured as a continuous variable determining the number of years the farmer is aware and the benefits obtained from it since the existence of the insurance scheme. The number of years of farmer's experience with IBCI was found to be significant and positively associated with farmers' adoption decision (See Appendix VII). Farmers with many years of experience with WIBI seemed to have better understanding of the IBCI scheme and consequently had a higher chance of participating compared to those with less experience, this is because farmers who are more knowledgeable with agriculture insurance is likely to adopt than the one with less knowledge. This finding coincides with findings of many other researchers including Mohammed and Ortmanna (2005) who established that, the more information and awareness farmers get about livestock insurance the

greater the probability of participation in Eritrea. Enough experience on technology or innovation is considered to be one among the reasons enabling farmers to evaluate and better understand the technology or innovation prior to uptake. (Hill *et al.*, 2013; Hassanpour *et al.* 2013) similarly found a significant and positive effect of farmers' experience in the decision to participate in insurance scheme in Iran. Coble and Knigh (2002) had the same thoughts about the great role played by years of experience with insurance enables farmers to realize the associated benefits in Nigeria. Fallah *et al.* (2012) realized that more knowledge farmers had on insurance led to wider insurance coverage compared to those with less knowledge in Iran. Jarvie and Nieuwoudt (2010) established that older farmers with more experience in farming in South Africa were risk-averse than the rest and hence struggled to reduce risk through insurance. Thus, as risks increased, risk-averse farmers purchased more insurance.

Monthly Income was measured in terms of amount a farmer earned as a continuous variable. The variable turned to be significant and positively influencing the adoption of IBCI (See Appendix VIII), It was found that farmers who have higher income have a higher likelihood to adopt IBCI than those with less income, and the adopters were seen to also engage themselves on other non-farm activities to generate their income to get more resources particularly investing in new technologies and participating in new agricultural interventions. This finding coincides that of Fallah *et al.* (2012) who as well found that increase in income led to increase the farmers participation in in agricultural insurance in Iran, this happens due to the fact that higher income farmers had more because farmers with higher incomes had more

funds to capitalize in new interventions than to their counterparts with a smaller income. According to Sargazi *et al.* (2013), higher income farmers had a tendency of securing their farms with agriculture insurance in Iran

4.2 Crop insurance products

Crop insurance in Tanzania is offered by several insurance companies wich are UAP Insurance Tanzania Limited, MGen Tanzania Insurance Company Limited, Jubilee Insurance Company of Tanzania Ltd, National Insurance Corporation of Tanzania (NIC) and Assemble Insurance.

The market has experienced a certain level of product innovations. For instance, in case of weather index insurance, insurers provide covers to both small and large scale farmers with all weather related risks such as drought, excess rain, diseases, insects , and fire. provision such covers is done directly to farmers or through agents/brokers and sometimes through partnership with some financial institutions including banks like NMB, CRDB, TPB, and NBC. Discussions with insurance companies that are offering agriculture insurance showed that in order to reach smallholder farmers partnerships is very important aspect that needs to be considered.For example, there are some insurance companies like MGen and UAP which partner with aggregators and banks to reach farmers particularly low income market segments. See explanation in the case below.

Crop insurance by UAP

UAP provides crop insurance that covers various perils resting from weather condition caused by hail storm, drought, fire, t, frost damage, excessive rainfall, flooding and lightning. In 2020 UAP Provided crop insurance cover to rice farmers in Mvomero, Morogoro region partnering with rice aggregators. UAP has been paying several claims resulting from drought, floods and animals, the major challenges the company face are i) Less awareness among farmers in complying the insurance laws and regulations, ii) high administrative costs especially in assessing losses. The UAP underwriter suggested that, they should consider designing products which are embedded and establish a strong distribution channel that will also perform an activity of creating awareness to farmers

The second theme was about general information about index-based insurance, challenges in its implementation and the modality in the distribution of its products. This theme addressed both second and third objectives, and the second objective was analyzed using descriptive statistics to show percentage of challenges faced by insurers in implementing IBCI. Despite the evident benefits of the index based insurance products, there are still challenges inherent with index insurance products (World Bank, 2010). The International Finance Corporation (IFC) presented that, poor financial facilities and weakness of insurance regulatory environment are considered as challenges that hamper development of agriculture insurance market in Tanzania. The study identified some other challenges such as quality and availability of historical weather and yield data, basis risk, and, capacity building of stakeholders (farmer, insurer and regulator).

