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Şinasi Akdemir

Sustainable Development and Management Research

Şinasi Akdemir continues his academic work studies, which he started in 1987 at Çukurova University. He is still working on agricultural sciences, agricultural economics, agricultural management, agricultural marketing, and sustainable development at the same university.

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Sustainable Development and Management Research

Editor

Prof. Dr. Şinasi Akdemir

Şinasi Akdemir continues his academic work studies, which he started in 1987 at Çukurova University. With his determination and hard work, he quickly passed the academic ladder and gained the title of professor in 1994. He is still working on agricultural sciences, agricultural economics, agricultural management, agricultural marketing, and sustainable development at the same university. Şinasi Akdemir, who has dozens of articles indexed in international indexes, has edited more than 10 books. He contributed to this book as both author and editor, with thoroughness work and great academic attention.

Preface

The book Sustainable Development and Management Research is a six-part work written by experts in the field. In the first part of the book, research in the field of sustainable development education in Turkey was examined. In the second part, the use of neuromarketing in the field of health is explained. The third chapter is reserved for the effect of internet-based applications on the functioning of health services. The fourth chapter is about the willingness of people to obtain organic products, which are very important for a healthy life. This subject has been examined in the context of organic dairy products. The fifth chapter explains how the producers produce their agriculture. Here, how the radish producers produce radishes, the problems they encounter, and the product quality are examined. In the last part, agricultural insurance, which is a very important issue for sustainable agriculture, has been researched considering the Togo sample.

As a result, we hope that this book, which includes studies that complement each other in various branches, from education to agriculture, from health to organic products, whose common denominator is sustainable development and management, will be beneficial to readers and researchers.

I hereby respectfully

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IMPACT OF FARM ASSETS ON THE WILLINGNESS TO UPTAKE AGRICULTURAL INSURANCE IN TOGO

PhD Student Elpidio KOUGNIGAN
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Prof. Dr. Şinasi AKDEMİR
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INTRODUCTION

Togo's economy, like that of most countries in the sub-region, has long been based on the agricultural sector. Even if the contribution of the sector to the formation of the GDP is reduced over the years, agriculture still plays a preponderant role in the economy and the development of the country with increasingly increasing added values. It represents 19% of the GDP (World Bank, 2021a), an absorption of 32% of the active population in 2019 (World Bank, 2021c); strategies for eradicating hunger and achieving sustainable development goals are largely based on the growth and development of the agricultural sector. However, despite the efforts and progress made in the sector, there is still a state of deficit. For example, the needs for rice, meat, fish, not to include agro-food products, cannot be met by national production, leading to import expenses amounting to $284,536,742 US in 2015 (for 13.38% of total imports) (World Bank, 2021b). To reverse the trend, many actions have been un-

dertaken, both at the national and sub-regional levels. We, thus, note the support, investment and productivity programs for the agricultural sector, and even support funds for entrepreneurs, many of which go to agro-food transformation projects. These projects have certainly allowed considerable progress in production but allow us to realize the dependent nature of structures and agricultural contractors for financing from the projects. Although the agricultural sector contributes enormously to the country's growth, although it shows even more promising growth potential in response to the projects carried out, the growing population, the needs for agro-food processing, the agricultural trade balance in deficit, there is a shortage of financial solutions. Public expenditure allocated to the agricultural sector was 2.5% of GDP in 2004, and 3.9% in 2010 (World Bank, 2012). Concerning the credits granted by the banks, the agricultural sector is the last beneficiary of bank financing with 0.2% of the total credits granted in 2019 (Togopresse, 2020). The role of financing in productivity, development, and innovation is no longer demonstrated (D'Souza, 2020). Agricultural credit has enabled the industrialization of agriculture in many economies (D'Souza, 2020). When we look at the explanatory causes of the underfunding of agriculture in Togo, apart from the family character of many farms in Togo, one of the essential reasons for the underfunding of the agricultural sector is the very nature riskiness of the sector compared to other sectors.

It is true that agriculture in Togo, like that in several countries in Africa, is very dependent on the seasons, increasing the level of risk of agriculture, which is to some extent dependent on nature.

Natural disasters are very costly for agriculture. According to an FAO report between 2005 and 2015, 96 billion dollars of agricultural and animal losses were caused by natural disasters in developing countries (FAO, 2021). In general, the drought is the most costly over this same period (29 billion US dollars). In Africa, the second (the most affected of the continents), just like Latin America and the Caribbean, drought and animal losses are the most costly disasters with respectively 10.7 and 13 billion dollars between 2005 and 2015 (FAO, 2021). Agricultural risks are among those factors that strongly influence decisions about input use, investment and technology adoption. Uncontrolled production risks and their cost are major impediments to investing in land improvement, irrigation, agricultural equipment and inputs, including fertilizers

