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Factors affecting Uptake of Index Based Crop Insurance among the Smallholder Farmers: A Case Study of Tanzania

Nassoro Hussein
Mpunde Venance

Factors affecting Uptake of Index – Based Crop Insurance among the Smallholder Farmers: A Case Study of Tanzania

By: Nassoro Hussein[1] & Mpunde Venance[2]

Abstract

The development of agriculture in Tanzania is facing several challenges. Risks are among the factors that are derailing the growth of this important sector. In a bid to reduce risks related to weather, Index Based Crop Insurance (IBCI) was introduced to smallholder farmers. This study aims to examine the determinants of uptake of IBCI. Data was collected through a household survey. Estimation of a Logistic Regression Model reveals that the age of the household head, farming experience, income and distance to paved roads have a significant influence on the uptake of IBCI in the area. These findings highlight the need to create more awareness among less experienced, young and those located a bit far from town centers (paved roads) with inadequate access to information about the usefulness and functionality of the IBCI as well as addressing issues of purchasing power.

Keywords: Adoption, Crop Insurance, Logistic Model

Introduction

Tanzania, like many other Sub-Saharan African countries heavily depends on the agricultural sector for food and industrial raw materials. This is despite, the transformation that has happened over the years through the emergence of other sectors such as mining, services, and manufacturing. Agriculture employs the vast majority of the population in this country. Nearly two-thirds of the working population finds employment in the agricultural sector. The sector produces food, important raw materials for locally made products as well as for export trade. Exporting agricultural commodities generates foreign currency for the nation. Available statistics indicate that the country has been earning an average of over 1.2 billion US dollars from the export of agricultural commodities (Comtrade, 2020). The annual growth rate of the sector has not been not impressive over the years as it has been ranging between 4% to 6% as per the Bank of Tanzania report (2022). The sector is facing multiple challenges such as; a relatively low level of public investment, overreliance on rain-fed agriculture, climate change, unintegrated markets, price volatility, and inability to access the market due to high transaction costs among other factors. The slow growth rate of the sector is generally mirrored by the slow pace of poverty reduction. Household Budget Survey report (2017) suggests that 26% of Tanzanians live below the poverty line, while rural poverty is estimated to be 33%. Like in other countries, agriculture in this country is succumbing to a variety of risks categorized as

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[1] *Department of Economics and Taxation, Faculty of Economics and Business, Institute of Finance Management, E-mail: ngwijo@yahoo.com*
[2]*College of Economics and Business, Sokoine University of Agriculture*

production, price, and policy risks (Cervantes-Godoy et al., 2023). Production risks are posing a major challenge to farmers whose livelihoods is closely linked to the environment. A study done by the World Bank in the year 2014 estimated the value of the average annual production losses in the agricultural sector as a result of unmanaged production risks to a tune of US $203 Million or 3.5 percent of the Agricultural GDP for the country. The amount may have increased now owing to increasing climate-related risks. However, traditionally, smallholder farmers have been managing these risks through diversification of crops (on-farm) and engaging in other off-farm income-generating activities. These mechanisms have been seen to work well for low-magnitude losses and are inadequate for severe and infrequent risks (Hazell, 1992; Aidoo et al., 2014). Public policy emphasizes investment in irrigation, research, and extension services. However, the meager budget allocated has remained a major challenge in achieving the intended target. Consequently, agriculture is highly exposed to vulgarize of ever-changing weather conditions (Omambia et al., 2010; NBS 2019). Due to the over-dependence of farmers on rain-fed agriculture, climate variability challenges are rapidly threatening the sustainability of agricultural production, food security as well as economic development (Njue et al., 2018). Several risky events have occurred in the past few years and their effects have been significant. For instance, On January 2020, there was heavy rainfall occurred in the Ruangwa, Liwale, and Kilwa districts in the Lindi region in the southeastern part of Tanzania. This resulted in flash floods which led to fatalities and major damage, 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).

According to Inter-Governmental Panel on Climate Change (IPCC) (2012), risks of climate change on agriculture are forecasted to increase. And that will be manifested in extreme weather events such as droughts, high solar radiation, extreme precipitation, and storms. Agricultural activities remain susceptible to such adverse weather events and that situation will severely impact the quality and yield of a crop (Dick et al., 2011). The development of risk management strategies is crucial in a bid to cope with the situation and achieve sustainable development of agriculture. Risks management strategies consist of policies and strategies seeking to reduce the risks of disasters and strengthen resilience and reduce losses (World Bank 2013). The Agricultural risks management system is primarily dominated by three channels; (i) risks are either controlled at the farm level (ii) through government initiatives and (iii) through market-oriented strategies (Anton & Kimura, 2011).

