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SUSTAINABILITY OF EXPERIMENTAL DROUGHT INSURANCE IN TANZANIA: ANALYSIS OF SMALLHOLDERS' WILLINGNESS TO HOLD CONTRACTS

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ABSTRACT

This study aimed at analyzing farmers' willingness to proceed with the drought insurance contracts in Bunda district. Relationship between the market force factors and the outcome variable was modeled to determine the explanatory variables that influence farmers' willingness to proceed with the drought insurance contracts using Ordinal regression statistical technique. It was revealed that, reluctance to proceed with insurance contract was expressed by majority of farmers in drought insurance pilot program. Farm size, age, trust on insurers, contract farming experience as well as satisfaction about the drought insurance contracts services were found to be statistically significant factors influencing farmers' willingness to proceed with the drought insurance contract in a subsequent year. Efficiency by the private investors and government's proper support will help farmers realize risk reduction benefits of the program and ensure its sustainability.

KEYWORDS: Sustainability, Drought Insurance Contract, Willingness to Proceed

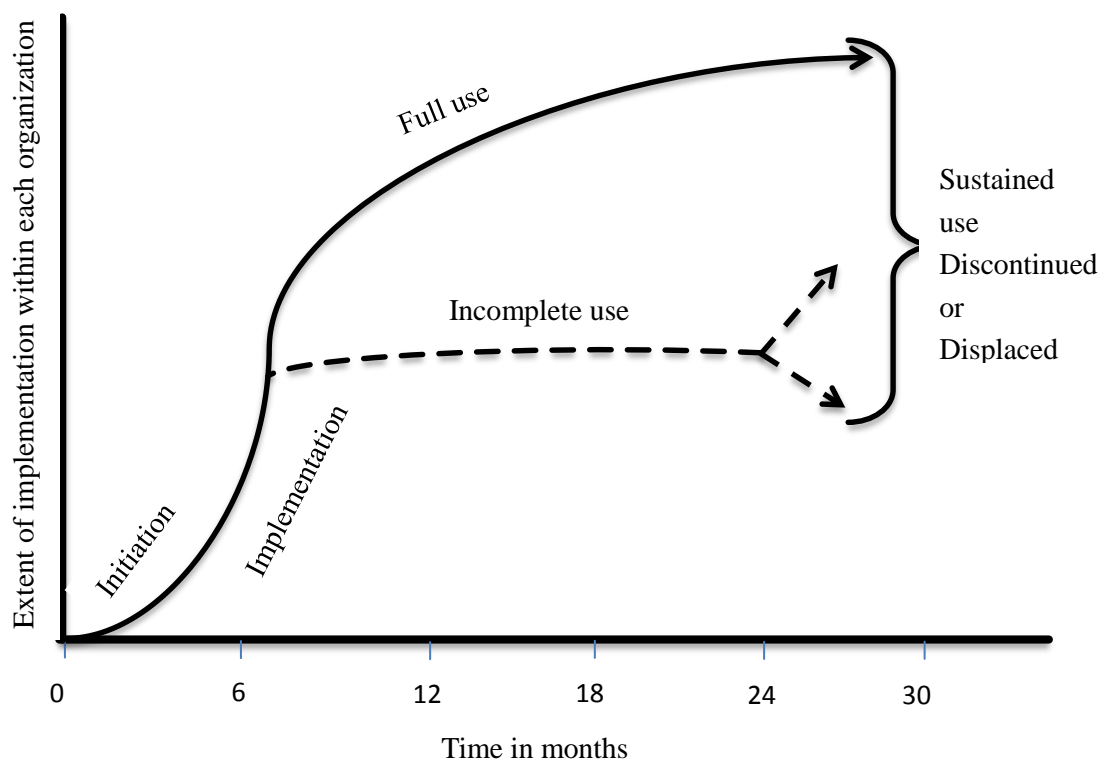
1. INTRODUCTION

Agriculture in Tanzania is the largest economy sector with a total contribution of 33.4% share to the national GDP according to 2014 revised GDP estimates for the base year 2007 (NBS,2014). Having a population of 47.78 million, nearly 75% of people in the country live in rural areas with their livelihoods depending directly or indirectly on agriculture. Despite its colossal contribution to the country's economy, 38% of adults in the country report hunger mostly caused by drought as one of the major risk that is undermining their livelihood (SFSA-SCBF,2014). In this regard, the need of having a viable agricultural insurance is therefore inevitable.

