Journal of Agricultural and Crop Research
Vol. 9(6), pp. 142-151, June 2021
doi: 10.33495/jacr_v9i6.20.181
ISSN: 2384-731X
Research Paper

Typology and determinants of the accessibility of agricultural holdings to index agricultural insurance: Case of the food-producing area of South Borgou (Benin)

Alain Togbédji Aguida[1]* • Paul S. Hountondji[2] • Jacob A. Yabi[3]

[1]Laboratory of Analysis and Research on Economic and Social Dynamics (LARDES), Department of Rural Economics and Sociology (DESR), Faculty of Agronomy (FA), University of Parakou (UP), BP 123 Parakou, Republic of Benin.
[2]FA / UP, BP 123 Parakou, Republic of Benin.
[3]LARDES / DESR / FA / UP, BP 123 Parakou, Republic of Benin.

*Corresponding author. E-mail: altags@yahoo.fr. Tel: +229 67673706 / 96472827.

Accepted 12th August, 2020.

Abstract. The objective of the study is to make the typology and identify the determinants of the accessibility of agricultural holdings to index agricultural insurance in the food zone of South Borgou in Benin. Data were collected from 320 heads of maize-producing farms in the three pilot municipalities. The producers were categorized into prosperity level classes of qualitative typology method, supported by Factor Analysis in Multiple Correspondence (AFCM). The binary logistic regression method determined the factors that influence the adoption of this insurance. Analysis of the data allowed to categorize the farms surveyed into rich (8.90%), medium (15.10%), poor (29.70%) and very poor (46.30%). In total, 68% of rich and medium holdings were insured against 33.30% for the very poor with a significant difference at the threshold of 1%. Thus, the factors which significantly influence the adoption of agricultural insurance at the 5% threshold are: access to formal credit, contact with extension, cultivated area, membership of an association and level of prosperity. These factors are important in promoting index agricultural insurance.

Keywords: Index insurance, typology, farms, AMAB, Benin.

INTRODUCTION

One of the sectors most directly threatened by climate change, agriculture is the lifeblood of the economies of developing countries in Africa. Climatic disasters have disastrous consequences on agricultural production and the incomes of farmers in southern countries. Indeed, the increase in the variation of temperatures and precipitations profoundly modifies agricultural activity and the speed of these changes strongly threatens the resilience of agrarian systems (irrigation and drainage, use of varieties adapted to the local environment, against land erosion, etc.) and their productivity. In recent years, index insurance experiments have been initiated and offer prospects for financial tools in the fight against climate change (Lagandré and Chetaille, 2010). This insurance allows farmers to secure income and credit systems, to develop more intensive and productive systems (Muller *et al*., 2012). In these insurance systems, compensation is not based on direct evaluations but on climatic indices or aggregate returns, to make them less expensive (Duffau *et al*., 2011; Muller *et al*., 2012). Agricultural insurance is being implemented in West Africa with the recent and/or ongoing establishment of

pilot projects for the development of index-based agricultural insurance, in particular in Mali (cotton, maize), Burkina Faso (cotton, maize), Benin (maize) and Senegal (peanuts, maize).

Benin's economy is mainly based on agriculture. This activity contributes to 33% of the GDP, provides around 75% of export earnings, 15% of state revenues and employs around 70% of the working population (PSDSA, 2017). Unfortunately, this agriculture is threatened by numerous productions, market and legal finance risks (Crane *et al.*, 2013) and especially climate; since it is mainly rain-fed (Katé *et al.*, 2015). Indeed, this agriculture is not marginalized from the effects of climate change because for more than 40 years, Benin has known strong climatic variability characterized by a fluctuation in the period and duration of precipitation, a variation in annual rainfall, an increasingly hot climate, drought, land degradation, unexpected floods, high winds and the proliferation of diseases and pests (Yabi *et al.*, 2012; Loko 2013). The diagnosis made on the effects of climate change in Benin, shows that drought, late and violent rains and floods are three major climate risks. The profound effects of climate change on agriculture, coupled with the low resilience and high vulnerability of populations to shocks, could considerably reduce their capacity to manage natural resources and thus alter their livelihoods, food security and their well-being (Agossou *et al.*, 2012). In addition, the evolution of climatic phenomena is also accompanied by the significant drop in crop yields. According to a study on climate scenarios and future agricultural yields, the drop-in yields will concern the main crops in sub-Saharan Africa, notably cassava (-26%), peanuts (-15%) and maize (-11%) (Doukpolo, 2014). These numerous phenomena bear witness to the climatic risks encountered by producers during agricultural production.