Fortunately, the use of the market-based approach to managing the risks is gaining momentum in many countries including Tanzania. Crop insurance constitutes one of the modern approaches to transferring and managing risks. This type of insurance mechanism 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 and hence a farmer is enabled to continue with agricultural activities even after the occurrence of the losses (Hazell, 1992; URT, 2019). Usually, crop insurance policy is sold as part of an adaptation strategy for managing climatic risks among farmers (Dougherty et al., 2020). Insurance is advocated as a part of the adaptation strategy in managing climatic risks in crop production (Dougherty et al., 2020). The insurance cover offers protection against losses caused by adverse events, and thus it enhances sustainable agricultural production. The policy offers loss compensation to farmers and hence they are enabled to sustain agricultural production even after encountering losses (URT, 2019). Furthermore, it provides an advantage to farmers when accessing credits from banks and other microfinance. Crop insurance for the public may be tied to a credit from Agricultural Development Banks (ADBs) such that, a borrower may purchase insurance to qualify for a loan (Hazell, 1992; URT, 2019).

In a bid to ensure that, farmers are adopting crop insurance and protecting themselves against adverse events, several initiatives have been taken in Tanzania. The effort includes; the provision of training to sensitize farmers on crop insurance and exempting Value Added Tax (VAT) in premiums paid by farmers from all agricultural insurance products to encourage the adoption of the same (Smith and Glauber, 2012). Despite all that has been done so far, the uptake or adoption of crop insurance is still very low (Doherty et al., 2021; Lambregts et al., 2020; Nshakira-Rukundo et al., 2021). Furthermore, there is limited information as to why only a few farmers have adopted the insurance policy. The existing opacity constitutes a motivation for designing this study to fill a knowledge gap. Therefore, the study aims at establishing factors determining the uptake of crop insurance among smallholder farmers and eventually suggests the possible means for promotion (URT, 2019). This study is in line with the current Government initiatives on the development of crop national insurance policy of 2014 and the Agricultural Sector Development Programme Phase II (ASDP II). All these emphases on agricultural Insurance as a means of managing risks and fostering agricultural transformation.

Literature Review

Theoretical Framework

The farming households in this district were trained and therefore are knowledgeable of how the weather index insurance scheme is operating. Based on the imparted knowledge, households may decide whether they should adopt the policy or not based on the perceived advantages and dis advantage of joining the crop insurance. In analyzing the determinants of the adoption or purchase of a crop insurance policy, a farming household model developed by Backer (1965) was considered. Based on the model, a household is considered to be a rational economic agent seeking to maximize utility subject to costs that are involved. Thus, a decision of whether to purchase an insurance policy or not is contingent upon the level of utility that will be gained after adoption as well as the costs involved (Adzawla et al., 2019). In this perspective, a farming household is assumed to be risk neutral. Thus, expected that rationally will compare the associated benefits and costs of purchasing crop insurance. If the benefits outweigh the costs, then rationally, they will adopt the crop insurance policy. However, the exposition given above is derived from a consideration that production and consumption decisions are two distinct decisions altogether. This is described as a separate property derived from twin assumptions of utility maximization and complete markets. However, there is no empirical evidence in developing countries including Tanzania that has reported the presence of the separation assertion (Mduma, 2006, Ahituv and Kimhi, 2002, Kimhi, 2001, Woldehanna, 2000). Therefore, it is clear that we can't use the separation theory to expound on household behavior in this study (Bradhan and Udry (1999). Basing on that, the adoption decision can't be explained by utility theory. Instead, a non-separable Farm Household Model is an appropriate means for describing such behavior. This means that there is a set of factors influencing the decision to adopt crop insurance rather than maximization of utility alone. That forms a basis for undertaking this study.

