ÇUKUROVA UNIVERSITY
INSTITUTE OF NATURAL AND APPLIED SCIENCES

MSc THESIS

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ECONOMIC AND COMMERCIAL FEASIBILITY STUDY OF AGRICULTURAL INSURANCE IN TOGO

DEPARTMENT OF AGRICULTURAL ECONOMICS

ADANA-2022

ABSTRACT

MSc THESIS

ECONOMIC AND COMMERCIAL FEASIBILITY STUDY OF AGRICULTURAL INSURANCE IN TOGO: CONDITIONS OF APPLICATION AND SUCCESS

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Year: 2022 Pages: 95
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This study's goal is to highlight the demand for agricultural insurance in Togo while examining the elements that influence its uptake decision. To do so, a national survey of food crop, cash crop, and poultry farmers was conducted in all 5 economic regions. The 456 data acquired via a questionnaire in 2021 were processed and analysed using comparison and regression tests, yielding significant results. According to the statistics, 67.76% of participants want agriculture insurance. The average amount of the premium of those wanting to subscribe is 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). With a P-value of 0.000, there is a strong relationship (Phi = 0.624) between the possession of a saving account and the desire to uptake agricultural insurance. Price volatility, marketing, drought, and crop or animal diseases and pests are the most common obstacles they face in their agricultural activity. 63% of the farmers in Togo have little or no knowledge of insurance. Risk aversion, access to credit, income from non-agricultural activities, etc. are variables that are correlated with the willingness to take out agricultural insurance. The study also revealed that farm revenue is affected by age and type of farming, as well as insurance uptake with a P-value less than 0.05. This research highlighted farmers' insurance expectations, reasons for adherence or non-adherence, and factors explaining their insurance attitudes.

Keywords: Agricultural insurance, Risk aversion, Risk management, Socio-economic factors, Togo, Logistic regression.

ÖZ

YÜKSEK LİSANS TEZİ

TOGO'DA TARIM SİGORTASININ YAPILABİLİRLİĞİNİN MALİ VE EKONOMİK ANALİZİ: UYGULAMA VE BAŞARI KOŞULLARI

Elpidio Antonio KOUGNIGAN

ÇUKUROVA ÜNİVERSİTESİ
FEN BİLİMLERİ ENSTİTÜSÜ
TARIM EKONOMİSİ ANABİLİM DALI

Danışman : Prof. Dr. Şinasi AKDEMİR
Yıl: 2022 Sayfa: 95
Jüri : Prof. Dr. Şinasi AKDEMİR
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Togo'da üreticilerin tarım sigortası taleplerinin belirlenmesi ve bu talebi etkileyen faktörlerin ortaya konması amacıyla yapılan bu çalışmanın birincil verileri ülkedeki beş farklı üretim bölgesinden temel gıda üreticileri,ticari ürün üreticileri ile kümes hayvanları yetiştiricilerini temsilen seçilen toplam 456 adet işletmeciyle 2021 yılında yapılan anketlerden elde edilmiştir. Araştırma; fiyatların oynaklığı, pazarlama, kuraklık ile hastalık ve zararlarla mücadeleyi üreticilerin karşılaştıkları en önemli sorunları olarak ortaya koymuştur. Ülkede üreticilerin büyük bir bölümünün (%63) tarım sigortası konusunda ya hiç bilgisinin olmadığı ya da çok az bilgiye sahip olduğu, %67,76'sının tarım sigortası yaptırmak istediği, riskten kaçınma istekliliği, krediye erişim imkanı, tarım dışı faaliyet gelirin bulunması tarım sigortası yaptırmayı etkileyen faktörler olarak belirlenmiştir. Üye olmak isteyenlerin ortalama ödemek istediği prim tutarı 6454.693 CFA'dır (ortalama yıllık gelirin %0,37'si ve ilk %52,19'luk gelirlerin yıllık gelirinin ortalamasının %1,63'ü). 0.000'lık bir P değeri ile, bir tasarruf hesabına sahip olmak ile tarım sigortası yaptırma arzusu arasında güçlü bir ilişki (Phi = 0.624) vardır. Yanı sırada. üreticilerin gelirini ise işletmecinin yaşı ile üretim deseni önemli ölçüde sigorta alımı ile ilişkili olduğunu ortaya konmuştur (P-değeri 0.05'ten düşük). Bu araştırma, çiftçilerin sigorta beklentilerini, uyma veya uymama nedenlerini ve sigorta tutumlarını açıklayan faktörleri vurgulamıştır.

Anahtar Kelimeler: Tarım sigortası, Riskten kaçınma, Risk yönetimi, sosyo-ekonomik faktörler, Togo, Lojistik regresyon.

EXTENDED ABSTRACT

Agriculture plays a significant role in Togo's economy, both in terms of its contribution to the country's gross domestic product (GDP) and the employment opportunities it provides for the population. The agricultural sector is also given significant attention in Togo's development strategy in order to make it a more powerful sector and, as a result, to kick-start industrialization in the country. Despite the fact that it has tremendous potential, the development of this industry is mostly based on financial resources provided by projects and other forms of funding. Overall, private sector investment amounts to only a very modest percentage of total expenditures. It is the high degree of risk that must be managed in agriculture that is the root cause of the low investment rate in the sector. This level of risk is not yet properly controlled. In order to make the business more accessible to both operators and investors, it is vital to design a meaningful risk management instrument that is both practical and effective. Among the research's primary objectives is to raise awareness about the necessity of agricultural insurance in Togo, as well as to investigate the factors that impact people's decisions to purchase insurance policies in this nation. This was accomplished through the conduct of a nationwide survey of agricultural producers of food crops, cash crops, and poultry farmers in each of the country's five economic areas. In the end, the 456 data points gathered through a questionnaire generated statistically significant results that were similar to those reported in the literature after being processed and evaluated using comparison and regression tests. It was discovered that 67.76 percent of those who participated in the study expressed an interest in acquiring farm insurance, according to the findings. Price instability, marketing difficulties, and drought are the most prevalent barriers that farmers face in their agricultural endeavours, according to the World Bank. Crop or animal illnesses and pests, which are less prevalent than the previously described issues, are examples of less often encountered difficulties that can arise. As a result, the farmer

community in Togo has little or no knowledge of insurance and is therefore unable of defending their own interests. It is found that the willingness to purchase agricultural insurance is correlated with the level of education of the farm's head or manager, membership in a cooperative, the number of years in operation, the type of production undertaken, the farm's income and expenses, the farm's assets, risk aversion, access to credit, and income from non-agricultural activities. The findings of the study also revealed that farm revenue is dependent on the age of the farm as well as the type of farm product produced on the farm. As a consequence of this investigation, the expectations of farmers about insurance, the reasons for adherence and non-adherence, as well as the aspects explaining their attitude toward insurance, have all been revealed. By gaining a better understanding of the various intrinsic and extrinsic factors, their interactions, and their effects on the attitude toward underwriting, it will be possible to develop better insurance policies that are more tailored to individual profiles, to develop insurance products that take into account the concerns of insurance producers and the management structures that accompany them, and to implement more effective awareness-raising campaigns.

ACKNOWLEDGEMENT

My first thanks to my supervisor, Prof Dr Şinasi AKDEMİR, for the knowledge given and the assistance throughout the master and the thesis process. My gratitude also goes to Mr Metin TÜRKER for the technical support. My gratitudes also go to Mrs Nazife EBERTÜRK.

This master of science and this work wouldn't be possible without the scholarship granted by YTB organization.

To my Father, Akou Yaovi, my family, friends and all of you who motivated, prayed, and continuously provided moral supports, this work is also thanks to you.

And finally to those whose names, I silenced, and my friends (especially Lare Lambénadame LAMBONI) that allocated their time to gather this great number of qualitative data, receive my gratitude.

To God be the Glory

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ACRONYMES AND ABBREVIATIONS

ANOVA : Analysis of Variance
DF : Degree of Freedom
FAO : Food and Agriculture Organization
FCFA : Franc de la Communauté Financière d'Afrique
GDP : Gross Domestic Product
MPCI : Multi-Peril Crop Insurance
US : United States

1. 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 undertaken, 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). 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 remainder of the document is as follows:

The objectives and hypotheses of the study highlight the points, on which the research will focus,

Chapter 2 containing the definitions of the concepts, the empirical studies and the conceptual framework makes it possible to become familiar with the terms, the concepts relating to risks and agricultural insurance, and to enrich oneself with the studies already available on the subject.

In chapter 3, the methodology used and the steps are detailed.

Chapter 4 presents in organized sections the results obtained, results, which are confronted with the existing studies in chapter 5 of the discussions. The main points of the work are then summarized in the conclusion with recommendations for future research and for the application of insurance programs.

1.1. Objectives

Check that the prerequisites for setting up an agricultural micro insurance system or developing an existing system are met.

Specifically, we will

- Determine the risks faced and the risk management tools of farmers
- Evaluate whether insurance is wished and determine the type of insurance products wished by the farmers
- Evaluate the access to loan of the farmers
- Determine the profile of farmers likely to take out insurance services

1.2. Hypotheses

The hypotheses that will be tested in this study are as follows:

- Producers face more risk of drought and price fluctuations
- Farms would like to have agricultural insurance products, with more emphasis on drought and price fluctuation insurance products.
- The rate of access to agricultural credit for agricultural producers in Togo is very low.
- Socioeconomic factors such as the number of years of experience, the type of crop (…) are determining factors in the subscription to agricultural insurance.

2. LITERATURE REVIEW

2.1. Definition of concepts

2.1.1. Agricultural risks

The degree of risk that the agricultural sector can confront is one of its distinguishing features. The FAO defines risk as the likelihood of the occurrence of hazards and shocks that have a negative impact on agricultural output, trade, markets, and consumption. (Demeke et al., 2016).