However, to cope with these effects of climate change and to minimize agricultural risks, many adaptation strategies have been developed by industry players and especially producers. These strategies include the adoption of new resilient varieties, the use of sustainable land management measures (SLM), the gradual change in the agricultural cropping calendar and technical itineraries, the intensification of the use of fertilizers, then agricultural insurance. Indeed, index agricultural insurance is an initiative whose experimentation began since the beginning of this millennium, in India, under the leadership of the World Bank, and has continued in other countries of the South, in East Africa (Malawi, Ethiopia, Kenya), the Maghreb (Morocco, Algeria, Tunisia) and West Africa through countries like Benin, Senegal and Ghana (Troy, 2013). These experiences have promoted original and a priori well-suited insurance systems for small producers in the South, because they are cheaper and relatively operational. Indeed, the use of index insurance, as a tool for managing agricultural risks that covers losses attributable to the effects of climate change and change and other natural phenomena, could favorably support the strategies implemented by the countries of the region to increase the productivity and sustainability of farms. Considered as a tool for adaptation to climatic variations and change, agricultural insurance makes it possible to secure producers' incomes and contribute to the development of more intensive and therefore more productive systems and promoters of the local, national and regional economy (Aguida, 2017). However, despite the numerous efforts on the part of the members of the Benin agricultural insurance structure AMAB (Mutual Agricultural Insurance of Benin), producers are struggling to subscribe to this insurance (case of the municipality of Ouèssè) (Hountondji *et al*., 2018) where to date, few producers have applied for insurance services without intending to take out agricultural loans. These various behaviors of producers are certainly linked to their perceptions vis-à-vis insurance and especially to their socio-economic characteristics including their level of prosperity.

Note that the adoption of an innovation depends on the socio-economic characteristics of potential adopters, the information they receive and how they use them, as well as the conditions of access to the necessary resources (Feder and Umali, 1993; Rogers, 2003; Young, 2007; Ali-Olubandwa *et al.*, 2010), it also depends on the structure and nature of the exchanges they have with their social networks and on their interactions with the institutions that support them. transfer of innovations, in particular agricultural extension, which also depends on the compatibility of the characteristics of innovations with the institutional (standards, rules, values), technological (existing technical systems, know-how, risks) and economic (accessibility of factors) production potential) potential adopters and their perception of the characteristics of the innovations proposed to them and the consequences of these on their level u of life (Rogers, 2003). Thus, the objective set for this study is to analyze the typology of farms adopting index agricultural insurance and identify the factors that influence the adoption of index insurance by farms.

Previous work on index insurance has been carried out on the analysis of producers' perception of agricultural insurance as well as the factors that influence their decisions to subscribe (Hountondji *et al.*, 2018) and on the contribution of index agricultural insurance to strengthen the resilience of family farms in Benin (Aguida, 2017). In general, these studies do not specifically relate to the same localities and do not have the same objectives and methodology as those envisaged by this research.

MATERIALS AND METHODS

Study area

Benin is a country in West Africa with a total area of 114,763 km^2. It is bounded by Togo to the west, Nigeria

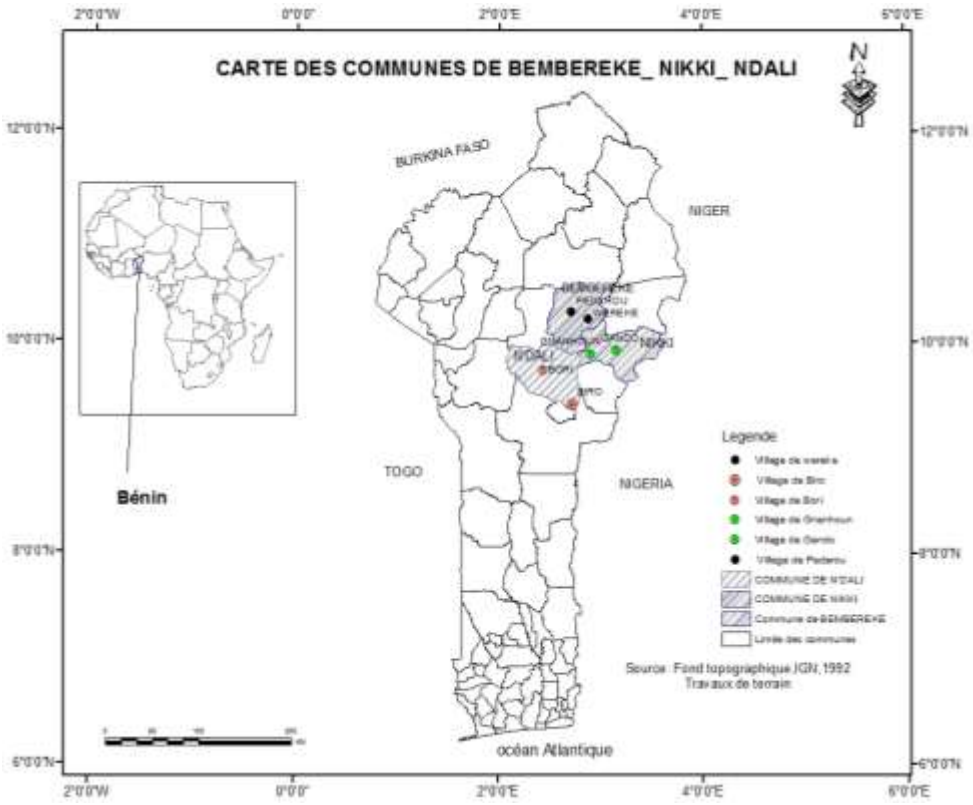

Figure 1. Presentation of the study area.

to the east, Burkina Faso to the northwest, Niger to the north, and the Atlantic Ocean to the south. The climate is subequatorial in the south, with two rainy seasons and two dry seasons. In the north, it is tropical with a single rainy season and dry season. The rainfall varies between 900 and 1450 mm of water per year and the temperatures fluctuate between 22 and 37°C. The index insurance pilot program which is the subject of this study is developed in agro-ecological zone III (food-producing area of southern Borgou) through the pilot municipalities of N'Dali, Bembèrèkè and Nikki (Figure 1). In this area, the production system is based on food crops (notably maize and yams). However, there are some cash crops such as cotton and groundnuts (PANA, 2008).