Methodology

Data and Sampling Strategy

This study was conducted in the Eastern part of Tanzania in the Morogoro region, Mvomero district. A total of five villages namely; Dakawa, Sokoine, Luhindo, Mtakuja, and Milama were selected for a household survey. The five villages were treated as an enumeration area. The study applied a combination of purposively and multi-stage sampling techniques to select both the study area as well as the households for interview. A survey was conducted in which a questionnaire was administered to heads of the households. These are households that were trained before and thus are fully knowledgeable of the

advantages of crop insurance. However, for some reason, a certain group of farming households decided to adopt while others failed to adopt due to certain factors. Therefore, this study is focusing on establishing factors determining the adoption of weather index-based insurance programs. Primary data were collected using a structured questionnaire through interviews, in addition to that Key Informant Interview was also used to collect information from the insurers to get the overall picture of weather index insurance in Tanzania. Using a random selection, the study managed to interview a total of 102 households. 49% of the selected households in those villages reported having adopted crop insurance. Farmers in this area are practicing mixed cropping farming systems comprised of maize, cassava, paddy-rice, Bambara nuts, and vegetables such as tomato, onion, okra, and cowpeas. In certain cases, they would mix those crops with fruits such as mango, pineapple, papaya, and watermelon produced in areas where there is water for flood irrigation.

Analytical Framework

Based on the theoretical explanation given above, it is clear that, whether a household will adopt crop insurance or not is a matter of probability that ranges from 0 to 1. This is consistent with how the households were asked to state whether they have adopted crop insurance or not. Impliedly the adopters were assigned 1 while non-adopters were given 0. Probability of whether one will adopt or not is contingent upon several factors. Thus, a binary dichotomous model is an appropriate model for determining factors that influence the adoption of crop insurance. Thus, in analyzing those factors, a binary logistic regression model was applied. This model represents a special condition of linear regression analysis when the response is binary, not continuous, and the explanatory variables are quantitative or qualitative (Hair et al., 2010). The model uses the theory of binomial probability which represents only two values to predict the probability (p) whereby 1 is for adopters and 0 for non-adopters of crop insurance.

Variables Used in the Analysis

The binary logistic regression model applies two dependent variables namely; the discrete choice to participate in the crop insurance scheme (a yes or no response), and the outline of the explanatory variables used in the model is shown in Table 1. Given a binary logistic model with the dichotomous dependent variable as shown below;

$$Ln\ (P_i/(1-P_i)) = \beta_0 + \beta_1 X_1 + \ldots + \beta_i X_i + e_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where,

Pi = Probability of adopting index-based crop insurance. 1-Pi =
Probability of not adopting index-based crop insurance. ß0 = Intercept ßi
=Regression coefficient Xi =Independent variable ei =Error term

Dependent Variable

The dependent variable captures whether one has adopted Index Based Crop Insurance (IBCI) or not. This variable is captured using a dummy variable (1 = adopters and 0= non-adopters).

Independent Variables

A set of variables are thought to influence the household decision to take up crop insurance. In this context, households act as a single unit, wherein production and consumption decisions are taken collectively and the head of the household is the overall in charge of the decisions.

Table1: Variables Used in the Empirical Analysis

Variable name	Description	Unit of measurement	expected sign
Insure	If participating in crop insurance scheme or not	Dummy: 1= yes, 0 = no	
Age	Age of the household head	Number of years	+
Gender	Gender of the household age	Dummy: 1= Male, 0 = Female	-
Credit access	Access to credit		+
Land owenership	Land owned by the household head	Dummy: 1= yes, 0 = no	-
Exp with IBCI	Years of experience with IBCI	Dummy: 1= yes, 0 = no	+
Income	Household income	Amount earned from household activities	+
Distance to road	Distance to the main road	Km	-
Education	Years of education of household head	Years	+
Farm size	Farm size		+
Distance to market	Distance to the market	Km	-
Awareness insurance	If household head is aware of crop insurance	Dummy: 1= yes, 0 = no	+

Thus, social economic characteristics circumscribing the household head are likely to influence the decision to adopt or not. such characteristics that influence the decisions include; the age of the household head, gender of the household head, access to credit, land ownership, years of experience with the insurance, household income, distance from the main road, education level of the household head, farm size owned and distance to the market.

Age of the household head: A plethora of literature has documented about the influence of age of the household head on adoption of innovation or technology. Generally, there is mixed views regarding the effect of this variable on the adoption of innovation. Ashraf et al., (2018) observed that, older people tend to be more risks averse than the young farmers and such differences may lead to discrepancies over the adoption decision. Conversely, older people may have accumulated more income relatively to the young farmers and that may bring different adoption outcomes.