Interest to initiate crop insurance in Tanzania can be traced back in 1986 when the National Insurance Corporation (NIC) conducted a feasibility study (Akyoo *et al.*,2013). Although there are more

than 26 operating insurance companies in the country, there is virtually no agricultural insurance program currently operating at full fledge despite evidence from studies recommending positively on the importance of the crop insurance (Sarris *et al.*,2006; Akyoo *et al.*,2013; SFSA-SCBF,2014). Empirical studies show reasons to entry barriers as being lack of enough market information on crop insurance schemes by insurers as well as lack of awareness of crop insurance on the side of small-scale farmers (Akyoo *et al.*,2013). And even when the level of awareness is satisfactory, evidence shows that, farmers may tend to understand the insurance program not in a way a typical crop insurance program ought to be understood by them (Smith & Watts,2009).

Figure 1: Program life cycle



Source: Scheirer, 2005

Farmers' willingness to invest and innovate is essentially limited by the absence of crop insurance. More often than not, the cost of uninsured risk for smallholder farmers with weak access to credit markets is even severe (Castillo *et al.*, 2012). Responding to this reality, efforts by the Tanzanian government to implement insurance contracts for small-scale farmers were seen materializing after the introduction of the crop insurance pilot programs such as the government supported drought insurance contract program to cotton growers in Bunda in 2012. However, studies show that, most governments in developing countries are incapable of providing subsidies to farmers persistently (Smith & Watts, 2009). In such a situation, self-sufficiency by any agricultural insurance programs is necessary for its sustainability in risk hedging. Scheirer (2005) defines a program as a set of resources and activities directed toward one or more common goals. Success of a program would depend on how sustainable a program is. A program can be sustainable if execution of program activities are ongoing and consistent or unsustainable if the program fails to perpetuate as was initially intended due to some reasons. Jana *et al.* (2004) show a model with five components for any sustainable program and asserts that: (i) It must be cost effective; (b) It must be useful to the target population, the stakeholders, and practitioners who must implement the program; (c) It must be realistic: a program must be feasible to implement with the existing skills of the practitioners; (d) It must evolve over time; and (e) It must be

sustainable: it must have an ongoing funding stream and constituency within the community to achieve long-term results. Hence, various economic components ought to be implemented so as to foster a long-term success of a program (Jana *et al.*, 2004).

The Economic vehicles in an agricultural insurance program may include but not limited to the sale of insurance contract policies; the institutionalization of a local lending institution for farmers; and continuous networking with the government, insurers, agents, farmers and other development partners. Further, Scheirer (2005) shows that initiation, development and adoption, implementation, sustainability as well as dissemination are series of overlapping and sometimes non-linear stages which a new program that is meant to improve some services often to go through (figure 1). Hence, assessment of sustainability examines whether activities and benefits of implementation phase continue, a task requiring data collection so as to achieve the purpose.

Conversely, Smith and Watts (2009) show that, sustainability has at least two essential elements which they named (1) the willingness of farmers to participate over the long term (from one year to the next) and (2) the capability of a country's public administration (e.g. regulatory agencies) and private insurance sector to deliver and manage the program after it has initially been established. Based on Smith and Watts assertion, this study was carried out using data collected from cotton farmers in Bunda district between December 2013 and January 2014 to assess

the program's success by analysing farmers' willingness to participation in the drought insurance pilot program.

2. CONCEPTUAL FRAMEWORK FOR THE SUCCESS OF AN AGRICULTURAL INSURANCE PROGRAM

This paper proposes the scheme for success of an agricultural insurance that builds on the Conceptual Framework for uptake of agricultural Insurance by Tsikirayi *et al.* (2013) as well as from lessons and experiences of agricultural insurance program implementations both from developed and developing countries. Success of an agricultural insurance program depends on how sustainable the program is. Sustainability can be defined as the institutionalization or routinization of programs activities into on-going organizational systems (Scheirer,2005). Drought in many parts of Africa is a long term development challenge that needs concerted multi-sectorial efforts and responses at various levels (Gautam,2006). Integrating technological, institutional and policy options are therefore essential strategies for managing drought and enhancing farmers' resilience and agribusiness (Shiferaw *et al.*,2014). Hence, a sustainable implementation of an agricultural insurance program in a country particularly whose economy is constrained with financial capacity to independently manage the programs successfully would depend mainly on three factors namely the private sector, the public sector and the factors of market force.

