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THE DETERMINING FACTORS OF ADOPTING AGRICULTURAL MARKET TRANSPARENCY INNOVATIONS IN SAHELIAN COUNTRIES

LES DETERMINANTS DE L'ADOPTION DES INNOVATIONS DE TRANSPARENCE DES MARCHES AGRICOLES DANS LES PAYS SAHELIENS

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Abstract

The objective of this study is to identify and analyze in sahelian countries the determining factors of adopting markets transparency innovation for better improvement of their level of competitiveness and efficiency.
The factors identified and analyzed are: the age of the heads of farm households, the level of education, the sex, sale price of farm products, sales offers of agricultural products, short message services (sms) using, peasant organization belonging, web or internet access, radio device owning or using.
The factors that have significant effects on the probability of adoption of market transparency innovations by farm households are: the age of the heads of farm households, the knowing to use sms, the sale prices and finally the level of sales offers of agricultural products on the markets.
The study showed that education, age (for young farmers between 20 and 49 years old), and sales offers are determinant factors that have negative effects on the probability of adopting market transparency innovations. However, sale prices, age (for old farmers, over 50 years old), knowing to use sms are factors that have some positive effects on the probability of adopting market transparency innovations.
The adoption by a farmer of Market Information System Second Generation (MIS2G) as a public innovation does not deprive or exclude other farmers from using this innovation and therefore has no positive effect on its valuation (increase in price) and its quantitative and qualitative improvement. Thus with the increase in the number of users due to free use, the network of the MIS2G device itself could become congested (negative externalities) and become inefficient in the long term.

Keywords: *Agricultural market transparency innovations, probability of adoption, determining factors, imperfect information, market competitiveness and efficiency*

Résumé

L'objectif de cette étude est d'identifier et d'analyser dans les pays sahéliens les facteurs déterminants de l'adoption des innovations de transparence des marchés agricoles pour une meilleure amélioration de leur niveau de compétitivité et d'efficacité.
Les facteurs déterminants ainsi identifiés et analysés pour l'adoption des innovations de transparence des marchés sont : l'âge des chefs de ménages agricoles, le niveau d'instruction, le sexe, le prix de vente des produits agricoles, les offres de vente des produits agricoles, l'utilisation des services de messages courts (sms), l'appartenance à une organisation paysanne, l'accès au web ou à Internet, la possession ou l'utilisation d'un appareil radio.
Les facteurs qui ont des effets significatifs sur la probabilité d'adoption des innovations de transparence des marchés sont : l'âge des chefs de ménages agricoles, le savoir utiliser les sms, les prix de vente et enfin le niveau des offres de vente des produits agricoles sur le marché.
L'étude a montré que l'éducation, l'âge (pour les jeunes agriculteurs entre 20 et 49 ans) et les offres de vente sont des facteurs déterminants qui ont des effets négatifs sur la probabilité d'adoption des innovations en matière de transparence des marchés. Cependant, les prix de vente, l'âge (pour les agriculteurs âgés, plus de 50 ans), le savoir utiliser les sms sont des facteurs qui ont des effets positifs sur la probabilité d'adoption des innovations en matière de transparence des marchés.
L'adoption par un agriculteur du Système d'Information sur les Marchés de Deuxième Génération (SIM2G) en tant qu'innovation publique ne prive ni n'exclut d'autres agriculteurs d'utiliser cette innovation et n'a donc aucun effet positif sur sa valorisation (augmentation du prix) et son amélioration quantitative et qualitative. Ainsi avec l'augmentation du nombre d'utilisateurs due à l'utilisation gratuite, le réseau du dispositif SIM2G lui-même pourrait se congestionner (externalités négatives) et devenir inefficace à long terme.

Mots-clés : *Innovations en matière de transparence des marchés agricoles, probabilité d'adoption, facteurs déterminants, information imparfaite, compétitivité et efficacité du marché*

Classification JEL : *D82-H41-Q13-L15*

Introduction

Information has been defined as knowledge of the facts or behaviors of others, past, present or projected (Cotta, A, 1968).