According to their frequency, source and their impact, agricultural risks can be sorted.

2.1.1.1. Types of agricultural risks

2.1.1.1.(1). Frequency and impact

Based on the frequency of occurrence and the magnitude of the impact, three kind of risks can be found.

Normal risks: They may or may not be frequent, are associated with very minor losses and damages, and mostly refer to idiosyncratic risks (ie farm peculiarities), resulting in minor price and yield differences. Farmers mitigate these risks by bearing them themselves.

Transferable risks: They are not common and may not include big-scale losses affecting a large area at the same time. Aside from risk avoidance (and, to a lesser extent, risk bearing) techniques, manufacturers can control those risks through insurance and marketing contracts.

Catastrophic risks: Catastrophic risks are distinguished by their tremendous intensity and, as a result, massive losses. When they occur infrequently, they can be controlled by public support services and, in some cases, risk reduction. However, a catastrophic risk with substantial damages occurring on a regular basis cannot be managed, rendering crop production in the area unviable.

2.1.1.1.(2). Source of risks

Market-related risks: Uncertainties concerning demand and supply of products, such as the availability of inputs, the availability of markets for far and off-farm products, the price of inputs, the price of farm products, and the revenue gained from farm operations, are examples of market-related risks (...).

Production risks: Production losses occur as a result of production hazards. They are mostly caused by weather events (drought, flooding, etc.) and biological elements (pests, crop and livestock illnesses, etc.).

Human and personal risks: They refer to issues with human health or family relationships that might have an impact on production activities: accidents, illnesses, death, divorce, fire danger, theft, and so on.

2.1.1.1.(3). Institutional and policy risks

This category includes insufficient regulatory measures, improper policy decisions, and a deficient market information system, all of which tend to exacerbate market and production risks.

2.1.1.1.(4). The nature of agricultural risks in Africa

When it comes to the nature of agricultural risks in Africa, the literature frequently agrees on price volatility as the most important factor. The price volatility index in Sub-Saharan Africa is higher than in the rest of the globe. Minot's research, for example, collects price statistics for several staple items in Sub-Saharan Africa and the rest of the world. The findings show that, between 2007 and 2010, the volatility of maize prices was higher in 46 African nations out of 47 investigated than in the rest of the world; 13 out of 21 African countries saw higher volatility in rice prices, and 2 out of 3 in wheat prices (Minot, 2011). In order to find a reason for the difference in volatility, the author compares them first by category. It demonstrates that processed foods are less susceptible to price swings (the case of bread and oil). The author emphasizes the low proportion of

agricultural raw resources in the production cost of these goods. Following these processed goods are drought-resistant agricultural crops such as millet, teff, and rice, the prices of which are less volatile than normal. This analysis enabled the author to discover a higher volatility index for agricultural food products than for imported agro-food products; this result raises the question of whether international market instability, rather than domestic factors, is a real cause or not of the volatility of agricultural product prices in Africa. Concerning domestic causes, Minot compares the volatility of maize prices within African nations with state policy action as an independent variable. Volatility is higher in countries with more political intervention. One of the reasons given by the author is that the policies are counterproductive, resulting in the withdrawal of private investors.

In line with internal variables influencing price volatility in African countries, we highlight the plethora of environmental, climatic, and meteorological dangers to which farmers are vulnerable.

Kerer et al., (2015) examine two major forms of risk when assessing agricultural risk in Uganda for risk management purposes. Those associated to rapid, unanticipated events, such as windstorms and torrential rainfall, and those related to cumulative events that occur over a long period of time, such as drought. The consequences of these risks have varied greatly depending on the farming system, available water resources, soil and crop type, the breadth of these hazards, and the usage of other risk management strategies such as irrigation and improved crop types. Poor infrastructure and mismanagement exacerbate these dangers.

2.2. Empirical studies on agricultural insurance

2.2.1. Models of Agricultural insurance

Iturrioz, (2009) divides agricultural insurance into three groups based on how claims are handled. These are *Indemnity-based*; *Index-based* and *Crop-revenue-based* agricultural insurance. Yusuf, (2010), on the other hand, believes in the many types of farm insurance. Multiple peril crop insurance (MPCI), named

peril, rainfall index, livestock and aquaculture insurance, index-based insurance products, and input-based insurance products are examples of these. Iturrioz is best related with that system in six ways: Indemnity-based insurance includes MPCI, named peril insurance, livestock insurance, and aquaculture insurance; index-based insurance is aligned with the rainfall or weather index, and index-based insurance products.

2.2.1.1. Indemnity-based

Indemnity insurance products pay out claims depending on the policyholder's actual injury. An assessment is made and an indemnity decision is taken in the case of an insured incident of damage. Agricultural insurance is sometimes divided into two types: peril and multiple peril. The amount insured under designated peril insurance is decided upon and is based on production expenses or expected crop revenue. Unless specifically excluded in the insurance agreement, MPCI provides coverage for all dangers affecting development. It is the most widely used type of crop insurance. MPCI covers a wide range of dangers, including drought, flood, insects, and disease, all of which might affect a large number of insured farms at the same time, resulting in huge losses for the insurer. The risks are sometimes bundled together in a single policy known as an MPCI policy to provide this form of protection. This type of insurance provides comprehensive coverage to producers but is far more expensive than peril insurance, necessitating government premium subsidies to encourage uptake. According to Binswanger (1986), as referenced by Makaudze & Miranda (2010), the most major constraint to the establishment of agricultural insurance markets has been the cost of conventional crop insurance.

2.2.1.2. Index-Based insurance

Index-driven insurance plans, according to Iturrioz (2009), pay out premiums based on an index calculation rather than actual damages. The index is a

statistic that is significantly related to losses and over which the insured has no control. Indicators include rainfall, temperature, regional yield, and river levels. Because of the restrictions and high costs associated with traditional MPCI insurance, researchers and practitioners are increasingly interested in alternative agricultural insurance systems based on indices (Makaudze & Miranda, 2010). Index insurance compensates agricultural producers based on a statistically measurable variable that is closely tied to output losses. It can offer adequate protection against natural disasters while avoiding the moral hazard and adverse selection problems that beset typical farm insurance systems.

2.2.1.3. Crop revenue insurance

According to Iturrioz, (2009), crop revenue farm insurance protects registered parties from the effects of low yields, low prices, or a combination of the two. It benefits both farmers who rely on short-term crop financing repaid with agricultural profits and financiers who have increased crop lending. It ensures both the supplier and the financier that the revenue estimates on which loans are based will be mostly realized.

2.2.1.4. Property insurance

Because it is taken on farm properties rather than actual crops, property insurance can be considered of as an indirect sort of agricultural insurance. Farmers buy this insurance to protect their farm property from theft and fire. Tractors, trucks, and other farm machinery can be used for this.

2.3. Conceptual framework for agricultural insurance uptake

Uptake refers to the acceptance or adoption of a new product or concept. Farmers' acceptance or use of agricultural insurance can thus be defined as agricultural insurance uptake. As a result, when evaluating the factors influencing farmer acceptance of crop insurance, the factors driving demand for agricultural

insurance are included. According to Parkin et al. (2002), the determinants of commodity demand are the product's own price, the price of alternatives and complementary items, the level of profits, consumer beliefs about future prices or earnings, and tastes and preferences. These variables cannot be seen in isolation because they all have an impact on one another and are all taken into account by commercial farmers when purchasing insurance. The own price element refers to the premium or price that the farmer pays annually or as a one-time annual payment for the insurance policy for a set level of coverage or indemnity. A high premium in relation to low coverage reduces demand for a particular scheme, whereas a cheap cost in relation to good coverage increases uptake. The availability of alternatives refers to the simplicity with which they can be obtained, as well as the costs and returns accessible from other agricultural risk management strategies such as farm diversification or cooperatives. The income element includes the amount earned from agricultural and non-farm activities. The bigger the amount of on-farm revenue, the greater the need for agricultural insurance to safeguard against income loss, but the existence of off-farm income can be considered as a tool for diversification and risk management, thus reducing the need for agricultural insurance. Consumer perceptions of future prices or income, such as yield forecasts, revenue forecasts, drought forecasts and their expected impact, expected return from insurance [(expected indemnity-premium)/premium], and the likelihood of obtaining claim reimbursement, can all influence the level of agricultural insurance uptake. Factors such as the farmer's age, experience, level of education, land size, insurer's reliability, and contentment with insurance are all considered tastes and preferences.

These characteristics are also linked to the farmer's risk aversion, which determines insurance demand.

Complementary goods are those in which a rise in demand for one good causes an increase in demand for the complementary one (derived demand). Increased demand for agricultural insurance would result from an expansion in

agricultural credit facilities that require crop insurance guarantees, for example. Complementary products can also refer to items sold in packages.

Tsikirayi et al., (2013) found that government subsidies for new farmers lead to dependency, making farmers unable to comprehend the true value and relevance of insurance, hence affecting the uptake rate in his studies on agricultural insurance uptake in Zimbabwe.

2.3.1. Theories of decision-making

There is a wide variety of literature available on decision-making method theories. According to Daniel Bernoulli's expected utility theory, the decision-maker chooses between risky and unpredictable opportunities by comparing the expected utility values of their outcomes in order to maximize benefit (Schoemaker, 1982). Risk and uncertainty have been shown in theoretical and empirical literatures to play an important role in the implementation of new agricultural technologies (Marra et al., 2003; Mercer, 2004). This is particularly true for African marginal farmers, who must handle risks on a daily basis in order to protect their livelihoods. The anticipated utility theory has been used as a basis for researching farmer decision-making in a variety of contexts (Babcock & Hennessy, 1996; Gómez-Limón et al., 2004; Oglethorpe, 1995), as well as to further improve thought about decision-making processes and the creation of alternative models.