and seeds. Agricultural risks are among the main reasons for poverty traps, as they can influence smallholders' decisions in favor of low-risk but also low-return subsistence farming, rather than increasing investment in enterprises high-yielding agricultural crops (FAO, 2021). For instance, in Turkey, the low risk reward offered by agricultural sector makes youth quitting farming resulting in a reduction of farm assets and an ageing population (Akdemir et al., 2021)in a context marked in recent years by a rural exodus of young people, marks the vagueness of the current state of the agricultural sector and its future. It is with this in mind that this research was carried out, based on a questionnaire survey of 312 producers in 5 provinces of Turkey, to assess the impact of the ageing of the rural population on the agricultural sector. The results of this study show that with age, producers invest less in agricultural activity, altogether abandoning productions requiring more labour. The possibility of taking over the family farm by descendants plays an important role in the degree of involvement of producers. Through these findings, this study makes it possible to address targeted agricultural policies according to age stages.","container-title":"New Medit","DOI":"10.30682/nm2104d","ISSN":"2611-1128, 15945685","issue":"4","journalAbbreviation":"New Medit","language":"en","page":"49-62","source":"DOI.org (Crossref. This impact on production can easily affect the chain at the level of processors, agro-food companies (…) in their planning, decision-making and development of activities. Considering the consequences on farmers, consumers, actors present throughout the value chains, and even on the national economy, the importance of risk management mechanisms is irrefutable. In sub-Saharan Africa, risk management operates more through the depletion of savings, production assets, crop diversification, diversification into non-agricultural activities, which could reduce agricultural production capacity, in terms of time, labor and other physical and financial resources. These methods of risk management and adaptation are not the most appropriate since they are not sustainable; they will lead families and farms to a precarious situation, a reduction in production capacity, or abandonment of agricultural activity (Demeke et al., 2016). Allowing the sustainability of agricultural activity therefore requires the establishment of an appropriate risk management mechanism that would allow agricultural producers to continue their agricultural activities without seeing their savings and production assets eroded. The agricultural insurance mechanism (conventional as index) has the

advantage of protecting farms or agricultural families without inducing them into difficult socio-economic situations or situations of reduction of agricultural capital. However, despite these benefits conferred by insurance mechanisms, the level of enthusiasm is not always up to expectations. Indeed, Africa has the lowest rates of insurance coverage and these agricultural insurance practices were only introduced from the 1990s. Increasing the adoption of insurance requires understanding the motivations and the determinants by analyzing from the point of view of the producers. Although agricultural insurance is young in Africa, there are scientific studies on the issue; most being post-project evaluation studies. However, studies on agricultural insurance in Togo are not yet available, nor is the insurance itself. Understanding the socio-economic motivations and expectations of Togolese producers would make it possible to set up a more suitable insurance service, and a massive adoption of it. It is in this context that based on the Contingent Evaluation Method, on comparison and regression analyses, this study analyzes the probability of adoption and the factors supporting or preventing this adoption by agricultural producers in Togo.

The results of this study will serve as a guide in understanding the factors of adoption or rejection of agricultural insurance - which is a new technology - in the agricultural world in Togo, and will make it possible to put in place the conditions necessary for an effective implementation of the agricultural insurance mechanism in Togo. The aspects taken in consideration for this research are the socio economical characteristics of the farmers, their assets and finance and their correlation with the will to subscribe to agricultural insurance.

1. RESEARCH METHODOLOGY

1.1 Research Design

The nature of the study is a descriptive cross sectional research. This study process collects information on a particular population pattern or events. The study used descriptive research designs to collect data through questionnaires to respond to awareness-raising questions, people's perception of insurance premium costs, and social-economic factors that decide the

use of farm insurance in enriching food safety. Kerlinger, (1983) says that using descriptive approaches, the relative frequency, distribution and interrelations of sociologically and psychologically variable can be analyzed by choosing a small population sample. The data collection method consisted of an open-ended and closed-ended questionnaire to obtain sectional and comparative data.

1.2 Sample Size and Sampling Technique

The population of the research study consisted of farmers and breeders in Togo. The target population was split into 3 groups, farmers involved in export oriented crops (soya, cashew…), farmers in food-producing cultures (maize, rice…), and breeders of poultry. The breeders of poultry were mostly chosen in Maritime region, since it is the place of high concentration of big breeders; concerning the soya and maize farmers, the target regions were all the 5 regions of the country in order to have a representative sample.

In line with the above and to ensure good representation in both categories, both probability and non-probability sampling techniques were applied. The reason for using stratified sampling method is that the study aims at capturing information from all the diverse groups of people; those with a certain form of professionalization (contractual agriculture, constant income) and those without. The study cross related these different aspects to see if there was any influence of them in the use of agriculture insurance as a means of enhancing food security. In order to achieve this, the population was divided into three sub-populations that is individually more homogeneous than the total population, each sub-population was called a strata. Items from each stratum constituted a sample. Simple random sampling technique was adopted for the strata of those without (or with very low) professionalization (food-crop producers). However, for the strata of those with a certain level of professionalization, the snowballing sampling method was used. This is because the subjects in this category are unknown as there was no sampling frame or available data to show where they are located. These sampling methods could give the desired representation for the subgroups. The identification of the participants was assured by technical advisers from support institutions that

were present during the interview or provided a data about some farmers.

The recent data of the population of farmers in Togo is from 2013, stating a number of 3,738,430 as farmer population, with 1,311,659 as the active farmers' population. Assuming this data, we can use the formula proposed by Yamane (1967).

$$n = \frac{N}{(1 + Ne^2)}$$

Where n is the sample size, N is the population size, and e is the level of precision; we chose 95% as interval of confidence.

When this formula is applied to our total farmers' population or active farmers' population the sample is 400.

In case, we suppose we don't know the size of the populations since the available data is not up to date, we can use this following formula proposed by Daniel (1999):

$$n = \frac{Z^2pq}{e^2}$$

Assuming we chose a 95% confidence level, 0.5 standard deviation (p), and a margin of error (confidence interval) of +/- 5%, q=1-p 95% – Z Score = 1.96

The sample size from this formula is therefore 385.

The size of the sample is selected as representatively as possible to minimize sampling error. Pre-testing the Instruments was done in the Savannah Region while the remaining regions were included in the actual study. A total sample size of 486 farmers was therefore targeted by the study, and 456 answers were validated. Sampling of farmers will be done as presented in table.