The public sector through the government plays a vital role in implementation of agricultural insurance programs by its involvement in developing and maintaining agricultural and weather databases that can be used by insurers to accurately design and price agricultural insurance contracts, that can reduce adverse selection (Mahul & Stutley,2010). Extension and other services essential in assisting and supervising farmers to manage their production risks before and after loss occurrence helps to reduce moral hazards where insurance exists. Given the fact that farmers are central in any agricultural risk management investment (FAO,2012), the government is responsible in disseminating information and educating farmers whose awareness to risk is low as well as supporting the private insurance sector in marketing and promoting programs of agricultural insurance (Barnett & Mahul,2007; Mahul & Stutley,2010).

The private sector through private insurance companies is responsible in providing sound actuarially agricultural insurance products. Agents and loss adjusters are employed by the private sector companies to sell policies to farmers, determine the extent of losses, collect premiums as well as pay claims. This helps to speed up payments when most required hence making farmers benefit from the private sector's efficiency. The fact that systemic weather effects induce high correlation among farm-level yields that deter the insurers' effort to pool risks, affordable reinsurance from reinsurance companies

is necessary for the success of private insurance company operations (Miranda & Glauber,1997).

The market factors involve the demand of agricultural insurance which directly affects uptake of agricultural insurance by farmers (Tsikirayi *et al.*,2013). According to Tsikirayi *et al.* (2013) the determinants of demand for a product depends on own price of the good, price of substitutes, complementary goods, consumer expectations about future prices or incomes and tastes and preferences. However, one more factor in addition is important in determining the demand of an agricultural insurance product: the farmers' awareness and knowledge about the risks they face as well as their level of understanding on the availability and operationalization of agricultural insurance.

Own product price is the price or premium the farmer pays monthly or annually for the insurance policy for a given coverage. This must be affordable for the success of an agricultural insurance program. A high premium that is not relevant to coverage will lower demand for a policy while the lower with high coverage will increase demand.

Availability of Substitutes is accessibility of returns from alternative sources other than the agricultural insurance products such as diversification of off-farm activities. This may have a positive or negative effect on the uptake of agricultural insurance. As incomes from off-farm increases, farmers' need for agricultural insurance increases so as to protect their incomes. On the other hand, availability of off-farm income may act as a form of an alternative risk management tool hence reducing the demand for agricultural insurance (Tsikirayi *et al.*,2013). Further, uptake of agricultural insurance may be influenced by consumer expectations about future crop prices or crop income in the form of yield or revenue forecasts, drought forecasts and the expected return from agricultural insurance. In addition, the perception of farmers on the probability of receiving claim payments also may influence uptake of agricultural insurance.

Tests and preferences is determined by age of a farmer, experience, level of education, land size, reputation of the insurer and satisfaction of the insurance which are altogether associated to risk preferences of the farmer that also influences demand an agricultural insurance. Complementary goods are products where an increase in demand of one product will lead into the increase in demand of the complementary product, a phenomenon commonly known as derived demand (Tsikirayi *et al.*,2013). Hence, an increase in agricultural credit services that requires crop insurance guarantee will in turn increase the demand for agricultural insurance. Therefore, credit facilities that are bundled with agricultural insurance policies may increase uptake of agricultural insurance and vice versa. A successful uptake of an agricultural insurance program would depend on among other factors, the awareness farmers have about the risks they have as well as the knowledge the public has about the product. Lack of farmers' understanding on

how the agricultural insurance operates together with other mentioned factors contributes to farmers' low willingness to purchase insurance products resulting into failures of these programs (Ackah & Owusu,2012).

Whether the drought insurance pilot program provides valuable risk hedging to farmers to be able to make them willing to continue with the program in the subsequent years remains to be unknown (Smith & Watts,2009). It is imperative to evaluate the performance of the drought insurance pilot program because, dissemination and sustainability of a program can only be ensured by having an effective program (Castillo *et al.*,2012). Hence, to evaluate the success of the program, the study specifically sought: (i) to assess farmers' willingness to participation in the drought insurance pilot program, three years after its commencement (ii) to assess the public and private sector preparedness to deliver agricultural insurance services in Tanzania (iii) to find out the factors influencing cotton growers' willingness to continue with drought insurance contracts in the pilot area. Thus, the research questions this study expected to answer were: (1) Are the farmers self-motivated in buying the insurance contract? (2) What factors affect smallholders' willingness to proceed with the drought insurance contract program in Bunda? (3) Is the country's public administration (regulatory agencies) and private insurance companies prepared to deliver and manage agricultural insurance in the country? Findings from this study are expected to contribute in the earlier body of knowledge on effectiveness of risk hedging programs in developing countries, Tanzania in particular.