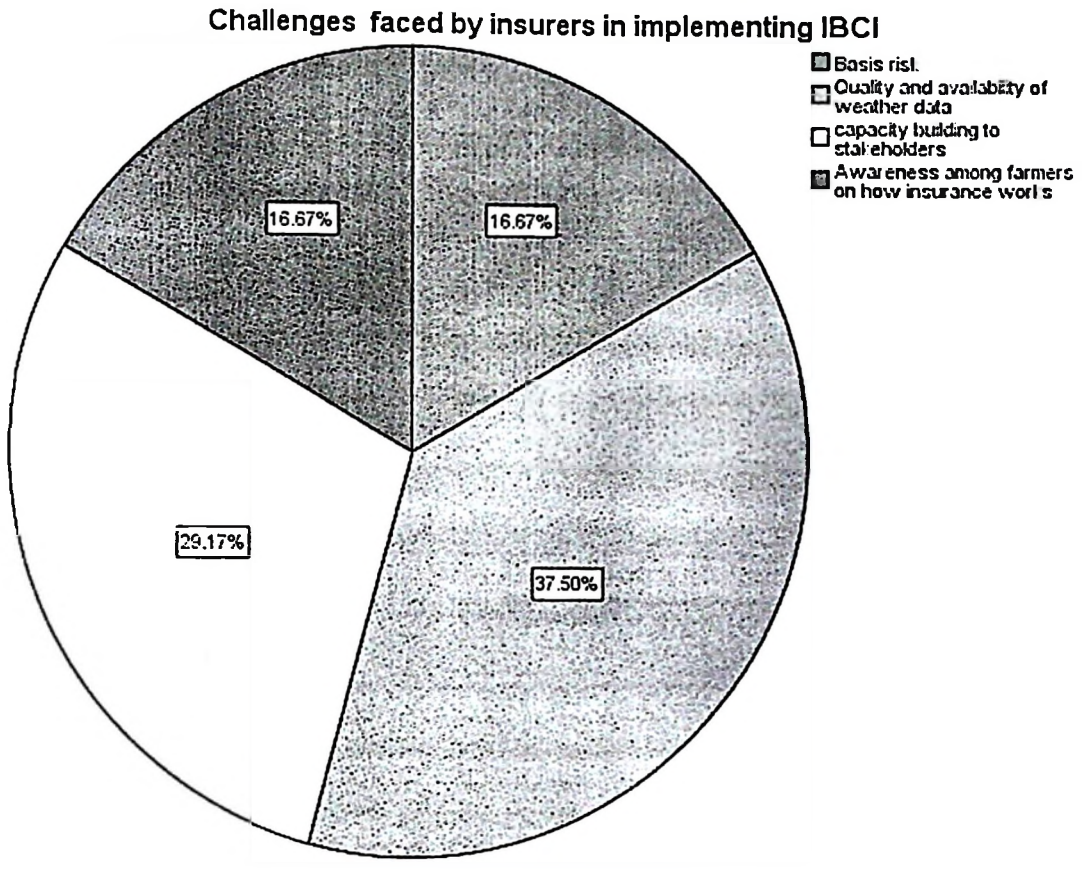

Figure 4.1 Challenges faced by insurers in implementing IBCI

The third objective was analyzed by using content analysis. A total of five insurance companies underwiring agriculture insurance were interviewed to determine their distribution models, it was found that most of the agriculture insurance companies in Tanzania use brokers and traditional sales agents to reach their clients. This sales-driven distribution model usually fails to meet some criteria such as having access to a large number of potential clients, distribution costs to the insurers, lability to improve clients' understanding of the insurance products, and the trust of the distribution channel to the community and hence this may not meet the needs of

smallholder farmers. Many smallholder farmers need much more engagement and adequate but simplified information to make purchase decisions. Many farmers were seen not to be satisfactory with the traditional sales agents claiming that it is hard for them to engage. Therefore, there is need to develop more innovative distribution models and channels to reach many smallholder farmers with microinsurance solutions. It is important to consider alternative partnerships including local NGOs, community-based organizations and community banks. Below are some of the quoted conversation given by insurers on the modality they use to distribute their agricultural insurance products.