Table 3.1. Sample size for the farmers

Region	Sample per region	Vegetal Producers	Breeders
Maritime region	92	43	49
Plateau region	128	92	36
Central region	31	27	4
Region of Kara	120	95	25
Savannah region	85	55	30
Total	**456**	**312**	**144**

Source: Survey results, 2021

1.3 Data Collection Procedure

The study used primary data. Primary data was collected using questionnaires administered by competent people experienced with rural and agricultural life and technical support to farmers. The tool was used to explore not only the opinion of stakeholders but also evaluate the response of insurance perception. In order to improve the response rate and quality of data gathered, the questionnaires to the respondents in the study was administered and the respondents interviewed accordingly.

Questionnaires were filled out at the same time as the interview. The main reasons for using the interview method of collecting data is to ensure that the questions would not be misunderstood, to assist illiterate respondents and to minimize the risk of collecting incomplete information as it is with self-filling questionnaires types, particularly when people are unable to understand the questions properly. This data collection method appeared to be the most appropriate in providing a safe basis for generalization and high accuracy.

1.4 Data Analysis

After data collection, the questionnaires were edited and coded for completeness and accuracy to avoid errors. Descriptive statistics tools of analysis that were used included tables, and Mean ratings to represent the response rate and information on the variables under study. The closed ended questions were analyzed using correlation analysis. The broad purpose of Pearson correlation analysis was to summarize data so that relationships and patterns can be easily interpreted and understood. The SPSS statistical software was used for that purpose.

A Logit model helped to estimate the factors that influence adoption or uptake of the new technology, because the dependent variable evokes a yes or no answer (Gujarati, 1998). It was however observed that, although there is statistical similarity between Logit and Probit models, which makes choice between them difficult, Logit model is computationally easier (Amemiya, 1981), hence its choice for this study. Following Gujarati (1998), the logit model is specified as follows:

$$\text{Ln}(Pi / (1-Pi)) = \beta\, 0 + \beta\, 1X1 + \ldots.. + \beta\, 13X13 + ei$$

Where:

Pi = probability of farmer accepting agricultural insurance

1-Pi = probability of not accepting agricultural insurance

$\beta\, 0$ = Intercept

βi (1, 2, 3…13) = Regression coefficients

Xi (1, 2, 3…13) = Independent variables and

ei = error term.

The open questions was analyzed and summarized in a content analysis.

1 FINDINGS AND RESULTS

1.1 Socio-economic characteristics of producers

The study took place with agricultural producers in the 5 regions of Togo.

The participants in our study are on average 38.13 years old; women constitute 15.79% of respondents. With 78.51% of respondents married, 52.85% as a rate of belonging to a cooperative, the level of illiteracy is 33.99%, the vast majority of literates having a primary level (33.99%). 86.72% of producers recognize a beneficial role of cooperatives. Most producers (62.5%) are not supported by an agricultural advisory or research institution; when they are, the ICAT is the institution that is most represented (33.77%). Production is more for marketing purposes (more than half of production) for 79.07% of producers.

With an average of 5.81 years of years of existence of the agricultural structure, the average farm size is 4.18ha with 18% of the land coming from rentals, for a general irrigation rate of 15% of the agricultural land total. As for the workforce, there are on average 1.6 permanent workers and 2.24 in high season. The average representation rate of family labour among the permanent workforce is 80.34%.

The distribution of agricultural land varies by region. The plateau region has 58.97% of farms over 5 ha, 30.12% of farms between 1 and 5 ha; the maritime region is in 2nd position with 17.09% and 24.10% respectively for farms of more than 5 ha and those between 1 and 5 ha. According to the cross tab analysis, membership of a cooperative, the proportion of harvests sold, the possession of savings in financial institutions (…) are variables that are positively correlated with the size of the farm.

Given the selection of the types of producers during the sampling, the dominant productions of the population studied are corn (30.92%), poultry (25.88%) and soybeans (25.66%). 54.50% of producers associate livestock with crop production; exclusive vegetable production is the case of 29.89%.

Table 4.1. Income distribution

INCOME (FCFA)	N	Percent
0-499999	149	32.68%
500000-999999	89	19.52%
1000000-1999999	113	24.78%
>2000000	105	23.03%

Source: Survey results, 2021

The average annual agricultural income is 1748894.74 FCFA, with a gross margin of 1388675.44 FCFA. However, a large proportion (32.68%) of the population records an income of between 40000 FCFA and 499999 FCFA.

Having an income outside of agriculture is the case for 59.21% of producers, with an average value of 832,411.81 FCFA.

The value of assets is evaluated on average at 1078701.98 FCFA (land excluded) for 354 producers.

33.11% of the producers revealed that they had no savings, and 33.99% claimed not to have a savings account in any financial institution whatsoever; it turns out that those without a savings account represent 96% of producers without savings. In addition, when asked to identify the barriers to savings, after insufficient income (47.59%), the lack of a financial institution is the second most cited cause (30.34%) as that primordial barrier.

Table 4.2. Desired insurance premium distribution

Amount (FCFA)	N	Percent
0-2499	64	14.04%
2500-4999	20	4.39%
5000-7499	260	57.02%
>10000	112	24.56%

Source: Survey results, 2021

The predisposition to subscribe to the insurance is noticed in 67.76% of the producers surveyed, with 57.02% of the participants in favour of paying an amount between 5000 FCA and 7499 FCFA. The motivations for subscription are essentially for risk management (95.15% of members) and easy financing (94.17%).