Gender of the household head; whether one is a male or female may have a differences over the adoption decision. Male head of the household is likely to have better access to information compared to his counterpart a female household head. Meanwhile, female head of the household is overwhelming with household chores, a male head of the household may be mingling with friends and thus is likely to difference in access information.

Access to credit; Crop insurance policy is having a price tag. This price may not be affordable to some farming households. However, if there is an access to credit, households may use such opportunity of borrowing and thus purchase the insurance policy. In light of this exposition, access to credit is among the independent variables that are estimated in the empirical analysis.

Land ownership: Land is one of the assets that may reflect amount of wealth owned by a household. Households with huge amount of wealth or assets including land are more likely to have the necessary ability to purchase the insurance policy. However, in this study this variable is included as a dummy variable "yes" =1 and "no" =0. Thus, this variable is also included in estimating factors determining adoption of crop insurance.

Experience with insurance: Previous experience of the farming household in dealing with any insurance products is likely to influence an uptake of the crop insurance. A farmer who is having an experience of

insuring a vehicle or tractor will be easy for him or her to understand the overall concept of insurance unlike a person who has never dealt with formal insurance market at all.

Household income: To purchase the crop insurance policy, farming household will require an income. It is therefore expected that, an increase in household income is likely to have a positive impact on adoption of crop insurance. In this account, crop insurance will be a luxury good within the context of the demand theory as it is likely to have a positive income elasticity of demand.

Distance from the main road or paved road: Main road or paved road as described are entry points of the rural area by the people who are hailing from any other part of the Tanzania or anywhere else. These are areas where information from outside the village would be firstly received before being disseminated to inter- land areas. Thus, farming households residing close to the main road are more likely to be better informed than those located far away. Information may be distorted when it is being disseminated to inter-land and this might lead to a different adoption decision. Thus, increased distance from the main road is likely to have negative influence on adoption of the crop insurance.

Education level: Level of education of the head of the household may reflects an access to and an ability to synthesize new information and derive an objective decision. On this account, household head with a relatively high level of education are likely to be better informed compared to those with a relatively lower level of education. Thus, level of education measured in terms of number of years is included in examining factors determining adoption of crop insurance.

Farm size owned: This variable may resemble the variable about land ownership. However, given that land ownership is a dummy variable as it was only asked whether a household owns a land or it leases from the market with "yes" or "no" answer. Size of the farming land owned may pose a different implication over the decision to adopt crop insurance or not. Farmers with small or large size of the farming land are likely to have different attitude towards risks and therefore varying adoption decision.

Distance to the market: Market centers are areas where rural people usually gather and not only purchase or sell various products but also exchange information. However, not all households would visit the market centers regularly. Thus, those located close to he these centers are likely to have a differential access to

information compared to those residing far away. In light of this observation, distance measured in Kilometers from the market centers is included establishing important factors influencing adoption of crop insurance.

Awareness with crop insurance: Though farmers were trained about crop insurance they may have different level of understanding**.** And **s**ince a random sampling technique is used during data collection, there is a likelihood of having household with awareness and those that are not adequately aware about the crop insurance. Varying level of awareness is likely to affect adoption decision. To reflect this in identifying factors determining adoption of crop insurance, farming households were asked whether they are aware about crop insurance or not.

Findings and Results Discussions

Social economic characteristics

Table 2 presents the analytical results of gender, education level, and whether they have adopted index-based crop insurance or not. As it is depicted 49% of the respondents were female while 51% were male. Gender may influence the decision to adopt crop insurance. For instance, male is likely to have more information compared to female, given that they can mingle with colleagues frequently unlike their counterpart who are tied up with household chores. In that respect, gender may be an important element in the adoption of crop insurance.

In terms of education, 49% of respondents have primary education, 32% have secondary education, 4.9% certificate, 13.7% diploma, and 1% undergraduate degree. The number of people with secondary education has been increasing in Tanzania owing to the Government's effort in expanding enrollment capacity. Education enhances understanding and analytic skills and therefore it may have a positive effect on the decision to adopt crop insurance. A higher level of education may be associated with access to information especially from abroad. Conversely, a higher level of education and access to information may increase the degree of risks averse to the extent of avoiding anything new.