Case 1: Crop insurance by MGen Tanzania

MGen insurance company provides agriculture insurance services in corners of Tanzania, farmers are covered based on the kinds of risks they want to be covered. "*We have been distributing our agriculture insurance products mostly through local agents who are based those areas where farmers are, though sometimes we partner with Banks to cover farmers who have borrowed money for agriculture activities. The challenging part in distributing agriculture insurance products, is that we as insures we are failing to capture a wide base of customers because of high costs we incur in paying the agents*" Source: Interview with Dina Joseph, Actuarial Officer

Case 2: UAP Insurance

UAP Insurance in Tanzania is among the best insurance companies which offer agriculture insurance, the company has gone extra miles to provide training annually to sensitize farmers about agriculture insurance. "*Based on the nature of the farmers,*

it is very challenging to reach customers because of the areas they are, so as UAP we have developed a network local agents who are one among the famers to act as our agents in connecting farmers with us, this sometimes reduces operation costs towards this business''. Source: Interview with Prosper UAP Underwriter

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study aimed at determining the drivers of adopting crop insurance among smallholder farmers with the objectives of analyzing the drivers of adopting Index based crop insurance, identifying challenges faced by insurers in the implementation of Index based crop insurance and analyzing the distribution model of crop insurance product. Thus, The factors influencing uptake of IBCI have been described and provided a basis of presenting a relevant conceptual framework. A BLRMwas used to represent drivers for uptake to whether or not to participate in IBCI, and also challenges as well as distribution model were well assessed using descriptive and content analyses.

Since agriculture is a natural activity and overly dependent in weather conditions which mostly affect the agricultural sector performance. Weather index-based insurance (WIBI) was introduced to cope with losses farmers get due to weather changes in Tanzania. There were few numbers of research done since the operation of WIBI started in the country, so there is less information associated with the status of WIBI in Tanzania. This study was done to understand performance of IBCI, drivers influencing uptake, challenges faced by insurers in implementing IBCI as well as insurers distribution model in reaching their potential clients. Better understanding of all these components would cause to more informed decision(policy implication) as a result of clearly understanding ways of broadcasting and uptake of the IBCI among farmers.

The conclusions emanating from this study indicate that WIBI in Tanzania is expanding since there are some efforts been made to promote it, and the following are salient conclusions:

1) IBCI is a risk management tool which is potential in the agricultural sector to cope with the weather related risks.
2) The study found that majority of farmers are lacking adequate knowledge of insurance services, though few of them were found to be aware of IBCI declaring that insurance officers do visit their cooperatives at the beginning of each season inviting them to buy covers, however they said to have not been taught more about it.
3) Distance from farmer's home to the nearest road was found significant at 0.014 between participants and non-participants especially in accessing insurance services from the traditional agents, farmers who lived nearest to the main road had positive influence to adopt insurance than their counterparties
4) Framers involvement in IBCI is still low, however there few of them who have capitalized in insurance in all production stages, this was noted from farmers that payouts they receive from insurance companies don't reflect the losses they have got and this is caused by the ward agricultural officers who have been given powers by insurance companies to assess the losses occurred immediately after happening of the loss event, so this was found to be a discouraging factor.
5) Insurance companies prefer much farmers who participate in irrigation scheme than those who are not in it, this is because in the irrigation scheme

the exposure to risks is minimal compared to the areas out of the irrigation scheme. In addition to that monitoring of areas outside the scheme is complex than within the scheme

6) The study found that, the main determinants of adopting IBCI in that particular study areas were distance to the paved road, income, age and number of years experiencing with the insurance scheme among farmers.
7) The study found that farmers who participate in IBCI had higher incomes compared to their counterparts
8) The distribution model in rural areas is not suitable for farmers, this is because, partners who sell the insurance covers do not have adequate knowledge of insurance and their social life sometimes affect others to purchase insurance covers to them

5.2 Recommendations

The recommendations emanating from the conclusions above are as follows;

1) Since it is seen that the participation in IBCI led to increased household income, more efforts are required to promote the adoption of crop insurance by farmers. Trainings, public seminars, and media advertisement on crop insurance should emphasized to raise farmers awareness and knowledge about WIBI scheme, furthermore the dissemination of agriculture insurance schemes should be increased through agriculture extension officers, insurance companies and its allies
2) Insurance companies should consider developing multiple bundles of products as one way of finding solutions to multiple challenges and risks

facing farmers. Since the agricultural insurance market is still infant in Tanzania, products designed should intend to address a range of risks farmers face.