2.2 Farm size and capital

2.3 Farm assets

Linear regression analysis was applied to determine which factors are correlated to total assets held by operations. As independent variables, the gender of the producer, the marital status, the age, the membership of a cooperative , the number of years of activity of the farm, the number of seasonal and permanent workers, the place of business registration, share of production sold, profit during the year, status of keeping financial records, amount of debt, family and personal expenses, amount of foreign funds , income, expenses, off-farm income, business profitability over the past 24 months, farm insurance status, and land assets. The R-squared of the model was found to be 98.6%. Thus, the independent variables remaining significant in the model explain 98.6% of the variance (variability) of the dependent variable. Based on the F-test of the ANOVA table, the model is significant (p-value = 0 <0.05, table 4.3).

Table 4.3. Factors related to farm assets- ANOVA (a)

Anova						
		Total square	**Df**	**Mean Square**	**F**	**P-value**
Model	**Regression**	20913257616745700.0	13	1608712124365050.0	2406.491	0.000
	Error	295472036355875.0	442	668488770035.917		
	Total	21208729653101600.0	455			

Source: Survey results, 2021

Table 4.4 Factors correlated to farm assets – Model Summary (b)

Model summary				
	R	**R-Square**	**Adjusted R Square**	**Standard. Error of the Estimate**
Model	0.993	0.986	0.986	817611.625

Source: Survey results, 2021

According to the model table obtained, the variables of location, the gender of the producer, the number of children, age, education, membership in the cooperative, the profitability status of the farm throughout the Year, debt, total margin, household expenses, insurance status, and land area are significant in the model (p-values < 0.05, table 4.3). Since the VIF values are much less than 10, there is no multicollinearity problem between the dependent variables.

Table 4.5. Factors Correlated to Farm Assets – Logistic Regression (c)

	B	Standard. Error	T	P-value	VIF
(Constant)	-1393326.600	150935.322	-9.231	0.000	
Location (1=rural; 2=city)	414460.937	71459.416	5.800	0.000	1.217
Gender (1=male; 2=female)	247359.319	62203.350	3.977	0.000	1.061
Number of Children	-24443.672	10425.536	-2.345	0.019	2.234
Age	15969.728	2774.095	5.757	0.000	2.344
Educational level	91922.929	24937.080	3.686	0.000	1.391
Membership to a cooperative (1=Yes; 2=No)	130272.413	45170.833	2.884	0.004	1.449
Profitability all the year(1=Yes; 2=No)	207788.670	53941.285	3.852	0.000	1.758
Debt	-0.479	0.049	-9.845	0.000	1.635
Spending for family	-0.719	0.076	-9.400	0.000	1.363
Total margin	0.016	0.007	2.291	0.022	1.342
Would you get an insurance? (1=Yes; 2=No)	-163225.560	52666.167	-3.099	0.002	1.727
Land assets of the farm	0.491	0.003	156.076	0.000	1.953

Source: Survey results, 2021

From the table above, it is observed that farm businesses in the urban area have 1.27 times more assets, women farms are 6% more valuable in term of asset. The asset of the farms gets smaller (2.23 times) as the number of children increases, but it is positively correlated with age (2.34 times), with the membership to a cooperative (44.9%), with the profitability expressed through the margin (34.2%), and as well as with education level

(39.1%). The resources of the farm is however negatively correlated with the amount of debt (63.5%) and the spending for the family (36.3%). It is observed that the farmers that don't want to uptake the agricultural insurance own 72.7% less assets than the others.

2.3.1 Factors impacting gross margin

A linear regression analysis was applied to determine the factors correlated to the agricultural gross margin achieved by the producers surveyed. As independent variables, the gender of the producer, the marital status, the age, the membership of a cooperative, the number of years of activity of the farm, the number of seasonal and permanent workers, the place of business registration, share of production sold, profit during the year, status of keeping financial records, amount of debt, family and personal expenses, amount of foreign funds , income, expenses, off-farm income, business profitability over the past 24 months, farm insurance status, and land assets. The R-squared of the model was found to be 68.4% (table 4.4). Thus, the independent variables remaining significant in the model explain 68.4% of the variance of the dependent variable. According to the F test of the ANOVA table, the model is significant (P-value = 0 < 0.05, table 4.3).

Table 4.6. Factors correlated to gross margin (a)

	R	R-Square
Model	0.827	0.684

Source: Survey results, 2021

Table 4.7. Factors correlated to gross margin – ANOVA (b)

Anova						
		Total Squares	Df	Mean Squares	F	P-value
Model	Regression	380960746569979,000	15	25397383104665.300	21.338	0.000
	Error	176158464186119,000	148	1190259893149.450		
	Total	557119210756098.000	163			

Source: Survey results, 2021

Table 4.8. Factors Correlated to Gross Margin – Logistic Regression (c)

	B	Standard. Error	T	P-value	VIF
(Constant)	539190.310	695763.048	0.775	0.440	
Location (1=rural; 2=urban)	-910570.753	344573.582	-2.643	0.009	1.194
Age	66075.929	13124.659	5.034	0.000	2.443
Level of education 1 = None 2 = Primary school 3 = Middle school 4 = University	287434.114	120851.440	2.378	0.019	1.299
Foreign fund amount	0.740	0.139	5.307	0.000	1.039
Land assets of the enterprise	7350.281	2246.755	3.272	0.001	1.053
Would you get an insurance? (1=yes; 2=no)	-837178.417	324464.457	-2.580	0.011	1.133
Fruit income	310681.617	79260.948	3.920	0.000	1.547
Peanut income	47409.591	24958.890	1.900	0.050	1.054
Cattle income	96603.519	20417.368	4.731	0.000	1.025

Source: Survey results, 2021

According to the model obtained, the variables such as location, age of the producer, education, amount of funds from abroad, land assets of the farms, income from fruits, income from peanuts and Livestock incomes

are significant in the model (P-values <0.05, table 4.8). The VIF values being well below 10, there is no problem of multi-collinearity between dependent variables.