However, it is only very recently that information has been considered as an economic good with its own value allowing individual and collective decisions.

The pure and perfect competition market is considered the only economically and socially efficient market because it allows a better allocation of resources.

The work of Hayeck F (1960), Hirwickz L (1960), Stiglitz J and Grosmman S (1980) has shown that market performance depends on their ability to ensure the dissemination of perfect information between economic agents. A high degree of imperfection of the information circulating between the agents could lead, according to them, to a suboptimal allocation of resources, an elimination of competition and competitiveness and therefore to a market failure.

Akerlof (1970) has shown that in a used vehicle market the seller is generally more informed about the condition of the vehicle than the buyer. The ill-informed, but rational, purchaser commits to purchasing the vehicle at a low price to offset the likelihood of stumbling upon a vehicle in poor condition. This very low purchase price will not encourage sellers to offer the good vehicles but rather the bad ones. Such a situation increases the likelihood of buying the wrong vehicle and forces buyers to demand further lower prices. Bad vehicles will gradually invade the market and the constant lower price demands of buyers will lead to a complete disappearance of good vehicles from the market. The phenomenon could continue until all trading of vehicles in the markets ceases when the likelihood of getting a bad vehicle becomes very high.

In addition to the problem of adverse selection, the work of Akerlof (1970) highlights the problem of the signal, namely that the used vehicle market can function very badly due to lack of means for the well-informed seller to be able to signal the quality. of the vehicle he sells to the ill-informed buyer. However, it is the work of Spence (1975) which, in addition to confirming those of Akerlof (1970), will draw our attention to the fact that the signal always carries a high cost which can reduce the seller's incentives to reveal information to others. the buyer.

For authors such as Porter (1976) and Caves (1986), the information market and the product market are closely linked. Thus in each product market coexists a market of information on the qualities of the products offered.

The authors of a neokeynesian theory (Arrow, 1962, Stiglitz, 2002), like those of the neoclassical theory, unanimously agree that the information which is at the basis of a functioning of the pure and perfect competition market is public information that in addition to being perfect and complete, it must be available and free for all actors, so a collective good, indivisible and inappropriate.

When information is produced, no agent can prevent another from using it because it is potentially available to all. It is these two characteristics of information (indivisibility and inappropriateness) which, according to the neokeynésiens, are at the origin of the externalities that it generates namely direct economic relations between agents not giving rise to an exchange through the mechanisms of the market, thus creating market failures.

Neokeynesians also attribute other characteristics that are intrinsic to the information itself. These characteristics include the value and uncertain quality of information and its asymmetry: authors such as Arrow (1962) argue that the value of information is known to the buyer only when acquired by Shapiro and Varian (1998) further confirm this theory before that the quality of the information is uncertain and is revealed only in use. High product prices signal high product quality, and low prices signal poor product quality, and cheaper, lower-priced products will invade the market and drive out products deemed too high for quality.

Since information is an experiential good in light of Arrow (1962) theory by Shapiro and Varian (1998), its demand can be limited when there is more uncertainty about its value and quality. This could make the functioning of the markets more imperfect. In fact, since the buyer does not know the real quality of the information until he has acquired it, it will be very

difficult for him to make a correct estimate of the quality of the information and to propose a price. According to Akerlof's law, it will thus tend to offer a price lower than the value of the equilibrium price of the information on the market. This could undoubtedly lead to an underestimation of the value of informational goods by up to 30% compared to that of material goods (Sakalaki and Thépaut, 2005).

For Porter and Caves (1986) the market for goods and services and the market for information about these goods and services are two different types of markets but intrinsically linked and intertwined with each other. They are intimately linked so that an offer of goods or services at a given price and quality implies at the interface the existence of an offer of information on the attributes (quantity, quality, color, price etc.) at a given price and quality. Similarly, the demand for goods or services at a given price and quality implies at the interface the existence of a demand for information on attributes (quantity, quality, color, price, etc.) at a price and at a given quality.