3) Insurers should consider developing innovative distribution and delivery models (Figure 2) through their partners so as to address weather related perils and use the partners to to promote these products, this will lead to sustained awareness creation and product knowledge dissemination.
4) Loss adjustors should be appointed and trained appropriately by insures rather than relying on ward agricultural officers to assess the losses and recommend amount to be paid, this discourages farmers to participate in insurance schemes.

5.3 Area for further research

1) Taking into account the significancy of IBCI and its impacts on farmers household income in Mvomero, there is a great need of undertaking similar study in other areas of Tanzania for the purpose of generating specific information applicable for that particular area. This information generated will inform the policy makers, civil society organizations and insurance service providers to strategize and promote uptake of crop insurance nationwide.
2) This study did not effectively discuss the challenges farmers face in understanding insurance concept generally, and indemnification ways towards loss compensation

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APPENDICES

APPENDIX I

Appendix I: FARMER'S QUESTIONNAIRE

Enumerator's name..... Questionnaire number.....Date.....

A) Households Characteristics

1. Respondent name(Optional).....Phone number.....
2. District.....Ward .....Village.....
3. Age.....
4. Occupation.....
5. Education level....

   Primary school [ ] Secondary school [ ] Certificate Diploma [ ]

   Undergraduate [ ] Post Graduate [ ] Other (*specify*) [ ]

6. Gender: Male [ ] Female [ ]
7.
8. Are you insured? Yes [ ] No [ ]
9. Experience farming in IBCI (Years).....
10. How many kilometres from you farm/home to the nearest market? .....
11. How many kilometres from you home to the paved road? .....

12. Membership to farmer organization

a) Are you a member of a cooperative? Yes/ No

b) When did you join the cooperative (Year).....

c) Functions of the cooperative:

i. Production and marketing of agricultural inputs (seeds, pesticides, etc)
ii. Input supply(fertilizer, seeds, etc)
iii. Gives loans
iv. Is for savings
v. Other(specify) .....

d) Does your cooperative get involved in weather index-based agricultural insurance?

Yes [ ] No [ ]

13. Do you have access to credit? Yes [ ] No[ ]

14. If yes specify

Family and friends [ ]

Informal saving and credit groups [ ]

Microfinance institutions [ ]

Banks [ ]

Saccos [ ]

Other (specify).....

B) General Information about Weather Index based Insurance (Particularly IBCI)

15. When did you first hear about the insurance scheme (Year)?

16. Where did you first learn about WIBI?

17. What kind of crop risks do you usually experience in this area?

Types of Loss	Estimated Monetary Value	Frequency of Occurrence

18. Other types of problems encountered in rice farming

i. .....

...

ii. .....

...

iii. .....

...

iv. .....

19. What are the benefits of crop insurance?

Payouts [ ]

Access to credit Increase area under cultivation [ ]

Access to extension services [ ]

Increase income [ ]

Other (specify).....

20. Any disadvantages? Specify.....

21. How is the insurance paid? .....

22. Who pays the insurance? .....

23. To whom do you pay? .....

24. Have you experienced any problems with IBCI program? Yes/ No

25. What kind of problems?

.....

26. Have they been able to resolve those problems? Yes/No

27. Through which channels or how? .....

28. How many years have you been insured?

.....

29. Generally how do you rate weather index insurance services?

Very bad [ ]

Fairly bad [ ]

Bad [ ]

Good [ ]

Very good [ ]

30. How many times were you visited by an extension agent in the last 12 months?

31. Have you ever received any kind of training on the index insurance? Yes/No

32. Land ownership

    a) How much land do you own in acres?

    b) Do you have a title deed for this land?

    c) Do you have any cash crops?

    d) How much land is used for rice cultivation?

33. What are your other sources of income?

    Rented out land

    Sell of livestock products

    Off-farm labour income

    Non-farm agribusiness income (shop, tailoring, others)

    Pension income

    Remittances from a family member

    Other (Specify).....

34. What process do you use in purchasing IBCI

35. How long does it take to get an insurance cover

36. What costs do your incur in the processing of purchasing insurance cover

S/N	Name of cost	Amount
1		
2		
3		
4		

APPENDIX II: KEY INFORMANT INTERVIEW CHECKLIST

A) GENERAL INFORMATION ABOUT THE KEY INFORMANT

Institution Name (Optional)..... Position of respondent..... Contact (e-mail/phone)..... Date of interview.....