According to table 4.8, farms located in rural areas make more profit; similarly, the profit of the producers increases with their advancing age; profitability is found to be positively correlated with the amount of funds received from the diaspora, the area of the farm, the income from fruit, vegetable, groundnut and cattle farms (when there are any) . However, it is reduced among those who do not intend to take out insurance.

2.3.1.1 Age and economic performance of farms

Is the performance of agricultural farms linked to the age of producers? In order to verify this idea, a mean comparison was performed. Beforehand, a normal distribution test of agricultural income, non-agricultural income, and farm assets according to age shows that the distributions are not normal, thus requiring a Kruskal-Wallis test due to the fact of the categorization of ages into 3 groups.

Table 4.9. Normal distribution test of farm income, off-farm income, and farm assets by producers' age

Age		Kolmogorov - Smirnov [a]			Shapiro Wilk		
	Statistics	Df	P-value	Statistics	Df	P-value	
Income from farming	19-30	0.191	75	0.000	0.722	75	0.000
	31-45	0.232	106	0.000	0.651	106	0.000
	46-72	0.293	43	0.000	0.393	43	0.000
Non-farm income	19-30	0.185	75	0.000	0.706	75	0.000
	31-45	0.444	106	0.000	0.139	106	0.000
	46-72	0.414	43	0.000	0.196	43	0.000
Asset	19-30	0.301	75	0.000	0.591	75	0.000
	31-45	0.380	106	0.000	0.277	106	0.000
	46-72	0.368	43	0.000	0.342	43	0.000

Source: Survey results, 2021

Normality tests of the Kolmogorov-Smirnov distribution as well as that of Shapiro-Wilk confirm abnormal distributions of farm income, off-farm income, and farm assets as a function of producer age (table 4.9).

Table 4.10. Kruskal - Wallis analysis (a) – Rank table / Age and farms' economic performance

Rank table			
Age		**N**	**Mean-rank**
Income from farming	19-30	123	213.99
	31-45	222	211.27
	46-72	111	279.03
	Total	456	
Non-farm income	19-30	90	134.46
	31-45	121	142.20
	46-72	59	123.35
	Total	270	
Asset	19-30	103	192.19
	31-45	187	165.89
	46-72	64	187.80
	Total	354	

Source: Survey results, 2021

Table 4.11. Kruskal - Wallis analysis (b) – Test Table / Age and economic performance of farms

Test table			
	Income from farming	**Non-farm income**	**Asset**
Kruskal -wallis h	21.611	2.341	5.180
Df	2	2	2
P-value	0.000	0.310	0.075

Source: Survey results, 2021

Farm income differs by age group (p-value = 0.000 <0.05, table 4.11). There is no significant statistical difference for off-farm income or assets by age. It can be seen that producers aged between 46 and 72 have higher agricultural incomes than the others. The averages are given below.

Table 4.12. Kruskal - Wallis analysis (c) / Age and economic performance of farms

Age		**Income from farming**	**Non-farm income**	**Asset**
19-30	Average	1601219.51	260200.00	860519.42
	N	123	90	103
31-45	Average	1368846.85	1283000.00	1234919.79
	N	222	121	187
46-72	Average	2672630.63	781203.39	973390.63
	N	111	59	64
Total	Average	1748894.74	832414.81	1078701.98
	N	456	270	354

Source: Survey results, 2021

However, it is not yet possible to confirm a difference between the other 2 remaining age categories. Thus, a Whitney Mann test is necessary to check if there is a difference between the 2 remaining age groups.

Table 4.13. Mann-Whitney analysis (a) - Rank table / Age and farm income

Ranks				
Age		**N**	**Average Rank**	**Sum of Ranks**
Income from farming	19-30	123	174.54	21468.50
	31-45	222	172.15	38216.50
	Total	345		

Source: Survey results, 2021

Table 4.14. Mann-Whitney analysis (b) – Test table / Age and farm income

Test	
	Income from farming
Mann-whitney u	13463.500
P-value	0.831

Source: Survey results, 2021

The P-value being greater than 0.05, it appears that the agricultural incomes of producers aged between 19 and 30, and those of producers aged between 31 and 45, are not significantly different, but are significantly lower than producers whose age is between 46 and 72 years old.

2.3.1.2 Types of production and economic health of farms

In addition to the possibility of a correlation between the age and the economic performance of the structures, the analysis looked at the possible relationships between the types of crops and the economic performance of the farms studied.

The study of the distribution of agricultural income, non-agricultural income, and farm assets according to the types of production is necessary beforehand.

Table 4.15. Normal distribution test of farm income, non-farm income, and farm assets by type of production

Type of production / Statistics		Kolmogorov - Smirnov [a]			Shapiro Wilk		
		Df	P-value	Statistics	Df	P-value	
Income from farming	Plant and animal production	0.240	172	0.000	0.545	172	0.000
	Plant production (alone)	0.176	22	0.074	0.904	22	0.036
	Animal production (alone)	0.182	29	0.015	0.752	29	0.000
Non-farm income	Plant and animal production	0.445	172	0.000	0.139	172	0.000
	Plant production (alone)	0.326	22	0.000	0.543	22	0.000
	Animal production (alone)	0.347	29	0.000	0.437	29	0.000
Asset	Plant and animal production	0.390	172	0.000	0.236	172	0.000
	Plant production (alone)	0.375	22	0.000	0.407	22	0.000
	Animal production (alone)	0.321	29	0.000	0.611	29	0.000

Source: Survey results, 2021

Wilk normality tests all confirm the abnormal distribution of farm income, off-farm income, and farm assets across production types (the P-values are less than 0.005, table 4.15).