In his 'diffusion of innovations' theory, Rogers (2010) explained how innovations are implemented over time. Diffusion is the mechanism by which ideas spread over time among members of a social system. An invention may be an idea or concept, technological knowledge, or a new method that a person perceives to be novel. Rogers (2010) described five factors that influence the rate of innovation adoption: relative advantage, compatibility, complexity, trialability , and observability . The decision to follow an idea is a five-stage mental process that includes understanding, persuasion, decision, implementation, and confirmation.

Rogers, (2010) proposed that an individual's innovativeness decides when the individual adopts the innovation and identified five successive adopter categories: innovators, early adopters, early majority, late majority, and laggards. The adoption process is often influenced by what are known as receiver variables, which include personality traits, social characteristics, and the perceived need for innovation. The diffusion of innovations theory has influenced several studies that attempt to explain the adoption of new agricultural technologies, and it has been used to establish farmer decision-making models in the tropics (Edwards-Jones, 2006; Mercer, 2004; Pannell et al., 2006; Reed, 2007).

Adoption is now viewed as a more complex learning process involving a diverse range of actors, rather than as the delivery of an external, typically science-based innovation with farmers as potential end users (Roling & Jiggins, 1998). According to Röling, (1992), the emergence of information systems thinking occurs when an articulated group of participants, networks, and organizations are required or managed to function synergistically to help knowledge processes. Roling & Jiggins, (1998) distinguish three types of knowledge systems: technology transfer, farm management development, and ecological knowledge systems. The most popular and traditional knowledge method is technology transfer, which views desirable farming practices as using science-based component technologies, farmer learning as the implementation of external developments, and facilitation as the delivery of these innovations. Farm management development functions within the framework of strategic rationality and seeks to promote the farmer's activities as an entrepreneur engaged in an economic enterprise centered on the farm as a whole. The primary goal of the ecological knowledge system is to assist land users in becoming specialists in the management of diverse ecosystems in a sustainable manner. It assumes farmers are experts on their own farm and make decisions based on knowledgeable intervention from observation and analysis through social learning (Roling & Jiggins, 1998).

Fishbein & Ajzen (1975) introduced the 'theory of rational action,' which is another way of looking at decision-making. It is an expectancy-value model that focuses on attitudes, subjective norms, intentions, and behaviors aimed at a particular goal. Expectancy-value models offer a structure for analyzing the correlation between a person's attitudes and underlying beliefs. The theory of reasoned action has gained significant attention in the field of consumer behavior and has been shown to be a strong indicator of intentions and behavior (Sheppard et al., 1988), and it has been updated and applied to the 'theory of expected behaviour' in subsequent years (Ajzen, 1991). A third aspect of this theory is perceived behavioral regulation, which predicts behavioral intention. Together, the attitude toward the behavior, subjective norms, and the understanding of behavioral regulation result in the creation of a behavioral purpose, which contributes to behavior success (Ajzen, 1991). Despite the fact that the theory is relatively reductionist and consequently has been the target of much criticism and debate over the years, it has become one of the most frequently cited models for the prediction of human behaviour (Ajzen, 2011).

There is a wealth of literature on decision-making technique theories available. The decision-maker chooses between risky and unexpected possibilities by evaluating the expected utility values of their outcomes in order to maximize benefit, according to Daniel Bernoulli's expected utility theory (Schoemaker, 1982). In theoretical and empirical literatures, risk and uncertainty have been proven to play a crucial influence in the deployment of new agricultural technologies (Marra et al., 2003; Mercer, 2004). This is especially true for African marginal farmers, who must deal with hazards on a daily basis to protect their livelihoods. The expected utility theory has been used to examine farmer decision-making in a range of scenarios (Babcock & Hennessy, 1996; Gómez-Limón et al., 2004; Oglethorpe, 1995), as well as to better thinking about decision-making processes and the development of alternative models.

Rogers (2010) discussed how innovations are implemented throughout time in his 'diffusion of innovations' theory. Diffusion is the process by which ideas spread among members of a social organization over time. An innovation can be a novel idea or concept, technological expertise, or a new approach. According to Rogers (2010), five criteria determine the rate of innovation adoption: relative benefit, compatibility, complexity, trialability, and observability. Understanding, persuasion, decision, execution, and confirmation are all stages of the mental process that leads to the decision to pursue an idea. Rogers (2010) claimed that an individual's innovativeness determines when they embrace an innovation and created five consecutive adopter categories: innovators, early adopters, early majority, late majority, and laggards. What are known as receiver variables, which include personality traits, social characteristics, and the perceived need for innovation, frequently impact the adoption process. The notion of diffusion of innovations has impacted various research that aim to explain the adoption of new agricultural technologies, and it has been used to build farmer decision-making models in the tropics (Edwards-Jones, 2006; Mercer, 2004; Pannell et al., 2006; Reed, 2007).

Adoption is increasingly seen as a more complex learning process involving a wide range of players, rather than just the delivery of an external, often science-based innovation with farmers as possible end users (Roling & Jiggins, 1998). The emergence of information systems thinking, according to Röling (1992), arises when an articulated set of individuals, networks, and organizations are required or managed to perform synergistically to aid knowledge processes. Roling & Jiggins (1998) classify knowledge systems into three types: technology transfer, farm management development, and ecological knowledge systems. The most common and traditional method of knowledge transfer is technology transfer, which considers desirable farming practices to be the use of science-based component technologies, farmer learning to be the implementation of external developments, and facilitation to be the delivery of these innovations. Farm

management development works within the framework of strategic rationality to support the farmer's actions as an entrepreneur engaged in an economic venture centered on the farm as a whole. The major purpose of the ecological knowledge system is to help land users in becoming professionals in the sustainable management of varied ecosystems. It implies farmers are experts on their own farm and make decisions based on informed intervention from observation and analysis via social learning (Roling & Jiggins, 1998).

The 'theory of rational action,' developed by Fishbein & Ajzen (1975), is another way of looking at decision-making. It is an expectancy-value paradigm that focuses on attitudes, subjective norms, intentions, and behaviors with a specific purpose in mind. Expectancy-value models provide a framework for examining the relationship between a person's attitudes and underlying beliefs. The theory of reasoned action has received a lot of attention in the field of consumer behavior and has been demonstrated to be a good predictor of intents and conduct (Sheppard et al., 1988), and it has been revised and applied to the 'theory of expected behavior' in recent years (Ajzen, 1991). This theory's third component is perceived behavioral regulation, which predicts behavioral intention. The attitude toward the behavior, subjective norms, and understanding of behavioral control all work together to create a behavioral purpose, which leads to behavior success (Ajzen, 1991). Despite the fact that the theory is highly reductionist, and has thus been the subject of much criticism and controversy over the years, it has become one of the most commonly mentioned models for predicting human behavior (Ajzen, 1991).

2.3.2. Explaining decision-making: an analytical framework

Given that technology adoption is a dynamic nonlinear process influenced by numerous variables, relying on a single theory to analyze decision-making may not provide an accurate picture of the adoption process. In decision-making, a holistic structure that takes into account the interaction of numerous aspects is required. In this research, we provide an empirical approach that takes into account

both extrinsic and internal aspects in technology adoption and stresses the interaction of both in decision-making about agricultural technology implementation and adaptation.

2.3.2.1. Intrinsic and extrinsic factors

The analytical process is centered on the position of knowledge, expectations, and attitudes. The acquisition of information about the innovation, which corresponds to Rogers' model, is the first stage in the acceptance decision-making process (Rogers, 2010). Farmers will learn about the characteristics of a new technology, how to adopt it, and what the outcomes are in terms of goods, yield, potential environmental advantages, dangers, and costs. A person's knowledge of a new technology then serves as the foundation for the expectations and attitudes that person develops about the technology. Fishbein & Ajzen (1975) discovered three mechanisms underlying belief formation. First, based on direct observation, a descriptive belief can be utilized to build a relationship between an entity and an attribute. Second, an attribute can be assigned to an item by inference from another belief about the object, which is referred to as an inferential belief. Third, an object-attribute relationship can be formed by accepting knowledge from an external source, which is known as an informative belief.

Farmers' impressions of an innovation are closely tied to their level of knowledge about it. Whereas knowledge refers to factual facts and understanding of how the new technology works and what it can do, perceptions refer to farmers' beliefs about it based on their perceived requirements and prior experiences, which may or may not be accurate. The attitude toward an innovation is then determined by the combination of knowledge and perceptions about it. According to the theory of planned behavior, the attitude component includes not only attitudes toward the behavior itself, but also attitudes toward subjective norms and perceived behavioral control. In this scenario, we anticipate that a favorable attitude toward an

agricultural invention will raise the possibility of adoption, while a negative attitude will decrease the likelihood of adoption.

Several external influences influence intelligence, behaviors, and perceptions. Farmers' traits, external environment characteristics, and innovation characteristics are the three kinds of extrinsic variables. For starters, the farmer's traits have an impact on knowledge, attitudes, and views. Personal characteristics (gender, age, marital status, etc.), socioeconomic characteristics (income, assets, education, etc.), personality characteristics (self-confidence, independence, etc.), position in social networks (network size, connectedness, frequency of interaction, etc.), and statistics are examples of these characteristics. Second, geographical settings (ecology, topology, soil conditions, climate, demography, proximity to markets, roads, and forests, and so on), societal culture (language, tribal background, religion, ideologies, norms, values, and so on), and political conditions all influence the development of knowledge, attitudes, and perceptions (land tenure and access rights, national policies, the structure of government, bureaucracies, the political character of a state and the existence of political freedoms and laws). Third, the properties of new technology influence people's knowledge, behaviors, and expectations. In the case of agricultural technologies, the benefits and costs of the new activity, such as the contribution it can make to household income, food protection, soil fertility development, health and nutrition, firewood and building materials, and so on, affect knowledge, perceptions, and attitudes, as do the costs of purchasing inputs, machinery, controlling pests and diseases, and so on.