B) QUESTIONS FOR KEY INFORMANT

1. How is WIBI organized? .....
   .....
2. How is it funded? .....
   .....
3. How is it performing? .....
   .....
4. How many times have had payouts since the insurance scheme started?
   ....
5. How much do you pay per acre? .....
6. Do you train farmers about WIBI? .....
   .....
7. Are farmers aware of the VAT exemption? .....
8. Are farmers compliant? .....
9. What are the major challenges that you face dealing with the insurance scheme?

i. .....

ii. .....

iii. .....

iv. .....

v. .....

10. What are other support measures (e.g: policy, regulatory, institutional facilitation) are necessary in order to improve the overall performance of the scheme? .....

.....

11. What are the future plans for the scheme? .....

APPENDIX III: FARMER'S CONSENT FORM

My name is **VENANCE MPUNDE**, and I am coming from Institute of Finance Management (IFM). I am conducting a research study to understand uptake of crop insurance in your community.

You are invited to take part in this research study titled "uptake of index-based crop insurance among smallholder farmers in Dakawa". Since you are well-informed of this visit, you are required to participate in the interview that will spend not more that 40 minutes.

This discussion is for research purposes only, and all the information obtained will be kept safe in our files. You will not be identified in any presentation of the study reports.

Your participation in this study is completely voluntary, and you may decide not to participate the interview. Also, you are free to refuse to answer any questions that you feel are not appropriate or that make you feel uncomfortable. You may ask any questions about the study at any point during the interview. Your participation or non-participation in the discussion will not affect any services you currently receive in any way.

There is no anticipated discomfort for those contributing to this study, so risk to participants is minimal. Although you may not directly benefit from taking part in this study, the information you provide may lead to improved programs and services in the community in the future.

You may contact the researcher at email address of phone number stated below. You will be given a copy of this form to keep it for your records, if you have any question on whether you have been treated illegally or unethical, contact the the IFM management.

If you have any concerns about this study, you may contact me:

Researcher's name: Venance Michael Mpunde

Email address: venancemm90@gmail.com

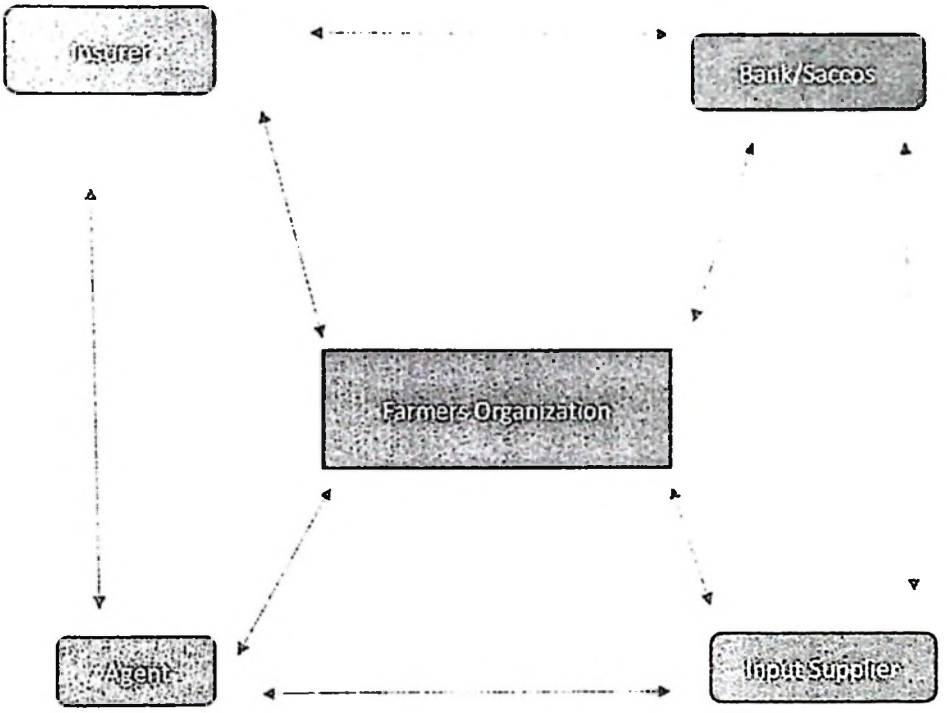
Phone number: 0657715289/0673064769

Do you agree to participate in this study? *[If YES, indicate below that the farmer consent has been obtained. Then proceed with the interview*

Farmer's signature: _____ Date:

_____/_____/_____

APPENDIX 1V: SAMPLE AGRICULTURE INSURANCE BUSINESS MODEL



APPENDIX V: CORRELATION TEST

	Age	Edu_level	Exp_IBCI	Dist_market	Dist_paved road	Acc_credit	Land_ownship	Land size	Crop_diversication	Av_income
Age	1									
Edu_level	.131	1								
	.188									
Expe_IBCI	.048	.123	1							
	.631	.219								
Dist_market	-.300**	.081	.057	1						
	.002	.421	.567							
Dist_paved road	-.056	-.335**	-.032	-.227*	1					
	.577	.001	.746	.022						
Access_credit	.092	.433**	.109	.089	-.135	1				
	.358	.000	.277	.374	.175					
Land_owship	.007	-.075	-.026	-.050	.006	-.051	1			
	.941	.452	.794	.621	.955	.609				
Land_size	.051	.025	.083	-.140	.102	-.133	.011	1		
	.611	.805	.409	.160	.308	.183	.913			
Crop_d'cation	-.076	.057	-.056	.093	.000	.052	.042	.120	1	
	.448	.572	.577	.352	.996	.606	.672	.228		
Av_income	.032	.361**	.319**	-.049	-.086	.207*	-.081	.440**	.004	1
	.749	.000	.001	.622	.388	.036	.416	.000	.968	

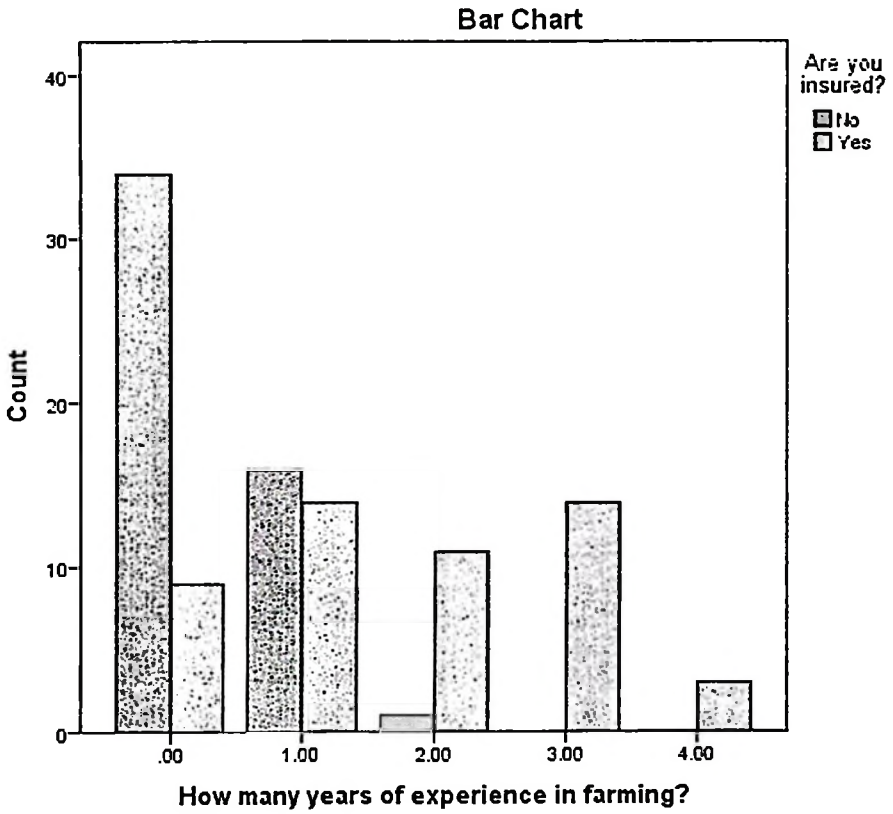
**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