Table 4.16. Kruskal - Wallis analysis (a) – Rank Table / Economic performance and type of production

Rank			
Type of production		**N**	**Average Rank**
Income from farming	Plant and animal production	248	255.06
	Plant production (alone)	136	155.52
	Animal production (alone)	71	272.32
	Total	455	
Non-farm income	Plant and animal production	191	145.24
	Plant production (alone)	43	131.73
	Animal production (alone)	35	83.14
	Total	269	
Asset	Plant and animal production	211	212.29
	Plant production (alone)	88	92.91
	Animal production (alone)	54	176.16
	Total	353	

Source: Survey results, 2021

Table 4.17. Kruskal - Wallis analysis (b) – Test Table / Economic performance and type of production

	Income from farming	Non-farm income	Asset
Kruskal -wallis	59.92	18.97	85.01
Df	2	2	2
P-value	0.000	0.000	0.000

Source: Survey results, 2021

According to the production model, there is a difference between the variables of farm income, non-farm income and business assets (P-value<0.05). Consequently, the group standing out must be excluded and the difference must be studied for the 2 remaining groups; the averages are given below.

Table 4.18. Kruskal - Wallis analysis (c) / Economic performance and type of production

Type of production		Income from farming	Non-farm income	Asset
Plant and animal production	Average	2019967.74	804769.63	1393739.34
	N	248	191	211
Plant production (alone)	Average	1091095.59	1527069.77	411170.45
	N	136	43	88
Animal production (alone)	Average	2084154.93	152485.71	844416.67
	N	71	35	54
Total	Average	1752342.86	835360.59	1064760.62
	N	455	269	353

Source: Survey results, 2021

2.3.1.3 Farm income and production

In terms of agricultural income, we see that those doing only crop production earn less income. If this group is deleted, we have the following.

Table 4.19. Mann-Whitney analysis (a) – Rank Table / Farm income and type of production

Rank				
Type of production		**N**	**Average Rank**	**Sum of Ranks**
Income from farming	Plant and animal production	248	156.85	38900.00
	Animal production (alone)	71	170.99	12140.00
	Total	**319**		

Source: Survey results, 2021

Table 4.20. Mann-Whitney analysis (b) – Test Table / Farm income and type of production

Test Statistics [a]	
	Income from farming
Mann-whitney U	8024.000
P-value	0.255

Source: Survey results, 2021

Since P-value > 0.05, there is no difference between the agricultural production income of those who combine livestock and crops and those who only have livestock. We therefore retain that producers who only cultivate crops earn less agricultural income than all the others.

2.3.1.4 Production and Non-Farm Income

In terms of non-agricultural income, according to the Kruskal-wallis test (table 4.18), we find that only those who only raise livestock have low incomes. We then proceed to the analysis by removing this group from it in order to test the evolution between the remaining groups.

Table 4.21. Mann-Whitney analysis (a) – Rank Table / Off-farm income and type of production

Rank				
Type of production		**N**	**Average Rank**	**Sum of Ranks**
Non-farm income	Plant and animal production	191	119.59	22841.50
	Plant production (alone)	43	108.22	4653.50
	Total	**234**		

Source: Survey results, 2021

Table 4.22. Mann-Whitney analysis (b) – Test Table / Off-farm income and type of production

Test Statistics [a]	
	Non-farm income
Mann-whitney U	3707.500
P-value	0.319

Source: Survey results, 2021

Since P-value > 0.05, there is no difference in terms of off-farm income between those who do mixed production (vegetation and livestock) and those who only do vegetable crops. That said, the farms that just raise livestock have the least income from non-agricultural activities, the others groups having their non-agricultural incomes significantly not different.

2.3.1.5 Production and assets

In terms of total assets, according to the result of the Kruskal Wallis test, we find that only those who exclusively grow crops have fewer assets (table 4.18). Let's then proceed with the analysis by removing this group in order to compare the assets between the remaining groups.

Table 4.23. Mann-Whitney analysis (a) – Rank Table / production assets and type of production

Rank				
Type of production		**N**	**Average Rank**	**Sum of Ranks**
Asset	Plant and animal production	211	138.80	29287.50
	Animal production (alone)	54	110.32	5957.50
	Total	**265**		

Source: Survey results, 2021

Table 4.24. Mann-Whitney analysis (b) – Test Table / production assets and type of production

Test statistics	
	Asset
Mann-whitney U	4472.500
P-value	0.015

Source: Survey results, 2021

Since the p-value is < 0.05, there is a significant difference between those who produce crops and livestock, and those who only deal with livestock in terms of farm assets. People engaged in both crop production and higher livestock are found to have more assets than those engaged in livestock only; the latter having more assets than those doing crop production only.

2.3.2 Insurance and economic characteristics of the farm.

2.3.2.1 Insurance and margin

The analysis and the comparisons of means have made it possible to realize that the characteristics inherent in the size and the proper functioning of the farm are positively correlated with the desire for agricultural insurance. This leads to verifying whether the subscription to agricultural insurance is in any way affected by the farm's gross margin. To do this, we compared averages with the gross margin achieved as the dependent variable, and the independent variable whether or not you wanted to subscribe.