Target group and sampling

The investigations were carried out in three districts, namely the municipalities of N'Dali, Bembèrèkè and Nikki. Based on an exploratory study of the environment, a two-stage sampling was carried out. The first step consisted in the random selection of survey villages on the basis of the complete list of pilot villages. So, we chose in each municipality two villages which are the villages of Biro and Bori in N'Dali, Gando and Gnanhoun in Nikki, Pedarou and Wereke in Bembèrèkè. The second step consisted in the selection of survey units that are agricultural holdings. The selection was made randomly and weighted to the number of policyholders per selected village. A total of three hundred and twenty (320) farm managers were surveyed, including one hundred and sixty (160) insured farms and one hundred and sixty (160) uninsured. The sample size was determined in relation to the number of holdings insured to be investigated on the basis of the formula below for a level of accuracy of +/- 7%.

$$n = \frac{N}{1 + N \times e2}$$

N = Size of the population of insured farms; e = accuracy level at +/- 7%

In order to make a fair comparison, non-member farms were also selected by survey village based on a list of farm managers drawn up by resource people in the village. The sample was drawn randomly, and the size was proportional to that of the insured farms drawn by survey village.

Data collection techniques and tools

The data were collected using the principles of the Accelerated Participatory Research Method (MARP) such

as semi-structured interviews, participatory observation, exploitation of existing data, revealing quotes and triangulation. Indeed, both qualitative and quantitative data were collected using a semi-structured questionnaire which was administered to the sampled farm managers. These data relate to the socioeconomic and demographic characteristics of the respondent, the various cultivated speculations, the area sown, access to financial services and agricultural advice during the last three agricultural seasons. Through the focus groups, we established a village monograph using a semi-structured interview guide.

Data analysis methods

Typology of farms

Several approaches are adopted for the classification of agricultural holdings into categories of distinct types. The two most commonly used approaches are the qualitative approach and the statistical approach. The qualitative approach is based on the typology of farms according to the classification by level of prosperity developed by Barbara Grandin (1988). This method is based on differentiation based on access to and control over resources as defined by prosperity. According to Sossou *et al.* (2013), the typology is directly carried out by men and women resource people from the farming world who have a perfect knowledge of the farms they classify. It reflects the reality of the environment. As for the statistical approach, it consists of collecting quantitative and qualitative data on farms and carrying out the typology by multivariate analysis methods. This typology by statistical approach, which also fixes the number of types (generally four), makes it possible to validate that carried out by the resource persons. In addition, the synthesis of the discriminating factors which result from the statistical analysis and the characterization of the types of farming done by the resource persons allows to make a detailed description of each type of farming (Sossou *et al.*, 2013). In the context of this research, we have tried to combine the two approaches in order to remain close to the reality of the environment and then make the detailed characterization of the types of farming ensured. Thus, after the qualitative typology, a Factorial Analysis in Multiple Correspondence (AFCM) was carried out in order to confirm the factors used by resource people to classify farms.

Method for estimating the determinants of the accessibility of agricultural holdings to agricultural index insurance products

The determinants of the accessibility of agricultural holdings to index agricultural insurance products are socio-economic and institutional. Thus, to identify them, the econometric regression method is the most used. It relates the characteristics of the producer to the dependent variable which is access to index agricultural insurance. This econometric regression is used in several forms, taking into account the nature of the dependent and explanatory variables; whether qualitative (logit and probit etc.) or quantitative (simple or multivariate regression). In this study, the Logit regression method was used given the qualitative and binomial nature of the dependent variable. This method has been proposed and used by several authors such as Belaidi (2013), Yabi *et al.* (2016) and Hountondji *et al.* (2018) in their study. This model looks like this:

$Y = f(X, e)$

With,
Y = dependent variable (adoption of index agricultural insurance)
X = matrix of variables likely to explain the variation of Y (Table 1)
e = logistics error in distribution

The estimation of our Logit model is based on the maximum likelihood method. The factors likely to influence access to index agricultural insurance by farms are presented in Table 1.

Taking into account the variables, the empirical model can be written as follows:

$$\begin{aligned} I_{ij} = {} & \delta_{0j} + \delta_{1j}AGE_{ij} + \delta_{2j}SEX_{ij} + \delta_{3j}NVINS_{ij} + \delta_{4j}ALPH_{ij} \\ & + \delta_{5j}ACTagr_{ij} + \delta_{6j}COOP_{ij} + \delta_{7j}CREDI_{ij} \\ & + \delta_{8j}SUPC_{ij} + \delta_{9j}SUPT_{ij} \\ & + \delta_{10j}NPROS_{ij} + \delta_{11j}VULG_{ij} + u_{ij} \end{aligned}$$

Where j and i are the indices and uij the error term as defined in Equation 1, the coefficients δ_{0j} are the constant terms and δ_{ij} the parameters to be estimated which directly give the impact of the factor represented by the variable access to index agricultural insurance j.