3 MATERIALS AND METHODS

3.1 Sampling and data collection:-

To assess success of drought insurance program, the study sought to find out framers' willingness to continue holding insurance contract in the subsequent year. An attitudinal item was designed to assess this attribute which was then put on a three-point rating scale using classifications of "I am unwilling," "I will consider," and "I am willing" which was later included in a questionnaire. Farmers participating in the drought insurance contract pilot program were selected for this cross-sectional survey conducted between December 2013 and January 2014. Purposive sampling was used to select the three wards in the district whereby, the sampled nine villages were selected using stratified random sampling technique. The sampling frame comprised of 1917 household heads participating in the program of which, a simple random sampling was

used to obtain a sample size of 259 cotton growers who were enrolled in the drought insurance program from villages where the program was implemented. The questionnaires were then used to collect the primary data constituting the market force factors and farmers' willingness to proceed with the drought insurance contract in the subsequent year.

3.2 Analytical model for the ordinal regression analysis/Modelling willingness to hold insurance:-

The hypothesis for this study was that, explanatory variables constituting the market factors have no influence on farmers' willingness to continue with the drought insurance contract program. The outcome variable "willingness to hold contracts" involved ordinal data; hence a generalized linear model was specified for this case as follows:

$$link(Y_j) = \frac{\theta_j [\beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k]}{\exp(\tau_1 z_1 + \tau_2 z_2 + \dots + \tau_m z_m)} \dots\dots\dots(1)$$

Where: γ is commutative probability for the j^{th} category, θ_j denotes the threshold for the j^{th} category, $\beta_1 \dots \beta_k$ are the coefficients of regression, x_1, \dots, x_k are explanatory variables while k is the number of explanatory variables. The location of the model is determined by the numerators in the right side, while the scale is specified by the denominator.

To model odds of observing scores of willingness to hold drought insurance contract, we use ordinal logistic regression as follows:

$$\ln(\theta_j) = \alpha_j - [\beta_1 x_{j1} + \beta_2 x_{j2} + \dots + \beta_k x_{jk}] \dots\dots\dots(2)$$

Where:
 j begins from 1 up to the number of categories minus 1

$\ln(\theta_j)$ =logit for the j^{th} category of the willingness
 α_j = threshold for the j^{th} category
 k is the number of regression coefficients
 $\beta_1, \beta_2, \dots, \beta_k$ are regression coefficients
 $x_{j1}, x_{j2}, \dots, x_{jk}$ are the j^{th} case of the nine predictor values selected for the model as being age of household head, sex, education level, farm size, Household income level, off-farm income, Trust of insurers, previous contract farming experience and satisfaction with private insuring companies. The overall model test was checked using Goodness of fit statistics, Chi-square and proportional odds assumption.

4. RESULTS AND DISCUSSION

4.1 Demographic characteristics of respondents:-

Results showed that majority of the surveyed households in the area (82.9%) were headed by males. Most of the household heads in the area were of the

assumption of parallel lines was not violated ($p=1.000>0.05$) suggesting that the relationship between the independent variables and the logits

Table 1: Gender, Age and Education of household heads

		Sex		Age(years)		Education levels			
		Females	Males	15-64	≥65	Informal	Formal	Pri	post pri
Farmers	n	44	215	239	20	48	211	199	12
	%	17.1	82.9	92.3	7.7	18.5	81.5	76.8	4.7

age between 18-45 (57.3%). As shown by Mattee *et al.*

were the same for all the logits. The null hypotheses

Table 2: Strength of the model’s prediction

Model	-2 Log Likelihood	Chi-Square	df	Sig.
<i>Test of parallel lines</i>				
Null Hypothesis	485.466			
General	482.140b	3.326	36	1.000
<i>Model fitting information</i>				
Intercept Only	542.708			
Final	485.466	57.243	18	0.000
<i>Goodness of fit</i>				
Pearson	-	1077.445	975	0.012
Deviance	-	453.144	975	1.000

Link function: Logit.