Table 4.40. Test of normal distribution of gross margin according to insurance subscription

Subscription to agricultural insurance / Statistics		Kolmogorov - Smirnov [a]			Shapiro Wilk		
		Df	Sig.	Statistics	Df	Sig.	
Margin	No	0.409	147	0.000	0.182	147	0.000
	Yes	0.274	309	0.000	0.514	309	0.000

Source: Survey results, 2021

The P-value being less than 0.05 (table above), the Kolmogorov-Smirnov and Shapiro-Wilk normality test reveal that the gross margin does not follow a normal distribution. The mean comparison analyses will then be done with the Mann-Whitney test.

Table 4.41. Mann-Whitney test (a) - Rank Table / Correlation between willingness to subscribe and gross margin

Rank table				
Subscription to agricultural insurance		**N**	**Mean-rank**	**Total rank**
Margin	No	147	150.41	22111.00
	Yes	309	265.65	82085.00
	Total	456		

Source: Survey results, 2021

Table 4.42. Mann-Whitney test (b) - Test Table / Correlation between willingness to subscribe and gross margin

Test Statistics [a]	
	Margin
Mann-whitney U	11233
P-value	0.000

Source: Survey results, 2021

Given that the P-Value < 0.05, it can therefore be concluded that there is a difference between the average gross margins of farms that wish to take out insurance and those that do not.

Table 4.43. Mann-Whitney test (c) / Correlation between willingness to subscribe and gross margin

Subscription to agricultural insurance	**Average**	**N**	**Standard. Deviation**
No	979156.463	147	4196693.042
Yes	1583495.146	309	2579494.062
Total	1388675.439	456	3199290.410

Source: Survey results, 2021

Since the average rank and the averages are higher for those who want to have insurance (we notice, in the table above, that they have more profit), it can be concluded that farms favourable to insurance generate more total profit than those who do not.

2.3.2.2 Insurance and agreed subscription amount

Still in the logic of determining the variables related to the adoption of agricultural insurance, a comparison test was performed by taking as an independent variable the amount of insurance premiums that farmers are willing to pay. The Mann-Whitney test was conducted for this purpose.

Table 4.44. Mann-Whitney test (a) - Rank table / Correlation between the amount of the insurance premium and the willingness to insure

Rank table				
Subscription to agricultural insurance		**N**	**Mean-rank**	**Total rank**
How much would you pay?	No	147	204.40	30047.50
	Yes	309	239.96	74148.50
	Total	456		

Source: Survey results, 2021

Table 4.45. Mann-Whitney test (b) - Test table / Correlation between the amount of the insurance premium and the willingness to insure

Test statistics	
	How much would you pay?
Mann-Whitney U	19169.500
P-value	0.003

Source: Survey results, 2021

Given that the P-value is 0.003 (less than 0.05), there is therefore a significant difference between the average premiums of farms that wish to purchase insurance and that of farms that do not. Given that the average rank is higher for those in favour of agricultural insurance (Table 4.43), it is observed that when farms are favourable to agricultural insurance, they are ready to pay on average more to insure themselves than those who do not want to get an insurance.

Table 4.46. Mann-Whitney test (c) / Correlation between the amount of the insurance premium and the willingness to insure

Subscription to agricultural insurance	Average	N	Standard. Deviation
No	5074.830	147	2625.190
Yes	6454.693	309	3984.901
Total	6009.868	456	3657.510

Source: Survey results, 2021

The amount of the agreed insurance premium proving to be an important independent variable, the question of the bearable threshold amount arises.

With the amount desired to be paid for the insurance as the independent variable, and the willingness to take out insurance (0 = no, 1= yes) as the dependent variable, the ANOVA table obtained when a linear regression is performed is available below. The model is in the form of "amount willing to be paid = 5074.83 + 1379.863* insurance willing". It is observed that the constant term and the insurance willingness variable are significant in the model (p-values < 0.05).

Table 4.47. Correlation between the amount of the insurance premium and the willingness to insure - ANOVA

Anova table							
B		Unstandardized Coefficients		T	P-value	Collinearity Statistics	
		Standard. Error			Tolerance	VIF	
Model	(Constant)	5074.830	297.256	17.072	0.000		
	Insurance	1379.863	361.105	3.821	0.000	1.000	1.000

Source: Survey results, 2021

It is observed that those who do not want to take out insurance (if the insurance willing variable is zero) want to pay at most 5074.83 (0.3% the mean annual income, and 1.28% of the mean of the annual income of the first 52.19% incomes) CFA for insurance. It is seen that the amount that those who want to purchase insurance want to pay for the insurance is 5074.83 + 1379.863 = 6454.693 CFA (0.37% of the mean annual income, and 1.63% of the mean of the annual income of the first 52.19% incomes). It can be said that the payments larger than this value are too much even for those who want to have an insurance. The reason for the large amount that those who do not want to buy insurance are ready to pay is to avoid risks despite their reluctance.