RESULTS

Socioeconomic and demographic characteristics of the producers surveyed

Analysis of Table 2 shows that overall the producers surveyed have an average age of 40 years with an average workforce of 14 people per household, 4 of whom are agricultural workers. The cultivated area is on average 13 ha with an average income from maize equal to 247 105 FCFA. In comparison, these quantitative variables of producers who have adopted index agricultural insurance are higher than those uninsured with a significant difference at the 1% threshold. Among the respondents over 36% are women, 30% have received

Table 1. Variables introduced in the model and expected signs.

Factors	Codes	Measures	Expected signs
Age	*AGE*	Continuous variable	±
Sex	*SEX*:	Binary variable (1 = man, 0 = woman	±
Literacy	*ALPH*	Binary variable (1 = Yes, 0 = No)	±
Educational level	*NIVINS*	Binary variable (1 = Yes, 0 = No)	
Number of workers	*ACTagr*	Continuous variable	±
Access to formal credit	*CREDI*	Binary variable (1 = Yes, 0 = No)	±
Cultivated area	*SUPC*	Continuous variable	+
Income from maize production	TREVMA	Continuous variable	+
Membership of an association	APASS	Binary variable (1 = Yes, 0 = No)	±
Level of prosperity	*NPROS*	Ordinal variable (4 = rich, 3 = medium, 2 = poor and 1 = very poor)	+
Total area available	*SUPT*:	Ordinal variable (1 = less than 10 ha, 2 = from 10 to 25 ha, 3 = 25 à 50ha et 4= more than 50 ha)	±
Cattle size	BETL	Variable ordinale (4= more than ten 0x, 3= from 2 to 10 ox, 2= at more, 2 ox et 1= None ox)	±
Contact with extension services	*VULG*:	Variable binaire (1 = Yes, 0 = No)	±

Source: Author (2019)

Table 2. Descriptive statistic of qualitatives socioeconomic and demographic variables of producers.

Quantitatives variables	Not insured	Insured	Everyone	Student test (t)
Age	37 (8)	42 (14)	40	3,080*
Size of household	12 (8)	16 (11)	14	2,923*
Agricultural workers	4 (2)	5 (3)	4	2,971*
Cultivated area (ha)	9 (8)	17(12)	13	5,812*
Income from maize production (FCFA)	100013 (222121)	401552 (584285)	247105	5,398*

* : Significant variables at 1%, ** : Significant variables at 5%. Source : Survey (2019).

formal education while 35% are literate (Table 3). Nearly 80% of producers belong to an agricultural association, 55% are in contact with extension agents and only 7% have access to credit. As regards goods, 30% of producers have cultivable land with an available area of more than 25 ha (Table 3). Those who breed cattle are on average 30.7% while the others have or do not have at most 2 draft oxen for plowing. Comparatively, these qualitative variables of producers who have adopted index agricultural insurance are better than those uninsured with a significant difference at the threshold of 1% except durable goods (5%) (Table 3).

Typology of farms focused on access to index agricultural insurance

According to the qualitative method of B. Gradin, in our medium of study, the typology of agricultural holdings by level of relative prosperity gave four main types of agricultural holdings. Overall, poor farms represent 29.70% and very poor farms 46.30%. The wealthy or wealthy represent 8.90% and the average 15.10% (Table 4). In terms of the rich and the means, more than 68% of farms are insured. The very poor represent only 33.30%. The difference between these prosperity classes is significant at the 1% threshold. The relative level of household wealth is measured through the size of the area sown and available on the farm and the number of head of cattle owned (Table 4). Poor and very poor farms exploit around 2 to 9 ha of crops each and have a very small herd generally made up of goats (0 to 2 heads) and less than ten poultry. These types of farms seldom have cattle and even if they do, the number cannot exceed a maximum of two heads which are nothing other than draft oxen intended for agricultural production (Table 4). As for the wealthy or the wealthy, they sow more than 50 to 90 ha of crops, of which almost 70% are food crops or 25 to 60 ha per crop year (Table 4). They have in addition large ruminants (cattle), small ruminants (sheep and goats), poultry and other goods of production or prestige such as the tractor, the van, the habitat in final materials, mills maize, etc.

"Rich" and "medium" holdings have easier access to index insurance unlike "poor" and "very poor" holdings, which unfortunately are the most numerous (71%) and the

Table 3. Descriptive statistic of quantitatives socioeconomic and demographic variables of producers.