Further analysis of the socioeconomic and demographic aspects is presented in table 3. According to the table difference between minimum and maximum age of the household is 33 years. The mean age is 40.23 with a standard deviation of 13.643, indicating a low level of variation in age among the sampled

households. Low age is associated with curiosity and thus, a higher chance of adopting anything new contrary to relatively old age.

Table 2: Distribution of sex, education level and Insurance status

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

Conversely, relatively old age may signal a higher level of farming experience and awareness, therefore may be associated with a higher chance of adopting a new intervention than a relatively younger farmer. Furthermore, this table is also indicating that the characteristics of noninsured farmers were not statistically significant from their counterparts with insurance except for age, years of experience in crop insurance, distance from farm to the market, distance from home to a paved road.

As depicted in the table, there, mean years of experience in farming is 1.0588 which is below the standard deviation. This is an indication that there is a wide difference in years of experience among the respondents. A relatively longer period or years of experience suggests that one is aware of how weather may be good and bad in certain years and thus may influence the decision to adopt crop insurance. Conversely, old age may be associated with a relatively higher years of farming experience and thus a high degree of risk aversion. The study also found that the average distance from farmers' farms to the nearest market is 2.53km with a minimum distance of 1km and 4km for the maximum distance. Usually, market centers are areas where information is received and disseminated, especially in rural areas. Information regarding crop insurance is likely to be an issue of discussion within a particular market. Therefore, farmers located to close to market centers are more likely to access information regarding crop insurance adoption than those located somehow far. On the basis of the analytical results presented, average distance to the paved road is 2.68 km. A farmer who is located nearest to the paved road is 1 Kilometer and farthest is 4 Kilometers

respectively. The paved road may act as a point where information is received by travelers and disseminated as well. Thus, a household located nearer to the paved road may have a higher chance of adopting Index based crop insurance compared to those located far away. Even when insurance agents are visiting the area, they would be first received by those residing close to the paved road.

Table 3. **Summary Statistics**

Variables	Minimum	Maximum	Mean	Std. Deviation
Age of the respondent	29	62	40.23	13.643
How many years of experience in farming?	0.00	4.00	1.0588	1.16741
How many kilometers from your farm/home to the nearest market?	1.00	4.00	2.5294	.71346
How many kilometers from your home to the paved road?	1.00	4.00	2.6961	.83000
Do you own a land?	0	1	.59	.495
How much land do you own in acres?	1	15	4.17	2.203
What is your average monthly income?	20000.00	1200000.00	244676.4706	209877.52967

Land ownership is yet another aspect that was probed by the study. On the basis of the analytical results, about 59% of the household reported to own the land while 41% were renting. The findings are confirming an assertion that, land rental market is developing in rural areas. Development of this market may be accentuated by youth who are joining farmers in areas where there is no idle land for them. Women without access to land may also hire land in order to carry out crop production. Land size owned and cultivated by the households may have a negative effect on the uptake of insurance, this means that, farmers who had cultivated large sizes of land had a lower chance of participating in crop insurance schemes compared to

their counterparts. Farmers with cultivating relatively small land sizes may have a fear of getting end up with nothing in case of a loss. This is unlike, those who are cultivating a relatively large area. The analytical results are also reflecting an overall picture of land ownership in the area. A smallest size owned by a household in the area is 1 ha while the largest area is 15 ha. The average land size is 4.17 ha, with a standard deviation of 2.203. Farmers with relatively larger areas might have a great chance of adopting crop insurance compared to those with relatively smaller plots. Larger plots may be associated with relatively higher risks compared to relatively small area. Besides, insurance is a cost therefore rationally it needs to be recovered, thus, there is a higher chance of recovering the cost if the land is relatively larger than if the land is small.