2.3.2.2. The role of communication and extension

The importance of extension and training in the development of knowledge, perspectives, and attitudes toward agricultural innovation cannot be overstated. Scherr (1992) defined five basic agroforestry-extension models: "medium-base extension," "commodities-based expansion," "trainings and visits,"

"research and extending farming systems," and "communal expansion." Because agricultural production systems vary substantially in nature and complexity in different countries, it is critical to account for these differences when adopting extension measures (Bernet et al., 2001). The emphasis on farmer expansion has grown, with farmers serving as key agents of change in their society and assisting in the dissemination of new technology to other farmers (Franzel et al., 2001, 2004; Kiptot et al., 2006). The "farmer first" strategy was adopted, emphasizing the relevance of local knowledge and farmer inventiveness in supplementing traditional technical transfer approaches to agriculture research and expansion (Pacey et al., 1989). Despite significant criticism of the approach, the idea of connecting agriculture with farmer knowledge has been broadly adopted (de Wolf, 2010). The extent to which farmers are interested in production and experimentation with new technologies, on the other hand, has frequently been overlooked in adoption studies. New technology is also regarded as a "finished product," with farmers expected to adopt it or not. Farmers, on the other hand, experiment with numerous technological innovations that science research institutions appear to ignore (de Wolf, 2010). Farmers' ability to adapt and apply cutting-edge technologies on a local level increases the likelihood of effective and long-term utilization (Douthwaite et al., 2002; Mekoya et al., 2008; Versteeg et al., 1998).

3. RESEARCH METHODOLOGY

3.1. Introduction

This chapter describes how the research was conducted and outlines ways through which the desired information will be gathered. It explains elements such as research design, population of the study, sampling techniques, sample size, data collection and data analysis method.

3.2. Research Design

The nature of the project 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.

3.3. Study area

Source: Addis Herald, 2022 (*Togo – Addis Herald*, n.d.)
Figure 3.1. Map of Togo

Study population: Togo is made up of 3,843,049 rural populations, of which 3,738,430 are agricultural; the average age of household heads is 45, with an average household size of 7.4 people. The active agricultural population is 1,311,659 (MAEP & DSID, 2013). The Plateaux region has the largest share of the active agricultural population, 30% or 393,786 people. It is followed by the savannah region (21.4%), the maritime region (18.4%), the Kara region (16.6%) and the central region (13.6%) (MAEP & DSID, 2013).

The overall illiteracy rate of rural households is 45.9%, 66.9% in the savannah, 52.8% in the Kara region, 41.2% in the maritime region, 39% in the Central region and 38% in the plateau region (MAEP & DSID, 2013).

Economy: Agriculture is the main activity of the population in rural areas. Agricultural households constitute 95.8% of rural households (MAEP & DSID, 2013).

53% of agricultural households (269,555 households) practice both agricultural and non-agricultural activities, while 47% (239,044 households) practice only agriculture (MAEP & DSID, 2013). Practiced on small plots, agriculture fails to feed the members of the household, which leads them to resort to other economic activities.

In general, the type of agricultural activity that occupies the members of the majority (70.1%) of agricultural households, regardless of the sex of the household head, is the combination "Agriculture and Livestock": 297,347 male households (71%), and 59,340 female households (66%) (MAEP & DSID, 2013).

Farms: At the national level, the number of plots per household by region is as follows:

Maritime region: 4.21
Plateau region: 5.00
Central region: 5.26
Kara region: 6.26
Savannah region: 6.43
Overall: 5.43
(MAEP & DSID, 2013).

Irrigation is practiced in Togo by only 16.6% of agricultural households, ie 84,866 households (MAEP & DSID, 2013).

At the regional level, the Plateaux, Maritime and Savannah regions occupy, in descending order, the first ranks in the practice of irrigation (MAEP & DSID, 2013).

Food crops: The most widely grown food crops are cereals. In the field of cereal cultivation, maize, sorghum and rice are, in order of importance, the most cultivated cereals in Togo (MAEP & DSID, 2013).

Maize ranks first among food crops grown by 397,792 male households against 80,435 female households, followed by sorghum cultivation by 216,351 male households against 32,241 female households. Rice cultivation comes in 3rd position. It is practiced by 192,950 male households against 24,446 female ones.

The interest of household heads in the cultivation of cereals is underlined at the regional level. Maize is mainly grown in all regions, regardless of gender; on the other hand, sorghum is mainly grown in the Kara and Savannah regions with respectively 89.9% and 83% of male households against 85.2% and 75.6% of female heads of households; the same trend is observed for rice cultivation, practiced by a greater proportion in the Kara and Savannah regions (MAEP & DSID, 2013).

Cash crops: Cash crops are grown by more than half of agricultural households in Togo, ie 279,434 households representing 54.4% of the total number of agricultural households (MAEP & DSID, 2013).

Oil palm is the main cash crop which occupies 22.1% of agricultural households (112,577) at the national level. At the regional level, the proportion of households practicing oil palm is high in the Maritime and Plateaux regions (MAEP & DSID, 2013).

The proportion in the other regions is low. On the other hand, the practice of the 2nd most important crop, cotton, is concentrated in the regions of Savannah, Kara, then Plateaux. In the Central region, cashew cultivation occupies more

agricultural households (MAEP & DSID, 2013). In recent years, Togo has positioned itself as a key global player in soybean production. Togo has been the world's leading supplier of organic soy to EU countries since 2018 (European Union, 2021).

Fruit crops: Among the fruit crops, there is the predominance of the mango tree grown by 43.3% of households. Next come banana, citrus and papaya trees, adopted respectively by 34%, 25.2% and 24% of agricultural households at the national level. Only the avocado tree is little cultivated (7.5% of households) (MAEP & DSID, 2013).

Breeding: As for livestock, 45,802 agricultural households practice cattle breeding, 118,136 agricultural households practice sheep breeding, 247,135 agricultural households practice goat breeding, 119,678 agricultural households practice pig breeding, 403,372 agricultural households engage in poultry farming. In terms of poultry farming, the Plateaux region is well ahead with the largest number of households (122,594), followed by the Savannah region (75,481), then the Maritime region (74,317). The Kara region comes in 4th position (73,172 households) while the Central region has only 57,808 households practicing poultry farming (MAEP & DSID, 2013).

Banking: 515,049 people living in rural areas have a bank account; however, compared to the total rural population, 3,223,381 people do not (MAEP & DSID, 2013).

3.4. 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 goal of this distribution in the population is to determine whether the type of production and its characteristics (income generated, contractual production, asset required by each kind of activity…) have a certain

influence on uptake of insurance. 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):

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

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

3.5. 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.

3.6. 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.

4. FINDINGS AND RESULTS

4.1. 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 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

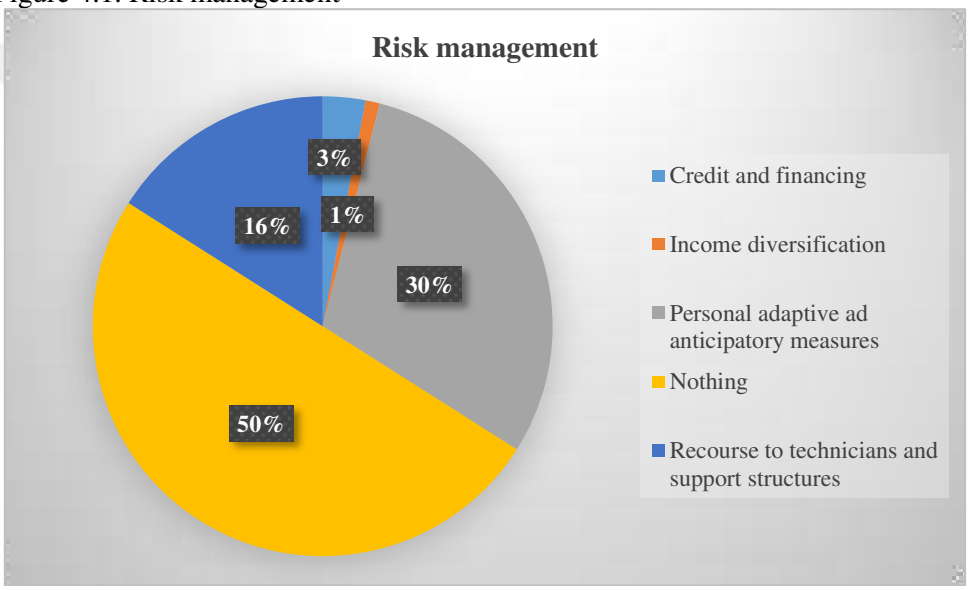
Amount (FCFA)	N	Percent
0-2499	64	14.04%
2500-4999	20	4.39%
5000-7499	260	57.02%
>10000	112	24.56%

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%).

4.2. What are the risk management methods used until now?

Figure 4.1. Risk management



Source: Survey results, 2021

This figure 4.1 summarizes the methods producers use to deal with the risks and problems they encounter in their business. The question was asked in an open-ended manner to collect all possible ideas and the answers were grouped into categories presented on the graph. It is obvious to note that most farmers are without solutions, 30% adapt with adaptive measures (such as crop diversification, crop and livestock associations, etc.). Only 3% claim to bear the risks with income from activities other than agriculture. While asked about the knowledge about the insurance, only 35% of the participants appeared to understand insurance as a

means to prevent and protect the activity against risks and damages; 63% don't have any knowledge about agricultural insurance. This finding shows the need for an effective risk management solution for agricultural producers in Togo.