(1998) and cited by Daninga and Qiao (2014), people in Tanzania are considered productive economically when their ages fall between 15-64 years and are regarded unproductive if their ages fall outside this range. From the findings, 92.3% of respondents belonged in productive age and 7.7% were in non-productive age. With regards to education, majority of household heads had primary education (61.5%), 4.4% had post primary education while households who never attended formal education were 34.1%.

4.2 Model’s strength and testing of hypothesis:-

The overall strength of the model in prediction and hypothesis testing is presented in table 2. Judgement concerning the model adequacy was made using test of parallel lines. The model

that the observed data was consistent with the estimated values in the fitted model was accepted because the p value of the likelihood-ratio test was insignificant, $p=1.00>0.05$. Results from the model fitting information showed that, there was association between dependent and independent variables because the chi-square statistics was significant at $\alpha=0.05$, $p 0.001$ suggesting that at least one predictor variable had influence on the dependent variable.

Hence, the null hypothesis that explanatory variables constituting the market factors have no influence on farmers’ willingness to continue with the drought insurance program was rejected.

4.3 Willingness to continue with the insurance contract:-

Findings as shown in table 4 revealed that, among 259 household heads who were interviewed and belonged in the drought insurance program, majority

experience in contract farming and farmers' satisfaction on contract services.

Concerning farm size, results revealed that a unit

Table 4: Odds ratio/parameter estimates

Variable	Estm	S.E	Wald	df	Sig	L.B	Up.B	Exp_B	95%CI	
									LoB	UpB
Offinc	0 ¹	0	1.706	1	0.192	0	0	1.000	1	1
Fmsize	-0.3	0.1	4.307	1	0.038**	-0.6	0.0	0.749	0.570	0.984
[sex=0]	0.3	0.3	0.782	1	0.376	-0.3	0.9	1.328	0.708	2.494
[sex=1]	0 ¹			0				1.000		
[Age=1]	-0.8	0.4	4.778	1	0.029**	-1.5	-0.1	0.446	0.216	0.920
[Age=2]	-0.7	0.4	3.45	1	0.063**	-1.5	0.0	0.473	0.215	1.042
[Age=3]	0 ¹			0				1.000		
[Trust=0]	1.2	0.3	15.12	1	0.000*	0.6	1.7	3.180	1.775	5.695
[Trust=1]	0 ¹			0				1.000		
[Expe=0]	-0.5	0.3	3.695	1	0.055***	-1.1	0.0	0.580	0.333	1.011
[Expe=1]	0.0			0				1.00		
[satisf=1]	-0.3	0.5	0.43	1	0.512	-1.2	0.6	0.742	0.303	1.813
[satisf=2]	0 ¹	0.4	0.003	1	0.957	-0.8	0.8	1.023	0.452	2.315
[satisf=3]	-0.8	0.5	3.004	1	0.083***	-1.7	0.1	0.458	0.190	1.107
[satisf=4]	0.1	0.4	0.021	1	0.886	-0.7	0.8	1.055	0.508	2.192
[satisf=5]	0 ¹			0				1.000		

Link function: Logit

¹This parameter is set to zero because it is redundant

Note: **, ***statistical significance at 5 and 10 per cent levels, respectively.

of them (nearly 64%) reported they would still need to consider whether to continue with the contract or not. Very few reported they were willing to continue with the program (12.7%). Fewer household heads (nearly 47%) expressed trust to companies involved in the drought insurance contracts while the majority 54% respondents reported to have little trust with the companies. Further, results as presented from factor summary showed that, more than half of the farmers (55.8%) were not satisfied with the contract services while 44.2% expressed satisfaction.

4.4 Factors influencing willingness to continue with drought insurance contract:-

Findings revealed that, five factors were observed to be statistically significant hence influencing willingness of farmers to continue holding drought insurance contracts (table 5). These were farm size, age of respondents, farmers' trust of insurers,

change in farm size decreased the odds of willingness to continue with the contract program by the factor of 0.75 when other factors are held constant. This implied that farmers with large farm sizes were not willing to continue with the drought insurance contract program. Since the contract required farmers to repay their loans after harvesting, when faced with poor harvests due to drought, farmers with large farms suffered most because of their relatively large loans hence making it hard for them in the subsequent year to repay for the current and the carried forward loans. The doubt to proceed with the program may have arisen from the mismatch of payouts between farmers' expectations and the insurer's payouts as established from weather indices. This findings are in line with Rosema *et al.* (2014) who showed that, farmers in the drought insurance pilot program in Bunda were disappointed due to incompatibility of expectations as they wanted high coverage but to be given at a low price.