Large land size under cultivation may be a reflection of relatively high household income or wealth status. The study has also found that there is a high variation in monthly income level as reported by the heads of household. Analytical results are depicting a variation of more than TZS 200,000 monthly income among farmers. Based on the survey finding, income is generated from different sources including from off farm activities. Basing on figure 1 above about a relationship between income and insurance status, it is evident uptake of IBCI is associated with household with relatively high income. This is supporting an assertion that income is an important element that may influence over the decision to adopt crop insurance.
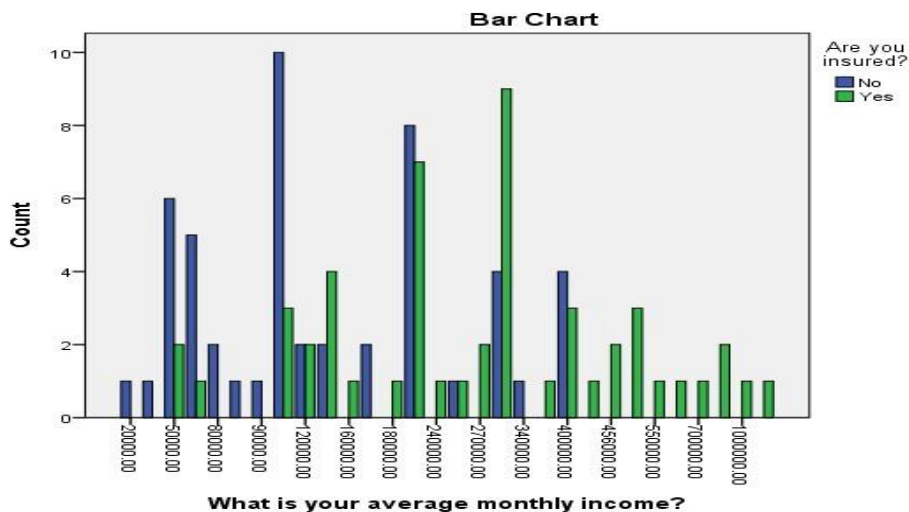

Figure I: Relationship between household average income and insurance status

Determinants of Crop Insurance Adoption

Analytical results on factors influencing adoption or uptake of in crop insurance in Mvomero district are as presented in Table 4 below. This follows an estimation of a logistic regression using maximum likelihood method. The characteristics of insured householders were not statistically significantly different from their counterparts without insurance except in terms of age, farming experience with IBCI, distance to the nearest road, and income levels. Hosmer and Lemeshow's chi-square tests the goodness-of-fit with p=0.000 at 14 degrees of freedom. The p-value of the test was not significant indicating that the model fitted the data well. Out of 9 variables, 4 were statistically significant, two of the variables had unexpected signs as explained below. The analytical results are suggesting that the age of the respondent has a negative influence on the adoption of IBCI. The variable was measured as a continuous variable in number of years and as presented above in the descriptive statistics, the mean age is 40 years. According to logistic regression analytical results presented below, young age increases a likelihood of adopting IBCI. Put it differently, older farmers who have gained enough knowledge in agricultural production and therefore are more likely to accept risks than young farmers. This is a reflection of the fact that age has a negative influence over adoption of technology due to perceived risks associated with the new ideas and the fact that, old age is associated with a low level of risks averse. This is consistent with what was reported by Ashraf et al., (2018) that older people usually make adoption decision on risk averse or risk neutral basis. This may be partly explained by the fact that, knowledge gained over time when working, plays an integral part in evaluating willingness to adopt an innovation (Feder et al., 1985; Baidu-Forson, 1999). However, some other studies have also reported contradictory findings. For instance, there is an argument that older farmers are expected to participate more in the insurance scheme than young ones because they are likely to have more resources compared to younger farmers. Furthermore, a decrease in participation is expected in old age. On the contrary, Abdulmarik et al. (2013) found that age was significant and positively influenced the probability of farmers' participation in agricultural insurance schemes in Nigeria. Similarly, Sargazi et al. (2013) found that the age of the household head increased participation in agricultural insurance schemes whereas older farmers were also more willing to purchase crop insurance in Iran. The distance was measured as a continuous variable in kilometers traveled by farmers in order to contact insurance agents whom were located in towns (paved roads). Distance to paved road has a significant influence on the farmers' willingness to adopt indexed based crop insurance within the district (P=0.014). This is consistent with a prior expectation of this study that farming household residing close to the paved roads. Have a higher chance of mingling with people arriving from other areas and exchange information.

Thus, this group of households is likely to have an additional information compared to those living inter-land (relatively far away from the paved road). Additional information may include issues related to benefits of adopting index based crop insurance.

Table 4 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	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%

Similarly, farmers who are located near the paved roads had better access to insurance agents who selling the insurance policy than those located far away from the main roads. Distance augments the overall transaction cost of the insurance policy and thus, it may be one of the discouraging factor. On the same vein, Birinci and Tumer (2006) found that farmers located more than 10 kilometers from the paved road had a lower tendency to participate in agricultural insurance in Turkey compared to those located nearer. These authors held that knowledge of the farmers about agricultural insurance was decreasing with an increase in distance from the paved road or town.