Qualitatives variables	Modalities	Not insured	Insured	Everyone	Khi- square test
Sex	Women	39.7	32.5	36.2	1.373
	Men	60.3	67.5	63.8	
Literacy	No	73.0	55.8	64.6	7.939*
	Yes	27.0	44.2	35.4	
Formal Education	No	77.8	61.7	69.9	7.585*
	Yes	22.2	38.3	30.1	
Extension services	No	53.2	35.8	44.7	7.477*
	Yes	46.8	64.2	55.3	
Access to credit	No	99.2	86.7	93.1	15.024*
	Oui	0.8	13.3	6.9	
OP	Non	38.9	0.8	20.3	54. 966*
	Oui	61.1	99.2	79.7	
Area available	Plus de 50 ha	6.3	36.7	21.1	41.259*
	25 à 50 ha	5.6	11.7	8.5	
	10 à 25 ha	65.1	40.0	52.8	
	Moins de 9 ha	23.0	11.7	17.5	
Cattle size	>10 ox	0.8	6.7	3.7	39.781*
	2 to 10 Ox	11.1	41.7	26.0	
	At more 2 ox	70.6	43.3	57.3	
	None ox	17.5	8.3	13.0	
Sutainable goods	0	94.4	87.5	91.1	3.640**
	1	5.6	12.5	8.9	

* : Significant variables at 1%, ** : Significant variables at 5%. Source: Survey (2019).

most vulnerable. In fact, 68.20% of wealthy farms have subscribed to index insurance, compared to 33.30% of very poor farms (Table 5).

Furthermore, the multiple correspondence factor analysis (AFCM) model produced to show the contribution of socio-economic and demographic variables to the categorization of producers into prosperity classes is good and satisfactory because the average value of Cronbach's Alpha is equal to 0.818 (greater than 0.7). Indeed, the model gives us two dimensions which record the information of the data. Thus, the total of the eigenvalues is equal to 8,173. This shows that 81.73% of the information in the analyzed data is contained or represented by dimensions 1 and 2 (Table 5 and Figure 3). Figure 2 shows the most important discriminating variables in the categorization of the farms surveyed. These variables are the areas cultivated and available by the producer, the size of the livestock, agricultural income, the possession of durable goods and the number of agricultural assets available on the farm.

Analysis of the determinants of agricultural insurance

From Table 6, the estimated binary logistic regression model is globally significant at the 1% threshold (χ^2 (DOF = 13) = 131; Sig = 0.000). The estimated coefficients of the model are thus statistically valid. In addition, 55.3% of the total variation in the dependent variable (adoption of index agricultural insurance) is explained by the variation in the explanatory variables included in the model (Nagelkerke's $R^2 = 0.553$).

Variables introduced into the model, those which influence the subscription of agricultural holdings to agricultural index insurance are:

- Access to formal credit and contact with extension which

Table 4. Characterization of the different classes of the level of prosperity of agricultural holdings.

Classes	Cultivated area (ha)	Available area (ha)	Animals and other earned goods
Rich	More than 33 ha (25 to 60 ha of food crops; 20 to 30 ha of cotton)	More than 50 ha	4-50 cattle, 5-8 goats, poultry, more than 100 ha of cultivable land, 0-1 small truck, 0-1 tractor, semi-hard to hard habitat
Medium	20 à 33 ha (15-20 ha food crops; 0-5 ha cotton)	25 to 50 ha	2-10 cattle, 0-5 goats, poultry, 40-50 ha of cultivable land, semi-hard habitat.
Poor	9 à 20 ha (4-9 ha food crops; 0-3 ha cotton)	10 to 25 ha	0-2 cattle, 0-2 goats, mois de 8 poultry heads, 7-25 ha of cultivable land arable land, banked habitat.
Very poor	Less than 9 ha (2-3 ha food crops; 0-1 ha cotton)	Less than 10 ha	0 Cattle, 0-2 goats and 0- 4 poultry, 5-10 ha of cultivable land, banked habitat.

Source: Survey (2019).

Table 5. Distribution of farms by prosperity class.

	Not insured (%)	Insured (%)	Everyone (%)	Test Khi-Deux
Rich	31.80	68.20	8.90	27.488*
Medium	21.60	78.40	15.10	
Poor	47.90	52.10	29.70	
Very poor	66.70	33.30	46.30	

Results of AFCM model				
Dimension	**Cronbach alpha**	**Total (value)**	**Inertia**	**Pourcentage of explained variance**
1	0.872	5.136	.395	39.505
2	0.727	3.037	.234	23.363
Total		8.173	.629	
Means	.818	4.086	.314	31.434

*: Significant variable at 1%, **: Significant variable at 5%. Source: Survey (2019)

have a positive and significant influence at the 5% threshold. However, when the producer has access to formal credit and is in contact with extension agents, he subscribes to index agricultural insurance (Table 6). This can be explained by the fact that agricultural insurance enables producers to reduce the risks of production in order to cope with agricultural credit. In addition, contact with extension allows producers to have knowledge and good perception of insurance.

- The cultivated area, membership of an association and the level of prosperity influence significantly and positively at the threshold of 1%. Thus, when these variables are large at the level of a producer, he tends to adopt agricultural insurance. Large-scale farming favors the adoption of agricultural insurance can be explained by the fact that the producer has an idea on minimizing the effects of climatic risks that insurance can bring him. Social participation can allow producers to be informed of innovations. As for the level of prosperity, it favors the adoption of insurance because according to Rogens' theory, it is the wealthy who are often the first to adopt an innovation. They are called innovators.

- The income from the sale of maize significantly and positively influences the adoption of agricultural insurance at the 10% threshold. The more income a producer gets from producing maize, the more he takes out agricultural insurance to minimize the risk of losing all of his income.