4.3. Farm size and capital

4.3.1. 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 company, 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 location variables, 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

Businesses in the urban area are growing, women business owners own bigger businesses, businesses are getting smaller as the number of children increases, businesses are growing with age, cooperative members are getting bigger their enterprises, enterprises that do profitable business throughout the year grow, enterprises with increasing debts become small family expenses in large enterprises It is seen that the enterprise amount increases, the total profit increases, the business grows, the lack of insurance reduces the business, and the business grows with the increase in the area of production land.

4.3.2. 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 company, 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 company, 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.

4.3.2.1. 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.

4.3.2.2. 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		**Kolmogorov - Smirnov [a]**			**Shapiro Wilk**		
		Statistics	**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

4.3.2.3. 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.

4.3.2.4. 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.

4.3.2.5. 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.

4.4. Subscription to agricultural insurance

4.4.1. Characteristics and perception of agricultural risks

We assessed producers' risk appetite by identifying the problems or risks they face, the problems they would like to get resolved, and the insurance products they would be willing to purchase. Thus, the producers had to note on a scale of 1 to 5, in ascending order of importance, the types of problems encountered, and those for which a solution is desired.

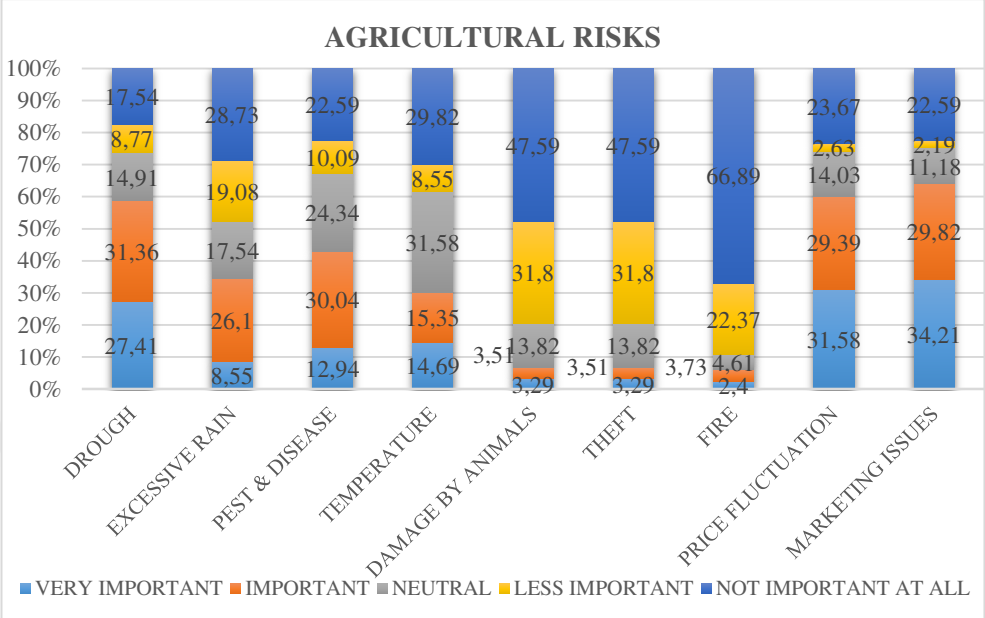


Figure 4.2. Degree of importance of agricultural risks and problems
Source: Survey results, 2021

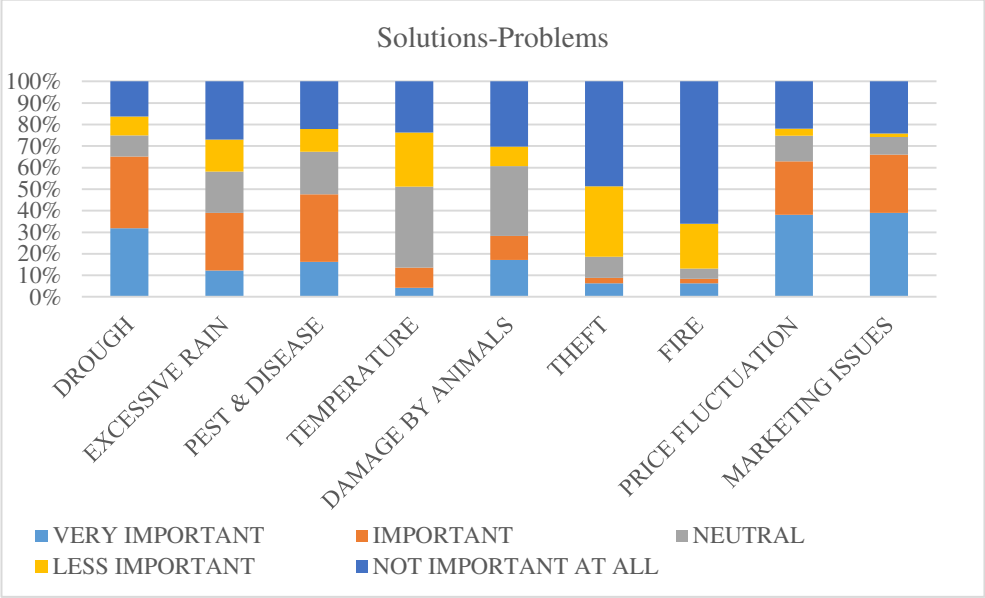


Figure 4.3. Degree of importance of the solutions to the risks encountered
Source: Survey results, 2021

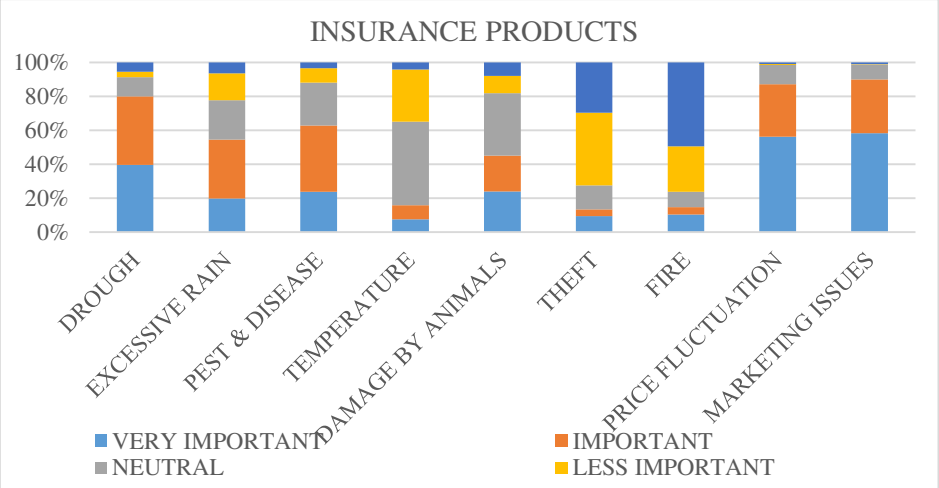


Figure 4.4. Degree of importance of the insurance products to the risks encountered
Source: Survey results, 2021

As shown in the figures above, for all these 3 questions revolving around the risks encountered and the desired solutions, by the importance given to them, there are constantly 3 risks that stand out from the others (drought, price fluctuation and marketing difficulties), followed by that linked to uncontrollable pests and diseases which is not negligible.

These graphs therefore allow us to state that the elements that most concern producers are drought, price fluctuations and marketing difficulties and, to a lesser extent than the others, pests and diseases.

4.4.2. Agricultural insurance and risk perception

A comparison of the means was carried out in order to determine the existence or not of difference in the means of the problems encountered according to the aptitude to subscribe to the insurance.

Indeed, among the problems, drought, price fluctuation and marketing difficulties are considered “important” and “very important” (respectively) by 58.77%, 60.96% and 64.04% of the population. These results are confirmed by similar proportions for "desired solutions" where we note that respectively 65.13%,

64.94% and 66.10% of producers designate solutions for drought, price fluctuation, and problems marketing as important and very important.

Table 4.25. Mean comparison test according to willingness to underwrite – Agricultural risks

Would you be willing to take out insurance to protect yourself?	**Yes**		**No**		**Total**		
	Average	N	Average	N	Average	N	P-VALUE
Problems or damage encountered/Drought	4.039	309	2.129	147	3.423	456	0.000
Problems or damage encountered/Excessive rain	3.165	309	1.619	147	2.667	456	0.000
Problems or Damage Encountered / Pests and Uncontrollable Diseases	3.505	309	1.959	147	3.007	456	0.000
Problems or damage encountered/Temperature	2.819	309	1.578	147	2.419	456	0.000
Problems or damage encountered/Damage caused by animals	3.249	309	1.748	147	2.765	456	0.000
Problems or damage encountered/Theft	1994	309	1.490	147	1.831	456	0.000
Problems or damage encountered/Fire	1.628	309	1.347	147	1.537	456	0.004
Problems or Damages Encountered/Price Fluctuation	4.214	309	1.850	147	3.452	456	0.000
Problems or damage encountered / Marketing problem	4.262	309	1.925	147	3.509	456	0.000
What problems would you like a solution for?/Drought	4.068	309	2.483	147	3.557	456	0.000
What problems would you like a solution for?/Excessive rain	3.379	309	1.660	147	2.825	456	0.000
What problems would you like a solution for?/ Uncontrollable pests and diseases	3.605	309	2007	147	3.090	456	0.000

What problems would you like a solution for?/Temperature	2.858	309	1.599	147	2.452	456	0.000
What problems would you like a solution for? /Damage caused by animals	3.282	309	1.660	147	2.759	456	0.000
What problems would you like a solution for?/ Theft	2.052	309	1.429	147	1.851	456	0.000
What problems would you like a solution for?/Fire	1.761	309	1.320	147	1.618	456	0.000
What problems would you like a solution for? / Price fluctuation	4.298	309	1.946	147	3.539	456	0.000
What problems would you like a solution for?/Marketing problem	4.337	309	1.898	147	3.550	456	0.000

Source: Survey results, 2021

According to the results of this means comparison test of table 4.25 upper, it can be noted that there is a clear and significant difference between the groups of farmers favourable to agricultural insurance and those not favourable. Indeed, those who are favourable attributed more importance to the problems and difficulties they encountered in their activities. They are therefore much more sensitive to risks and show more aversion than producers who do not want agricultural insurance.