Also findings showed that, an increase in age (years) was associated with an increase in the odds of unwillingness to continue holding the contract

venture into crop insurance. Three insurance companies expressed possibilities of extending their services into agricultural insurance subject to the

Table 5: Number of Insurance Companies in Tanzania in 2013

Life and non-life Insurance Companies in Tanzania					
Available companies in Tz*	Insurance companies	Interviewed companies	crop ins.	livestock ins.	Co's planning to start up crop ins.
29		16	0	1	2

*Registered Insurance companies according to Tanzania Insurance Regulatory Authority (2013)

Source: Author

insurance, with an odds ratio of 0.446 (95% CI, 0.216 to 0.920), Wald $\chi^2=4.778$, $p<0.05$, when other variables in the model are controlled. Thus, farmers within the age of 18-45 were more willing to continue with the program than other groups. This is most probably due to the fact that they were economically active hence more likely to diversify activities such as engaging in off-farm income generating activities that could increase chances of repaying their debts.

Trust was another factor that determined willingness of farmers to proceed with the program since results indicated it increased the odds of willingness to continue with insurance contract by the factor of 3.18 when other factors are held constant. Household heads that had trust on insurers were more willing to proceed with the program than those who had no trust on insurers.

Also experience influenced willingness as findings showed that, it was associated with an increase in the odds of unwillingness to continue holding the contract insurance, with an odds ratio of 0.580 (95% CI, 0.333 to 1.011), Wald $\chi^2=3.695$, $p<0.1$, holding other factors constant. This implied that farmers with less experience in contract farming were more likely to continue receiving the services of drought insurance than those with experience in the past suggesting that, those who were previously enrolled in contract farming might have had either unpleasant experience in the past or the expectations of the experienced had been missed.

Lastly, the model predicted that being neutral on satisfaction about the drought insurance contract services decreased the odds of willingness to continue with the insurance contract by the factor of 0.46 (95% CI, 0.333 to 1.011), Wald $\chi^2=3.695$, $p<0.1$ when other factors are held constant. The implication could be that, probably farmers who remained undecided were not likely to opt for insurance contracts in the future unless there was improvement in handling of the program services.

4.5 Preparedness of Public and Private Sector to Offer Agricultural Insurance

With regards to the insurance companies' preparedness to venture into agricultural insurance, results showed that out of the interviewed 16 companies, only one company claimed to provide livestock and tree plantations insurance (table 5). No insurance company in the country had fully engaged in crop insurance. The survey revealed that nearly all insurance companies had no immediate plans to

condition that, the government develops and improves suitable policies and infrastructures essential in designing insurance policies that will not only reduce famers' risk but also minimize the companies' risk of insuring farmers. Only 2 companies were in the process to start crop insurance in the country. These findings depict that, up to the time of this study, the preparedness of insurance companies to venture into agricultural insurance was still very low.

These results are in line with the findings by SFSA-SCBF (2014) on Tanzania agricultural insurance feasibility which revealed that, although the insurance sector had grown in the past years from 6% of adults in 2009 to up to 19% of adults in 2012 who were insured, most of these insurance products were through group life insurance that is embedded in a deposit account or loan with a financial establishment

5. CONCLUSION AND RECOMMENDATIONS

Lack of willingness by majority of farmers to continue engagement with the drought insurance program under pilot was a result of challenges that made them fail to feel the risk reduction benefits of the program. The explanatory variables identified to influence willingness to continue with the program were farm size, age of respondents, farmers' trust of insurers, experience in contract farming and farmers' satisfaction on contract services. The study further revealed that, up to the time of this study, the preparedness of insurance companies to venture into agricultural insurance was still very low in the country. These challenges altogether undermine the sustainability of drought insurance in Tanzania and the growth of Tanzanian cotton sector at large.

The government ought to seriously intervene in observing and adequately addressing the technical and policy problems that are sources of farmers' dissatisfaction about the benefit of the program. Collaboration from both the private and the public sector is essential in ensuring the success of drought insurance program implementation through increased efficiency by the private investors as well as government's commitment in supporting the program. To improve farmers' willingness to engage in drought insurance contract program, pertinent challenges ought to be timely and adequately addressed by the government so as to enable farmers realize the risk reduction benefits of the program.

Effective policy and strategies for supporting and enhancing the development of infrastructures must be adopted by the government and development partners so as to attract insurers to venture into the agricultural insurance business in Tanzania.

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