DISCUSSION

The work of Sossou *et al.* (2013) on “farm typology test focused on financing agricultural production in Benin” used the statistical approach combined with the qualitative to categorize farms in four (4) types of prosperity level classes that are the poorest and most vulnerable, the poor, the wealthy and more rich and privileged. This confirms the results of this study which also found the same classes. The work of Bonou-zin (2012) confirmed these different classes using the qualitative approach. However, Ayena and Yabi (2013)

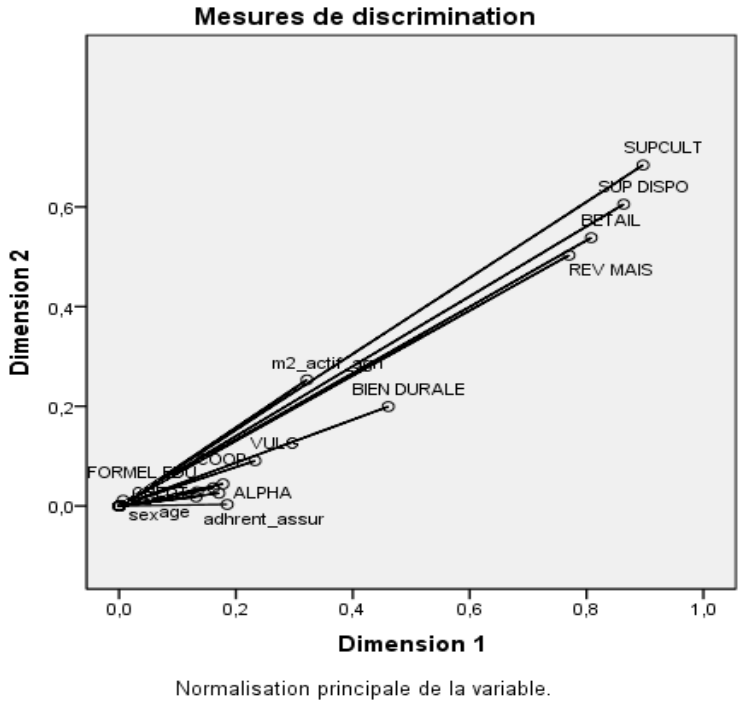

Figure 2. Discriminating criteria of relative prosperity and defined orders of priority.

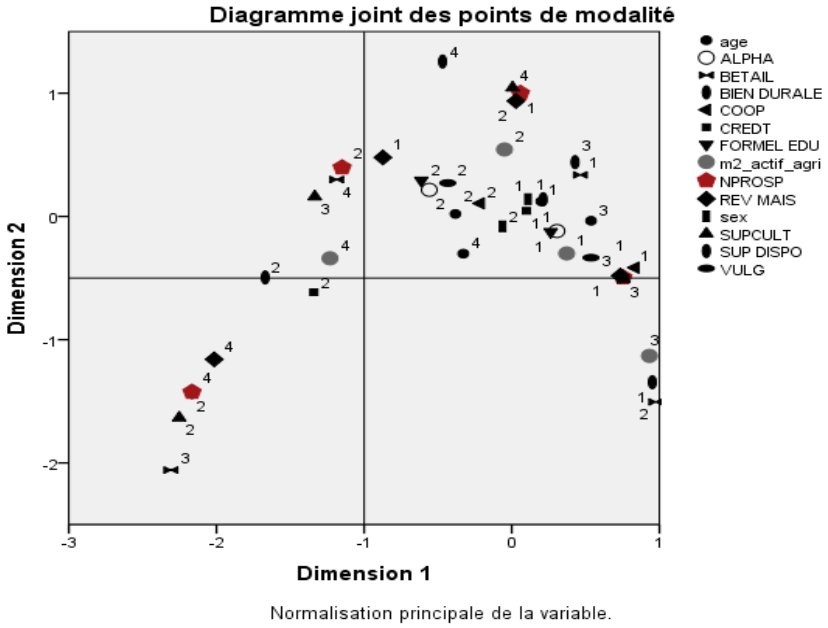

Figure 4. Characterization of agricultural holdings according to the AFCM.

used the statistical approach and found three categories of producers participating in the Family Farming Council. Furthermore, the discriminating factors that result from this typology are the areas cultivated and available by the producer, the size of the livestock, the agricultural income, the possession of durable goods and the number of agricultural assets available on the farm. These factors found confirm those found by Bonou-zin (2012), Adégbola *et al.* (2012), Sodjinou (2011) and some of Sossou *et al.* (2013) which help to categorize farms into

Table 6. Estimation of the determinants of agricultural insurance.