When we go further with an analysis of comparison of means, it is revealed that there is a significant difference in the scores attributed to all the problems encountered as well as to the desired solutions depending on whether the producers are favourable or not to the agricultural insurance; those in favour of insurance assigning a higher score to the difficulties cited than their non-favourable counterparts; however, it should be noted that for the three aforementioned difficulties (drought, price fluctuation and marketing difficulties), the differences between the two groups are more pronounced.

4.4.3. 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
How much of your production do you and your family (or members) sell ?	1.570	307	2.360	147	1.820	454	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
Hypothetical reasons for not subscribing / I don't trust	2.820	309	3.000	147	2.880	456	0.143
Hypothetical Reasons for Not Subscribing/It's Not Important	1.490	309	3.000	147	1.980	456	0.001
Hypothetical Reasons for Non-Subscription/Lack or Insufficiency of Income	2.680	309	3.000	147	2.790	456	0.003
Hypothetical reasons for not taking out / Negative experience with another insurance (or insurance product)	1.980	309	3.000	147	2.310	456	0.001
Perceptions of insurance functions or roles	3.680	309	3.000	147	3.460	456	0.001
Perception of insurance companies	3.650	309	3.000	147	3.440	456	0.001
How much have you got savings ?	319040.52	232	212186.67	30	306805.35	262	0.548

What is the approximate distance you need to travel to get to the nearest financial institution?	9.810	309	34.740	147	17.850	456	0.001
Encouraging Factors/Convenient Location of Institution	4.310	309	2.750	147	3.800	456	0.001
Factors Encouraging Subscription/Fast Disbursement of Reimbursement	4.320	309	2.620	147	3.770	456	0.001
Factors Encouraging Subscription / Quality of Service of Financial Institution Staff	4.040	309	2.510	147	3.550	456	0.001
Factors Encouraging Subscription/Low Cost of Subscription	4.130	309	2.620	147	3.650	456	0.001
Period of the Participation Payment	3.930	309	2.220	147	3.380	456	0.001
Factors Encouraging Underwriting / Lack of Real Estate Requirement as Collateral	4.080	309	2.450	147	3.560	456	0.001
Factors Encouraging Subscription /Availability of Other Financial Services from the Same Institution	3.950	309	1.970	147	3.310	456	0.001

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.

The expectations or expectations of farmers (rapid reimbursement in the event of damage, cost of subscription premiums, etc.) that would favour their subscription are significantly (P-value= 0.001) higher with the desire to subscribe to insurance.

One cannot help noting that those who are in favour of subscribing to agricultural insurance are significantly closer to a financial institution than their mates unwilling to uptake an insurance are. Indeed, while the first have to travel about 9.8 km to reach a financial institution, the others travel 34.74 km.

The difficulty of access to financial institutions gives way to questions relating to savings and access to credit. To determine the correlation between the latter and the propensity to subscribe, chi-square correlation tests were carried out.

4.4.4. Savings and subscription

Table 4.27. Relationship between savings practice and subscription – Cross-tabulation

Crosstab				
Count				
		Subscription		Total
		Yes	No	
Do you save money?	Yes	269	36	305
	No	40	111	151
Total		309	147	456

Source: Survey results, 2021

Table 4.28. Relationship between savings practice and subscription – Chi-square

Chi-square tests					
	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact sig. (1-sided)
Pearson chi-square	176.047a	1	0.000		
Continuity correction	173.234	1	0.000		
Likelihood ratio	177.307	1	0.000		
Fisher's exact test				0.000	0.000
Linear-by-Linear Association	175.661	1	0.000		
N of Valid Cases	456				

Source: Survey results, 2021

Table 4.29. Relationship between savings practice and subscription – measures of association

Symmetric measures					
		Value	**Asymptotic Standardized Error [a]**	**Approximate [Tb]**	**Approximate Significance**
Nominal by Nominal	Phi	.621			.000
	Cramer's V	.621			.000
Interval by Interval	Pearson's R	.621	.039	16.897	.000 [c]
Ordinal by Ordinal	Spearman Correlation	.621	.039	16.897	.000 [c]
N of Valid Cases		456			

Source: Survey results, 2021

According to the Chi-square table, the value of P being less than 0.05 (table 4.28), the hypothesis of a correlation between savings and subscription is confirmed with a fairly strong degree of association (phi=0.621, table 4.29).

4.4.5. Ownership of an account and subscription

Table 4.30. Relationship between ownership of a savings account and subscription – Cross-tabulation

Crosstab				
Count				
		Subscription		Total
		Yes	No	
Do you have a savings account with a financial institution?	Yes	267	34	301
	No	42	113	155
Total		309	147	456

Source: Survey results, 2021

Table 1: Relationship between savings account ownership and subscription – Chi-square

Chi-square tests					
	Value	**Df**	**Asymptotic Significance (2-sided)**	**Exact Sig. (2-sided)**	**Exact sig. (1-sided)**
Pearson chi-square	177.769 [a]	1	.000		
Continuity correction [-]	174.960	1	.000		
Likelihood ratio	179.916	1	.000		
Fisher's exact test				.000	.000
Linear-by-Linear Association	177.379	1	.000		
N of Valid Cases	456				

Source: Survey results, 2021

Table 4.31. Relationship between savings account ownership and subscription – measures of association

Symmetric measures					
		Value	**Asymptotic Standardized Error** [a]	**Approximate** [Tb]	**Approximate Significance**
Nominal by Nominal	Phi	.624			.000
	Cramer's V	.624			.000
Interval by Interval	Pearson's R	.624	.039	17.031	.000 [c]
Ordinal by Ordinal	Spearman Correlation	.624	.039	17.031	.000 [c]
N of Valid Cases		456			

Source: Survey results, 2021

We have a value of P less than 0.05 (table 4.30), thus validating the hypothesis of the correlation between the possession of a savings account in a financial institution and the desire to subscribe. It can also be seen that the degree of association is just as strong (table 4.31).

4.4.6. Access to credit and subscription

In order to verify if there is a link between access to credit (even informal) and subscription, a chi-square test was performed and gives the following results.

Table 4.32. Relationship between access to credit and subscription – Cross-tabulation

		Subscription		Total
		Yes	No	
Have you received a loan in the past three years (2017-2020), including loans from informal sources, such as family and friends?	Yes	186	8	194
	No	123	139	262
Total		309	147	456

Source: Survey results, 2021

Table 4.33. Relationship between access to credit and subscription – Chi-square

Chi-square tests					
	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson chi-square	122.162a	1	.000		
Continuity correction	119.933	1	.000		
Likelihood ratio	144.410	1	.000		
Fisher's exact test				.000	.000
Linear-by-Linear Association	121.895	1	.000		
N of Valid Cases	456				

Source: Survey results, 2021

Table 4.34. Relationship between access to credit and take-up – symmetric measures

Symmetric measures					
		Value	Asymptotic Standardized Error [a]	Approximate [Tb]	Approximate Significance
Nominal by Nominal	Phi	.518			.000
	Cramer's V	.518			.000
Interval by Interval	Pearson's R	.518	.032	12.889	.000 [c]
Ordinal by Ordinal	Spearman Correlation	.518	.032	12.889	.000 [c]
N of Valid Cases		456			

Source: Survey results, 2021

According to the results of this test, we can confirm that access to credit is strongly linked (Phi=0.518, table 4.34) to the will to subscribe.

4.4.7. Insurance and agricultural activities

One of the questions of the study is the existence or not of a relationship between the type of crops and the subscription to agricultural insurance. The quest for the answer to this question led us to carry out a Chi-square test between the type of cultivation to be carried out and the desire to take out insurance. The productions have been grouped into 3 types. Livestock, high-income crops (soya, cashew, fruit and vegetables, cassava), and lower-income crops (corn, rice and cotton).

The test results are listed in the tables below.

Table 4.35. Relationship between type of production and subscription - Cross-tabulation

			GROUP OF CULTURES		
			ANIMAL PRODUCTION	CASH CROPS	FOOD CROPS
Would you be willing to purchase agricultural insurance to protect yourself?	Yes	Count	116	84	109
		Expected Count	97.6	90.1	121.3
	No	Count	28	49	70
		Expected Count	46.4	42.9	57.7
Total		Count	144	133	179
		Expected Count	144.0	133.0	179.0

Source: Survey results, 2021

Table 4.36. Relationship between type of production and subscription - Chi-square

Chi-square tests			
	Value	Df	Asymptotic Significance (2-sided)
Pearson chi-square	15.945a	2	.000
Likelihood ratio	16.813	2	.000
N of Valid Cases	456		

Source: Survey results, 2021

Table 4.37. Relationship between type of production and subscription – symmetrical measures

Symmetric measures			
		Value	Approximate Significance
Nominal by Nominal	Phi	.187	.000
	Cramer's V	.187	.000
N of Valid Cases		456	

Source: Survey results, 2021

Since the P-value is less than 0.05 (table 4.36), the hypothesis of a correlation between the type of production and willingness to subscribe is accepted, with a somewhat weak degree of association (Phi=0.187, table 4.37).