2.3.3 Other Insurance Factors

Table 4.26. Mean comparison test according to willingness to subscribe

Insurance subscription	Yes		No		Total		
	Average	N	Average	N	Average	N	P-value.
Number of children	2.98	309	3.43	147	3.12	456	0.09
Number of years of exercise or installation of the farm or the organization	6.45	309	4.48	147	5.81	456	0.001
How many permanent employees does your farm employ in total?	1.73	309	1.32	147	1.60	456	0.146
How many seasonal workers does your farm employ during peak season?	2.55	309	1.52	147	2.21	456	0.004
How many of your permanent employees are family members (other than yourself)?	1.42	309	1.18	147	1.34	456	0.326
How many of your seasonal employees are family members (other than yourself)?	0.73	309	0.35	147	0.60	456	0.004
Land situation/How much agricultural land do you own? (Ha)	4.9200	290	2.6800	141	4.1900	431	0.369
Land situation/area of agricultural land leased? (Ha)	1.400	266	0.580	120	1.140	386	0.003
Percentage of land possessed	80.00%	261	92.00%	141	85.00%	402	0.001
Percentage of land rented	20.00%	261	8.00%	141	15.00%	402	0.001
Total income	2038108.74	309	1140863.95	147	1748865.36	456	0.013
Total expenses	454911.72	309	162133.17	147	360529.16	456	0.001
Total margin	1583197.02	309	978730.79	147	1388336.20	456	0.06
Total value of assets	1415152.59	232	438577.87	122	1078592.94	354	0.018
External revenue sources	961607.15	224	202217.40	46	832229.64	270	0.314
Amount consent for insurance	6454.70	309	5074.83	147	6009.87	456	0.001
How much have you got savings ?	319040.52	232	212186.67	30	306805.35	262	0.548

Source: Survey results, 2021

This table shows that certain groups of producers are more inclined to take out agricultural insurance than others. The difference between these groups is statistically significant.

Thus, the farms most suitable for subscription are established relatively longer (6.45 years against 4.48 years), employ 1.68 times more seasonal workers, have, in number, twice as many seasonal family work (in proportion to the total number of seasonal workers, this represents 28.34% against 22.52% within the group not in favour of agricultural insurance). In terms of exploited agricultural area, the area leased is on average 2.4 times higher (1.39 ha) among those for agricultural insurance.

Excluding leased acres, Supporters of agricultural insurance have significantly 3.23 times more assets than others, 1.79 times more farm income, and 2.81 times more farm expenses.

3 DISCUSSION

3.1 Poverty and Adoption

From this study, we find that those with more assets, and achieving more margins are more favourable to taking out insurance. The level of wealth of producers is therefore a factor that favours the adoption of insurance.

Tsikirayi et al., (2013) argue that for many poor farmers agricultural insurance is not a priority in the sense that they also face competing demands with scarce or small cash surpluses from agriculture. This explains why most poor farmers prefer to manage their production risks through diversified farming systems, low-input strategies and off-farm incomes. Thus, according to the authors, the priorities of farmers are first to ensure that they have timely access to inputs of seeds, fertilizers and, often, credit to buy these inputs. Only then can they consider purchasing crop insurance. This finding agrees with that of Meijer et al., (2015) in the analysis of the reasons for the adoption and non-adoption of new technologies (agroforestry, more specifically).

Their results showed that agroforestry is not adopted by the "poorest of the poor", whose main priority is to have food on the table and who cannot afford to take risks by investing money, time and labour in new technologies that have uncertain long-term benefits. In contrast, as argued by Jerneck & Olsson (2014), farmers who enjoy higher levels of food security are more likely to be "opportunity seekers" and may be more inclined to venture into this newness, which is agroforestry.

3.1.1 Insurance and cultivated area

In Table 4.26, the leased areas of producers in favour of agricultural insurance are twice as high as those of producers who are not in favour (P-value < 0.05). Such a result suggests that producers who have rented land for their production are more in a logic of maximizing yields and profit and therefore welcome any means of minimizing risk in order to make their exploitation beneficial. Jin et al., (2016) find similar results with land owned by Chinese producers and explain this by the fact that a larger sown area also means more climate risks and potential damage due to climate change and hazards, thus pushing these actors to seek protection.

Njue et al., (2018) share the same results (positive correlation between area allocated to maize and crop insurance subscription) in a study involving Kenyan maize smallholders. The authors comment on these results by the fact that the increase in a rented area implies a particular importance attached to the speculation concerned, hence the necessary measures to protect the farm against these risks.

3.1.2 Family size

Results show that family size matters in insurance uptake at the household level. Coefficient of the household size was statistically significant at 10 percent and negatively influenced the probability of a household to take up crop insurance. The findings correspond with Okoffo et al., (2016) who find similar result among cocoa farmers in Ghana. In Nepal,

household with one more member was also found to undermine uptake of weather-index insurance by 0.8 – 1.1% (Guo & Bohara, 2015). Large households are often faced with complex expenditure priorities hence low disposable incomes hinders households with high number of dependents to adopt agricultural insurance as a risk management instrument. Furthermore, Rahut & Micevska Scharf (2012) argues that farm households with large families and small farms are disposed towards non-farm diversification strategies.

CONCLUSION

In this context of climate change causing the disruption of the seasons, multiplying bad weather and damage, added to unprecedented competition favoured by free trade, it is no longer possible to continue agriculture almost totally dependent on nature without provide effective protection and damage limitation measures for a developing country that relies heavily on the agricultural and agro-food sector to initiate its industrial revolution. This study focused on identifying the need for agricultural insurance and the willingness of Togolese farmers to subscribe to an agricultural insurance mechanism that still does not exist in the rural world. 67.67% of the participants are favourable to insurance.

Being able to be considered as a socio-economic feasibility study of an agricultural insurance project, it will be necessary to retain from this study that the number of years of establishment of the farm (P-value: 0.001), level of education (with 0.01 P-value, 25% increase of chance of purchase when the level increase), number of seasonal workers (favourable farmers employed averagely 1.68 time more than the others, P-value 0.004), income and expenses from these agricultural activities as well as other sources of income are some key factors that have been highlighted as correlated with the desire to subscribe.

The study made it possible, among other things, to realize that the financial means of operators can prove to be a factor hindering their subscription. The chi-square test confirmed that farmers saying yes have signifi-

cantly (P-value= 0.000) more gross margin. A study on the impact of the usage and familiarisation of financial services on agricultural insurance would be complementary to this research.

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