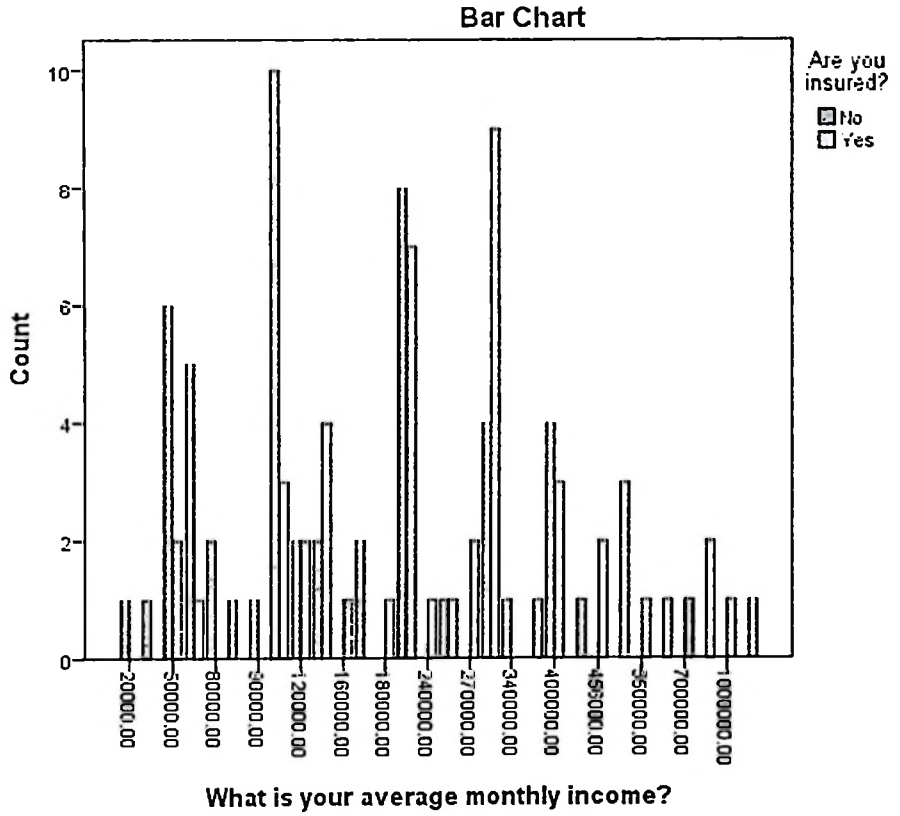
APPENDIX VI: TOLERANCE AND VARIANCE INFLATION FACTOR

Variables	Collinearity Statistics	
	Tolerance	VIF
Education level	.658	1.519
Experience with IBCI	.884	1.131
Distance to the nearest market	.824	1.214
Distance to the paved road	.831	1.204
Access to credit	.765	1.306
Land ownership	.986	1.014
Land size	.729	1.371
Average income?	.604	1.657
Age of the respondent	.867	1.153

APPENDIX VII: RELATIONSHIP BETWEEN INSURANCE STATUS AND EXPERIENCE IN IBCI



APPENDIX VIII: RELATIONSHIP BETWEEN HOUSEHOLD AVERAGE INCOME AND INSURANCE STATUS



APPENDIX IX: GOODNESS OF FIT

	Chi-square	df	Sig.
Step	81.886	14	.000
Block	81.886	14	.000
Model	81.886	14	.000

APPENDIX X: GENERAL INFORMATION ON THE CROP INSURANCE PROGRAM IN MVOMERO-MOROGORO.

A. Object of Insurance

The object of index based crop insurance shall be the standing crop planted on the farmland specified in the insurance application up to the harvest time and in addition to that, the assured farmer should have an insurable interest on.

B. Amount of Cover

The insurance shall cover all related costs such as production cost, inputs, etc, all these costs will be considered in the indemnification process that is nothing more or less will be paid back in case of losses. Types of Insurance Cover

This is an all risks coverage against crop loss caused by natural disasters (i.e., drought, earthquake,typhoon, flood, , and volcanic eruption) as well as pest infestation and plant diseases. Period of Cover

The insurance coverage starts from direct seeding or upon transplanting up to harvesting, on condition that that insurance coverage shall commence from the date premium is paid and insurance cover being provided to insured Insurable Rice Varieties

All rice varieties accredited for production by the National Seed Industry Council (NSIC) are insurable.

C. Premium Charged

In practice, the insures charge an average of TZS 5,000 per acre for every month during the whole production period. The total premium charged per acre ranges

from TZS 25,000 to 50,000 depending on the nature of the farm, location and crops.

D. Risks covered

- Natural disasters including typhoons, floods, drought, earthquakes, and volcanic eruptions.
- Plant diseases, e.g., tungro, rice blast/neck rot, grassy stunt, bacterial leaf blight and sheath blight.
- Animals such as elephants, domestic animals
- Pest infestation by any of the following major pests: rats, locusts, armyworms/ cutworms, stemborer, black bugs and brown planthopper/hopperburn.