In order to identify the causes that may affect the decision to underwrite or not, a logistic regression analysis was performed.

A logistic regression analysis was conducted to uncover the factors that affect agricultural insurance take-up. The underwriting decision was taken as the dependent variable. As independent variables, the place of residence of the farmer, gender, age, education and membership of a cooperative, the number of permanent workers, the number of seasonal workers, the accompaniment or not of the farm by a structure, the total land assets, the share of production sold, the income, the expenses, the state of keeping of the registers, the total value of the assets, the external income, the evolution of the business in the last 24 months, savings status and access to credit (formal and informal). The correct accuracy rate of the obtained model is 91.6% (table below). According to the model, adherence to agricultural insurance can be predicted at 96.8% and abstention at 57.1%.

Table 4.38. Logistic Regression - Classification Table / Factors impacting insurance uptake

Classification table

		Would you uptake an agricultural insurance?		Percent Correct
		Yes	No	
Would uptake an agricultural insurance?	Yes	181	6	96.8
	No	12	16	57.1
Overall percent				91.6

Source: Survey results, 2021

Table 4.39. Logistic regression – Variables in the equation / Factors impacting insurance uptake

Summary of the model (Dependent variables: Would uptake an agricultural insurance? 1= Yes: 2=No)						
Independent variables	B-factor	Standard Error	Wald	Df	P-value	Exp (B) odds ratio
Constant	-1.90	0.20	87.81	1	0.00	
Level of education 1 = None 2 = Primary school 3 = Middle school 4 = University	-1.40	0.54	6.66	1	0.01	0.25
Number of permanent workers	1.01	0.46	4.86	1	0.03	2.74
How much of your production do you and your family sell? (1. Everything; 2. Most; 3. About the half; 4. Less than the half	1.68	0.70	5.73	1	0.02	5.34
Total asset value	-0.000004	0.00	9.40	1	0.00	0.999999
Total external income amount	-0.00001	0.00	5.23	1	0.02	0.999994
Have you received a loan in the last three years (2017-2020), including loans from informal sources such as family and friends? (1=Yes; 2=No)	2.16	0.81	7.04	1	0.01	8.70

Source: Survey results, 2021

The variables given above are significant in the model (P-value < 0.05).

As the level of education increases, the desire to take out insurance increases (25%). Farmers whose most of their production is sold are more likely to

take out insurance (5.34 times). It is also noted that as the value of assets increases, the desire to insure increases (1 times); the number of permanent workers is (2.74 times) negatively correlated with the willingness to take out agricultural insurance. The analysis tells us that as income from non-agricultural sources increases, insurance take-up increases , as does informal borrowing and willingness to take out insurance (8.7 times).

4.4.8. Insurance and economic characteristics of the farm.

4.4.8.1. 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		**Kolmogorov - Smirnov [a]**			**Shapiro Wilk**		
		Statistics	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 companies 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.

4.4.8.2. 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

		Unstandardized Coefficients		T	P-value	Collinearity Statistics	
		B	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.

4.4.8.3. Reasons for not subscribing

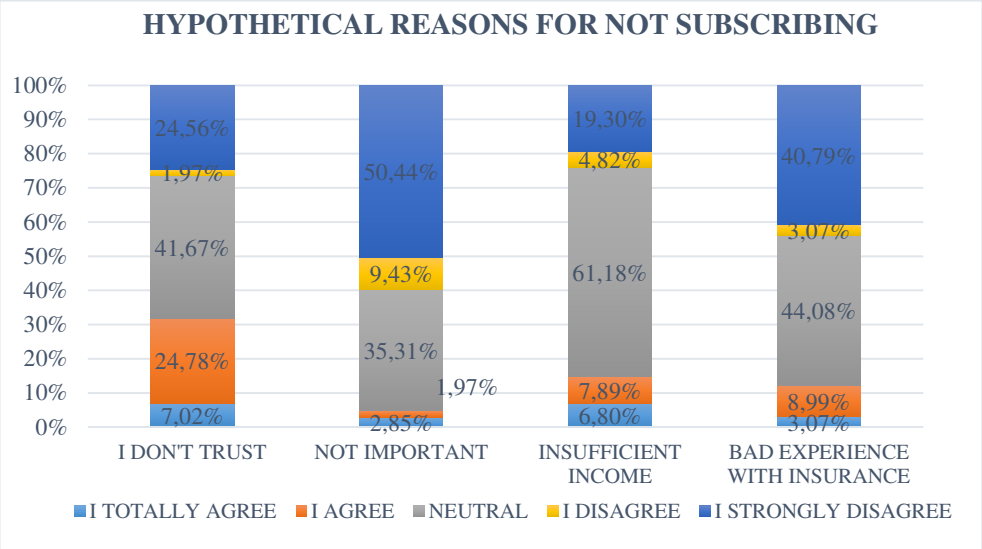


Figure 4.5. Hypothetical reasons for not subscribing
Source: Survey results, 2021

5. DISCUSSION

5.1. Possession of a bank account and insurance

Having a savings account with a financial institution is positively correlated with the willingness to take out insurance. Njue et al., (2018) find results along the same lines in their study. According to the authors, this correlation is explained by its character as a financial service which allows its owner to protect himself against possible risks. Having a savings account with an institution would also be a tool for measuring the confidence that producers have in financial institutions (possibly that of financial institutions in them), their probable familiarity with the financial services already available. Indeed, having a savings account with a financial institution implies a certain perception of the importance of financial institutions, trust in them, a very important factor in the adoption of this new technology. In her thesis on factors affecting the decisions of farmers to make agricultural insurance, in Adana (Turkey), the usage of credit was found to be correlated to insurance uptake (Unal & Akdemir, 2018).

5.2. 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.

5.3. Perception, knowledge and adoption

To understand the impact that the perception of insurance and knowledge of the principles of insurance could have on underwriting. With logistic regression analyses, we note that there is indeed a significant correlation between these variables and underwriting. The more important producers consider the functions of insurance, the more they are willing to join; likewise, the more their knowledge of the principles of insurance approaches veracity, the better is the disposition to subscribe. Douthwaite et al., (2002) demonstrate the place of the perception of a new technology in their evaluation study of the dissemination among farmers of alley cropping and the use of Mucuna cover crops in West Africa. The authors realize that it is for the positive effect of Mucuna on weeds rather than its role in soil fertility that these plants were adopted. The positive correlation between knowledge of the principles of insurance and its adoption is also highlighted by Njue et al., (2018), Dercon et al., (2014) and Unal & Akdemir, (2018) in Turkey who prove the positive effect of regular insurance-related training on the subscription of farmers.

5.4. Technical support and adoption

In the literature, we can note many sources reporting a link between the technical support that a producer receives and his probability of subscribing to agricultural insurance. Our analysis (Chi-square) also establish a correlation between these two variables. These results are similar to those of Nahvi et al., (2014) in their study on insurance uptake factors of rice farmers, and Masara & Dube, (2017) who prove that farmers who receive extension information from Non-governmental and community-based organizations are significantly 260.6 times more likely to purchase agricultural insurance than farmers who do not receive extension information from non-governmental and community-based organizations. The same results are also shared in Adana, Turkey, where farmers 46.96% of the farmers meet at least once a week with agricultural specialist for technical information (Unal & Akdemir, 2018).

It is clear that contact with experts promotes awareness and knowledge among farmers. Insofar as the agricultural experts contribute to the improvement of the technical and financial health of their farms, a climate of trust could then be established with regard to these experts and technical advisers and would facilitate subscription. Moreover, the insurance seems a bit complex to understand by some farmers, so that it is perceived as a charge without benefits (Ceballos et al., 2015). This explains the positive correlation - between the level of exposure of farmers to information on agricultural insurance and the likelihood that these farmers will be able to insure their agricultural enterprise - highlighted in the different studies (Masara & Dube, 2017; Nahvi et al., 2014). When one considers the fact that the adoption of a new technology is strongly linked to knowledge, perceptions and attitude towards this technology, these factors are themselves influenced by communication and extension information (Meijer et al., 2015), there is a better understanding of the effect of technical support and extension on producers' understanding of insurance procedures, agricultural insurance risk management policies and mechanisms, leading to eventual adoption (Akinola, 2014).

However, Bonabana-Wabbi (2002) and Masara & Dube (2017) warn of the opposite effect that the popularization of a technology can have if access to information is not precise and concise enough or is not helping to evade all the doubts of the producers.

5.5. Member of a cooperative and insurance

Participation in farmers' organization is also positively associated with intention to use agricultural insurance. These results are consistent with those of. Njue et al., (2018) that membership in farmers' organizations has the ability to encourage the uptake of agricultural insurance in a household. Social organizations also provide an avenue for acquiring information through training and peer-to-peer learning. Unal & Akdemir, (2018), with 87.8% of the surveyed farmers being member of an agricultural organization, notices that insurance uptake is significantly correlated with membership of association.

5.6. Labour and insurance

The literature allows us to understand the link between the subscription to agricultural insurance and the labour used by producers. Njue et al., (2018) explain why the use of hired labour in crop production had a positive and significant effect (at 1%) on insurance premium purchases. Seen as a marketing indicator, households using hired labour are more aware of the risks than subsistence production. Indeed, agricultural labour constitutes the bulk of agricultural production, especially where mechanization is underdeveloped. Therefore, the authors add, commercial farmers are more likely to invest in insurance instruments to hedge against risks and to protect expected returns on investment (of these costs) against climatic hazards among others risks by increasing the level of insurance coverage to minimize possible losses. This helps to understand why the participants in our study who say yes to agricultural insurance employ 1.68 times more workers that are seasonal (table 4.26). In the table 4.39 the logistic regression shows us that

the number of permanent workers is negatively correlated to the uptake of insurance. If we assume that permanent workers are essentially from family (80.34%), we can understand that the very variable influencing is the family oriented farm instead of the business-oriented farm as it should be.