Factors	Coefficients	Standard error	Wald	Sig.
Age	0.017	0.019	0.852	.356
Sex	0.496	0.383	1.681	.195
Literacy	0.483	1.027	0.221	.638
Level of education	0.067	1.040	0.004	.949
Farm assets	0.037	0.088	0.172	.679
Access to formal credit	3.525	1.612	4.784**	.029
Cultivated area	0.247	.096	6.656*	.010
Maize income	0.000	.000	3.521***	.061
Membership of an association	4.590	1.135	16.365*	.000
Level of prosperity	1.509	0.578	6.807*	.009
Total area available	-0.383	0.634	0.365	.546
Livestock size	0.727	0.769	0.894	.344
Extension contact	0.888	0.418	4.526**	.033
Constant	-13.960	4.157	11.276	.001
-2log-vraisemblance = 208,376				
R-deux de Nagelkerke = .553				
Khi-Chi-deux = 131,164 ; Ddl = 13, Sig = .000				

*: Significant variables atc1%, ** : significant variables at 5%, *** : significant variables at 10%. Source: Survey (2019)

different level classes of prosperity. Likewise, Ayena and Yabi (2013) used factors such as the use of hired labor, the total area sown, experience in cotton production and membership of an organization as criteria having really served to differentiate producers.

The study by Ghazanfar *et al.* (2015), on perception and information as well as on the factors influencing producers in the adoption of insurance as a risk management mechanism in Pakistan reveals that a good knowledge of agricultural insurance by raising awareness among producers can influence positively its adoption. As a result, producers who are not aware of insurance and are ill-informed do not adopt agricultural insurance. This result confirms the results of this study which reveals that contact with extension agents or membership in a group or association positively influences the adoption of insurance. The results found by Kumar *et al.* (2011) in India, on the analysis of the perception of producers and their level of information on agricultural insurance reveal that factors such as: the extension of cultivated areas, income from non-agricultural activities, knowledge presence of risks, the number of workers on the farm positively influence the adoption of agricultural insurance. This confirms the results obtained which stipulate that the cultivated area and agricultural income positively influence the adoption of index agricultural insurance. Likewise, Ajan (2007) has shown that insurance is for those with large farms. Also, Farzaneh *et al.* (2017) found in their study that high income also influences adoption of crop insurance. Still in the context of the factors influencing the adoption of agricultural insurance, Bharati *et al*. (2014) showed that young people with large areas of land are more likely to adopt agricultural insurance.

Furthermore, the results of Kangale *et al.* (2016) report that education, social participation and the cultures covered by insurance were positively and significantly correlated with the producer's perception of insurance. A study by Branstrand and Wester (2014) based on several works summarizes all the factors that would influence the adoption of crop insurance. These are: age, experience, education, area planted, debts, ease of access to land, geographic position, local conditions (types of soil, need or no water), non-agricultural income, expected production yield, perception of yield risk, diversification (number of crops grown), risk preference and perception of insurance.

CONCLUSION

In summary, the typology of farms in the food-producing area of Sud Borgou in Benin classifies the producers surveyed in four categories of level of prosperity. The rich farms which represent 8.90%, feel 29.70% and the very poor 46.30%. In terms of the rich and the means, more than 68% of farms are insured. The very poor represent only 33.30%. In addition, the factors which significantly influence the adoption of agricultural insurance are: access to formal credit, contact with extension, cultivated area, income from the sale of maize, membership of an association and the level of prosperity.

REFERENCES

Adégbola YP, Olou BD, Adjovi G, Bankolé AB, Kpadonou R (2012). Typologie des exploitations agricoles du basin cotonnier Nord du Bénin. Rapport d'étude, PAPA/INRAB, p. 68.

Agossou DSM, Tossou CR, Vissoh VP, Agbossou KE (2012). Perception des perturbations climatiques, savoirs locaux et stratégies d'adaptation des producteurs agricoles Béninois. FSA-UAC. Afr. Crop Sci. J 20, (Issue Supplement s2):565 - 588 ISSN 1021-9730/2012 $4.00 Printed in Uganda. All rights reserved ©2012, African Crop Science Society.

Aguida TA (2017). Assurance agricole indicielle et résilience de l'agriculture familiale». *Editions Universitaires Européennes*, ISBN 978-3-639-60674-4, Février 2017.

Ali-Olubandwa AM, Odero-Wanga D, Kathuri NJ, Shivoga WA (2010). Adoption of Improved Maize Production Practices among Small Scale Farmers in the Agricultural Reform Era: The Case of Western Province of Kenya. J. Int. Agric. Ext. Educ. 17(1):21-30. doi:10.5191/jiaee.2010.17103.

Ayena M, Yabi J (2013). Typologie et rentabilité économique des exploitations agricoles participant au conseil à l'exploitation familiale à Banikoara. 4th International Conférence of the African Association of Agricultural Economists, September 22-25, 2013; Hammamet, Tunisia. PDF, p. 128.

Belaidi S (2013). Les déterminants de choix de l'irrigation localisée par les exploitants de la mitidja; p. 158.

Bharati RC, Azad NK, Chakraborti S, Chandra N, Singh SP (2014). Factors affecting adoption of crop insurance in Bihar. J. Agric. Res. 1(2):102-107.

Bonou-zin RDC (2012). Genre et performance économique des systèmes de production cotonnière du centre et au nord du Bénin. Université de Parakou (UP). Ecole Doctorale Pluridisciplinaire (EDP), en vue de l'obtention du Diplôme d'Etude Approfondie (DEA) en Economie des Ressources Naturelles (ERN). p. 99.

Branstrand F, Wester F (2014). Factors affecting crop insurance decision: a survey among Swedish farmers. Master'thesis. Agricultural programme economics and management. ISSN 1401-4084.