Furthermore, Ali (2013) found a positive relationship between participation in an insurance scheme and road access in Pakistan. Purchasing power is an important element when demanding for any specific good or services which has a price tag. This is represented by income of the household. As depicted by the table 4 monthly income of the household has a positive influence over the decision to adopt Index based Crop

Insurance which is highly significant at 1% level (P=0.01). In this account, if income has positive influence on the adoption of IBCI then the insurance may be categorized as a luxury good whose adoption may be increasing with an increase in income. Thus, any efforts to increasing monthly income will spur adoption of index based crop insurance. This finding coincides that of Fallah *et al*. (2012) who also found that income to have increased adoption of agricultural insurance in Iran, this happens because farmers with higher incomes had more resources to invest in new interventions compared to their counterparts with less income. Sargazi *et al.* (2013) expounded that, farmers with higher incomes had a tendency to participate in agricultural insurance in Iran in order to secure their farm. Years of experience in IBCI was measured as a continuous variable measuring the number of years the farmer is aware on the existence of the insurance scheme and benefits obtained from it. The number of years of farmer's experience with crop insurance was found to be positive and significantly associated with farmers' adoption decision. Farmers with more years of experience with IBCI appeared to have better knowledge of the crop insurance scheme and therefore had a higher chance of participating than those with less experience, this is because farmers who are more knowledgeable with agriculture insurance are likely to adopt than the ones with less knowledge. This finding coincides with findings of many other researchers including Mohammed and Ortmanna (2005) who found that the greater the extent of information and awareness on livestock insurance, the greater the probability of participation in Eritrea. More experience on a technology or innovation is expected to enable farmers to evaluate and better comprehend the technology or innovation prior to uptake (Hill *et al.,* 2013; Hassanpour *et al.* 2013) also found a positive and significant effect of farmers' experience with an insurance scheme on the participation decision in Iran. Coble and Knigh (2002) found that years of experience with insurance played an important role in enabling farmers to understand the associated benefits in Nigeria. Fallah *et al*. (2012) also found that farmers with more knowledge on insurance had wider insurance coverage than those who did not in Iran. Jarvie and Nieuwoudt (2010) found that the older, more experienced farmers in South Africa were more risk-averse and therefore attempted to reduce risk through insurance. Therefore, as risks increased, more insurance was purchased by risk-averse producers.

Conclusions and Recommendations

Agricultural production is biological in nature and overly dependent in weather conditions. Unfortunately, the weather conditions are changing and not predictable. Thus, IBCI was introduced to cope with losses farmers get due to weather changes in Tanzania. However, ever since it was introduced, there is scanty

information regarding its adoption. Therefore, this study aimed at stablishing factors determining uptake of IBCI among smallholder farmers in Mvomero district, Morogoro region. Data was collected from the households within the district. A combination of stratified and multistage sampling technique was used to soliciting information using a questionnaire. On the basis of the data analysis, this study has revealed that 49% of the respondents have adopted IBCI. Estimation of a binary logistic regression model was done in order to establish factors determining adoption of the insurance. On the basis of the analysis, the study has established that Age of the household, distance to paved roads, farming experience and monthly income are the major determinant factors of adoption of crop insurance.

On the basis of the findings, the study recommends that strengthening public education in rural communities especially those located far inter-land about the functionality and importance of crop insurance is crucial in a bid to augment level of adoption. Public seminars, trainings, and media advertisement on crop insurance should be emphasized to raise farmers' awareness and knowledge about IBCI scheme. Furthermore, the dissemination of agriculture insurance schemes should be increased a linkage between the agriculture extension officers and insurance companies. Insurance companies should consider developing multiple bundles of products in order to address multiple challenges and risks faced by farmers. Since the agricultural insurance market is still infant in Tanzania, products designed should intend to address a range of risks farmers face. Insurers should consider developing innovative distribution and delivery models through their partners so as to address weather related perils and use the partners to promote these products, this will lead to sustained awareness creation and product knowledge dissemination. Strengthening farmers' cooperatives may help to enhance their bargaining power and thus improve their income. As found in this study, purchasing power or income is among important element for adoption. Furthermore, establishment of saving and credit scheme may help to enhance access to credit which may be used to pay the required insurance premium.

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