5.7. Insurance and related products

According to Tsikirayi et al., (2013), the success of agricultural insurance depends on other basic agricultural services such as extension services, timely availability of inputs, agricultural credit and efficient marketing channels for agricultural products. The uptake of agrıcultural ınsurance is demonstrated to be positively correlated to the availability of other services (Nshakira-Rukundo et al., 2021). In our case study, these results make it possible to understand the plebiscite on the part of those in favour of agricultural insurance, towards products ancillary to insurance with a particular instance on inputs (95.15%) and food stamps (83.5%).

5.8. Insurance and experience with risks

From our study, we note that producers who are more sensitive to the problems encountered in their agricultural activities are significantly more favourable to a subscription. It therefore follows that awareness of the risks incurred or the shock experienced during losses is a motivating factor that leads those concerned to seek to protect themselves against such possible situations. This view is consistent with Makaudze & Miranda, (2010) and Tsikirayi et al., (2013) who argue that farmers who take out insurance are likely to have suffered significant losses in the past. Farmers in disaster-prone geographies tend to have high levels of insurance take-up, as they seek to protect against the high risk of loss. Other studies on the adoption of agricultural insurance have shown similar results. Sadati et al., (2010) and Masara & Dube (2017) noted that damage experience, which is often proportional to the number of years in farming,

positively influences a farmer's decision to purchase agricultural insurance. These results explain why Jin et al., (2016) in their study in China support and confirm the hypothesis that risk-averse Chinese producers have a higher probability of protecting themselves with index insurance.

Our results are in agreement with many works of existing literature (Condliffe & Fiorentino, 2014; Petrolia et al., 2013) establishing the positive link between risk aversion and subscription to agricultural insurance.

Risk aversion would therefore positively affect the farmer's decision to take out agricultural insurance.

5.9. Insurance and type of production

The results of our Chi-square test between type of production and willingness to subscribe reveal a correlation. Tsikirayi et al., (2013) make the same observation in their study on subscription to agricultural insurance according to production. This is how he discovers that a tobacco farmer is more likely to insure because of the higher costs and profitability of the business (unlike a grain farmer).

5.10. Insurance and expectations

Mean comparison tests have made it possible to realize that farmers' expectations regarding insurance are important to them when they want to take out insurance. The question of underwriting factors was asked with a view to gathering more information on what could lead them to buy or abandon insurance. In order of importance, the rapid disbursement in the event of damage, the convenient location of the institution, the low cost of insurance premiums, the non-requirement of collateral goods as a guarantee, the quality of staff service and the periods of payment of insurance premiums adapted to the cash flow realities of the agricultural world are the factors on which producers are looking. Tsikirayi et al., (2013) note the low esteem of producers towards insurance providers, which they explain by the dissatisfaction recorded by respondents with regard to the provision

of services due to the delay or non-payment of insurance disaster insurance. This is consistent, they add, with earlier findings from the World Bank Commodity Risk Management Group - in "Innovative rainfall-indexed insurance" in 2006 - which showed that the high uptake of an agricultural weather insurance policy in India resulted from a payment promptness of the policy and great knowledge of the features of the policy possessed by the farmers, which contributed to the satisfaction of the insurance.

5.11. Insurance and level of education

The logistic regression analysis establishes a positive link between the level of education and the willingness to subscribe. Because higher levels of education facilitate the understanding of certain more or less complex concepts, openness to new technologies, innovation, etc., we can deduce that this variable allows producers to understand the operating mechanism more easily and the merits of this new product. Ertan & Mustafa, (2012) and Kiziloğlu, (2017) also found similar results in their research in Turkey. According to Enjolras et al., (2012) and Ye et al., (2017), an individual's level of education reflects their ability to understand and use financial insurance tools. Such a result does not surprise Jin et al., (2016) in their work on index insurance. The authors explain that because the information on the trigger levels of abnormal precipitation and temperature and the compensation schemes of weather index insurance are conceptually complex, many have not been able to understand the insurance policy, leaving more chance the most educated to enrol there.

5.12. Insurance and number of years of farming experience

Our Average t-student comparison test confirms that farms that are in favour of agricultural insurance are significantly older than those that do not want it (with a difference of 2 years on average). Our results show that the effect of individuals' farming experiences on the weather index insurance uptake decision is

positive (table 4.26). Jin et al., (2016) explains this by the fact that farmers with more years in agriculture may have had more bad experiences on crop damage or loss.

However, Sadati et al., (2010), Mohammed & Ortmann (2005), and Akinola (2014) showed that experience can negatively influence agricultural insurance take-up. These authors argued that older, more experienced farmers are less willing to buy insurance because they might have acquired enough knowledge over time to deal with production risks without insurance and would be of less interest to the farmer long-term investment in agricultural technologies.

5.13. Reasons for non-adoption

5.13.1. Bad experience, lack of confidence

To the question of knowing the hypothetical reasons for non-adherence to agricultural insurance, although the "neutral" category was the most preferred answer, especially for the "insufficient income" variable (61.18% of neutral answers), it is the "lack of trust" which brings together the most definite answers (31.80% do not trust, figure 4.5). When Njue et al., (2018) discuss the reasons for abandoning insurance in Kenya, 23% of farmers cited lack of compensation despite incurred losses (basis risk) as the main reason, while an almost equal proportion abandoned purchasing insurance because their expectations were not met (which might involve little pay-out relative to the actual losses incurred) or because insurance was no longer available in their locality; which is consistent with the lack of confidence clearly mentioned by 31.80% of our respondents and the large proportion of neutral responses which can be understood as a wait-and-see attitude. This is also consistent with a research in Antalya, in Turkey, where the insufficiency of the farm income, the cost of the insurance premium and the irregularities in the reimbursement from the insurance came to be the main reasons why farmers don't regularly purchase insurance (Akçaöz et al., 2006). Nalinci, (2018) also came up with the same results of farmers not trusting the

reimbursement process, stating the insufficiency of revenue or the cost of the premium as reasons of not getting an agricultural insurance.

5.13.2. 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.

5.13.3. 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

6. CONCLUSION AND RECOMMENDATION

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. The literature review made it possible to have avenues for researching the risks faced by farmers and the key variables involved in their decision to adopt or not agricultural 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), membership of a cooperative, technical support, maintenance of a financial register, possession of a savings account in a financial institution, type of agricultural speculation, income and expenses from these agricultural activities as well as other sources of income, without forgetting the perception of risk are some key factors that have been highlighted as correlated with the desire to subscribe.

Because the external factors (technical support, membership of an agricultural cooperative) have proven to have an impact on the perceptions, knowledge (which are moreover very insufficient or even absent with more than 63% of the farmers) and the attitudes of our study population, promotional efforts to enable the establishment of agricultural insurance must take into account how

the proposed insurance schemes can be explained and communicated to local farmers, in order to minimize negative effects. surprises from insurance awareness campaigns.

In investigating the reasons for a possible non-adoption of agricultural insurance, the wait-and-see rate (characterized by neutral responses of more than 35.31% of the participants) indicates that farmers will become more involved if their first experience with insurance presents a result rather positive relative to their stated expectations, or will drop out as seen in other studies. In addition to training and communications around this new technology, mechanisms aimed at ensuring simplicity and speed of insurance while taking into account individual realities would constitute a major advantage for popularization and success.

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 significantly (P-value= 0.000) more gross margin. The logistic regression revealed that the ones that contracted a loan in the past 3 years have 8.7 times more chances to subscribe (P-value= 0.01). A public support mechanism, or facility to get loan based on a prior uptake of insurance would therefore be beneficial for more massive participation.

Thanks to the socio-economic characterization of favourable and unfavourable farmers, the study allows political actors, technical support and advice actors for these same farmers, and financial or insurance organizations to understand the motivations of each type of producer, to develop targeted policies, measures or solutions.

While this study looked at the receptivity or not of farms in Togo to the agricultural insurance program and the factors that could ensure its success or failure, it does not include a study on the type of insurance that would be most suitable and beneficial.

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CURRICULUM VITAE

Born in Lomé-Togo, Elpidio completed his studies in Togo up to his bachelor's degree in the agricultural economics field at the Agronomic Higher School of the University of Lomé in 2017. His first research project was on the "development constraints of the guinea fowl value chain in the prefecture of Tone," where he analysed all the participants in the value chain, their activities, and the bottlenecks of the chain. That research work was done as the end-cycle internship of the bachelor's degree, from April to July 2016, at the Togolese Institute of Agricultural Research (ITRA) under the supervision of Dr Yao LOMBO, currently the general director of the institution, and Dr Koffi YOVO (for the university). After graduation, using project management, agribusiness competencies, and the skills learned during the bachelor cycle, he undertook a business initiative in soya roasting for poultry feed in 2016. That entrepreneurship developed an understanding of the rural world and marketing-managerial practices. Later on, in 2018, as an agricultural engineer, he joined the research team of ITRA that was assigned the mission of establishing the fertility map of Togo. That mission involved both field skills for collecting soil samples and laboratory skills for running the analysis. His determination to learn more and his achievements helped him get a scholarship for a Master of Science (Msc) in 2018 in Agricultural Economics in Turkey. Together with his supervisor, Prof Dr. Şinasi AKDEMİR, he demonstrated high research abilities on hot topics like "the impact of the economic crisis on farmers' behaviour" and "the impact of an ageing population on agricultural sustainability", passing by the "impact of COVID-19 on farmers' and consumption habits". Elpidio KOUGNIGAN's goal is to be an expert in value chains and marketing.