Crane L, Gantz G, Isaacs S, Jose D, Sharp R (2013). Introduction to risk management. Extension Risk Management Education and Risk Management Agency. United state department of agriculture. 40. p.

Doukpolo B (2014). Changements climatiques et productions agricoles dans l'ouest de la république centrafricaine. Sciences de la terre d'Université d'Abomey-Calavi.

Duffau A, Lagandré D, Chetaille A (2011). Assurance indicielle et warrantage, quel intérêt pour les petits agriculteurs ? Coll. Études et travaux, série en ligne n° 28, Éditions du Gret, www.gret.org, p. 44.

Farzaneh M, Allahyari MS, Damalas AC, Seidavi A (2017). Crop insurance as a risk management tool in agriculture: the case of silk farmers in northern Iran. Land Use Policy 64(2017):225-232.

Feder G, Umali DL (1993). The Adoption of Agricultural Innovations: a review. Technological Forecasting and Social Change 43:255-98.

Ghazanfar S, Qi-wen Z, Abdullah M, Ahmad Z, Lateef M (2015). Farmers' Perception and Awareness and Factors Affecting Awareness of Farmers Regarding Crop Insurance as a Risk Coping Mechanism Evidence from Pakistan. J. Northeast Agric. Univers. 22(1):76-82.

Hountondji RL, Tovignan et S, Hountondji PS (2018). Determinants of Farmers Awareness about Crop Insurance Case of Ouesse District, Benin. Int. J. Progress. Sci. Technol. (IJPSAT), ISSN: pp. 2509-0119. Int. J. Sci. High Technol. http://ijpsat.ijsht-journals.org 12(1):37-45.

Kangale PD, Deshmukh AN, Sonali A (2016). Farmers perception towards crop insurance scheme. Int. Res. J. Agric. Econ. Stat. 7(2):248-250.

Katé S, Hounmenou GC, Amagnide A, Sinsin B (2015). Effets des changements climatiques sur les activités agricoles dans la commune de Banikoara (nord-Bénin). E-J. Sci. Sci. Technol. (2):10.

Kumar DS, Barahb BC, Ranganathana CR, Venkatrama R, Gurunathana S, Thirumoorthya S (2011). An Analysis of Farmers' Perception and Awareness towards Crop Insurance as a Tool for Risk Management in Tamil Nadu. Agric. Econ. Res. Rev. 24:37-46.

Lagandré D, Chetaille A (2010). L'assurance indicielle, une réponse face aux risques climatiques ? Le dossier « s'adapter aux aléas, oui mais comment ? ». *Grain de sel,* nº 49 — janvier – mars 2010. PDF, 2pages.

Muller B, Sall M, Leblois A, Balde A, Fall M, Kouakou P, Affholder F (2012). L'Assurance Agricole Indicielle En Afrique De L'Ouest: Principes, Premières Réalisations Et Perspectives. *CORAF, 2012.* PDF, p. 6.

PSDSA (2017). Plan Stratégique de Développement du secteur agricole: Orientations Stratégiques 2025 et de Plan National d'investissements Agricoles et de Sécurité Alimentaire et Nutritionnelle (PNIASAN) 2017-2021. Version provisoire. MAEP, Mai 2017 p. 3.

Rogers EM (2003). Diffusion of innovations. Fifth edition. New York: Free Press.

Sodjinou E (2011). Poultry-Based Intervention as Tool for Poverty Reduction and Gender Empowerment: Empirical Evidence from Benin. PhD thesis, Institute of food and resource economics faculty of life science university of Copenhagen, p. 256.

Sossou CH, Lebailly P, Hinnou CL (2013). Essai de typologie des exploitations agricoles axée sur le financement de la product ion agricole au Bénin. Communication présentée aux 7ème Journées de recherches en sciences sociales. INRA-SFER-CIRAD. Angers (Agro campus Ouest -Centre d'Angers), France, les 12 et 13 Décembre 2013, p. 23.

Troy B (2013). Assurance et développement agricole : nouvelles dynamiques en Algérie, au Maroc et en Tunisie, Fondation pour l'agriculture et la ruralité dans le monde (FARM), Document de travail N°5, édition de Décembre 2013.

Yabi JA, Bachabi FX, Labiyi IA, Ode CA, Ayena RL (2016). Déterminants socio-économiques de l'adoption des pratiques culturales de gestion de la fertilité des sols utilisés dans la commune de Ouaké au Nord-Ouest du Bénin. Int. Faculté d'Agronomie, Université de Parakou. Parakou, Bénin, p. 64.

Yabi I, Afouda F (2012). Extreme rainfall years in Benin (West Africa). Quaternary Int. 262(7):39-43.

Young HP (2007). Innovation diffusion in heterogeneous populations: Contagion, social influence and social learning. CSED working paper n° 51. Washington DC: Brookings Institution.

Loko YL (2013). Perceptions paysannes et impacts des changements climatiques sur la production et la diversité variétale de l'igname dans la zone aride du nord-ouest du Bénin. International Formulae Group. All rights reserved.doi: http://dx.doi.org/10.4314/ijbcs.v6i1.13. Int. J. Biol. Chem. Sci. 7(2):672-695.