The analysis of the theory of Porter (1980, 1986) and Caves (1980) on the interweaving and linking of the information market to the product market has shown us that the performance of product markets depends on that of the markets of informational goods that are structurally failing markets because the information exchanged is a private good often requiring research costs that could slow down its demand.

As the market for a product is intimately linked to the quality of market information, a sale transaction for a quantity of this product systematically incorporates that of the sale of information quality and a purchase transaction for a quantity of this product, integrates that of the purchase of information quality. However, it is difficult to distinguish in the sale price or the purchase price of the product, the share of information from that of the quantity of the product purchased or sold on the market. In other words, the sale of the quantity of a given product is also a sale of information about this product and the purchase of the quantity of a given product also corresponding to the purchase of information about this product.

These intrinsic characteristics of production and information management limit the development of an optimal Pareto information market. Information therefore has a systematically imperfect and failing market.

However, the optimal functioning of the product market requires a perfect functioning of the information market, in particular an operation capable of eliminating the asymmetries of information between the actors (anti-selection and moral hazard), eliminating transaction costs in particular those related to the search for information by the actors, to eliminate the externalities and possibly the stowaways that lead to free access and to over-exploitation, thus compromising the production and the demand for information.

Studies on the markets for goods and services are generally very frequent, on the other hand those on markets for the information associated with them remains very rare, an almost non-existent path for those interested exclusively in the analysis of the factors determining the demand for information.

In sub-Saharan Africa, the number of undernourished people increased from 176 million to 218 million between 1990 and 2014 according to the same source. These sufferings of the

people illustrate and characterize some of the defects in the functioning of African economies, in particularly agricultural markets. In fact, the poor functioning of agricultural markets is generally characterized by the rigidity of demand, the seasonality and irregularity of agricultural production, price instability, market segmentation, and high transaction costs and the lack of transparency in the markets (FAO 2015, 2018).

In Sahelian Africa, food shortages in the cities and the countryside while there are surplus areas, the poverty of agricultural households while they accumulate surpluses of production, the inaccessibility to the products sold on the markets whereas the consumers have sufficient means to pay, are evidence that the functioning of agricultural markets is failing.

However, authors of economic theories such as Akerlof (1970), Spence (1974), Coase (1960) and North (1992) have demonstrated that market failures are related to imperfect information problems between actors, particularly asymmetries of information, negative externalities, the existence of market power and high transaction costs. And since the work of the neo-classics, it is accepted that the pure and perfect competition market can only be effective if all the actors have access to the perfect, complete and free information on all the economic transactions that take place in the markets, in particular, information on the quality, quantities and prices of goods and services exchanged.

Market Information Systems (MIS) are innovative technologies for providing perfect information on agricultural markets.

Being supposed to produce perfect information for better market transparency MISs have been proposed to reduce market information asymmetries in order to be able to obtain transparent and efficient markets (Galtier F. and Eggs G. David-Benz, H. 2003, 2012).

There is some work on the analysis of the information market in Africa, in particular on the information offers of Market Information Systems (MIS). We could cite the work of Svensson and Yanagizawa (2009), Jensen (2007) and Aker (2008), Subervie and Galtier (2012), Courtois and Subervie (2014) who showed the impact of these information offers on the efficiency of agricultural markets in Africa.

MIS had a positive influence on the performance of these markets, allowing merchants to increase their profits.

Svensson and Yanagizawa, studying the impact of a Ugandan MIS, called Foodnet, broadcasting via a radio program information on farm gate prices paid to corn farmers showed that these maize producers have increased the share of production sold by 32% for all crops combined.

These authors attribute these impacts to an improvement in the bargaining power of producers over buyers.

Recent studies have assessed the impact of second generation MIS on farmers' behaviors and incomes.

Jensen (2007) and Aker (2008) showed that the mobile phone has positive effects on food trade in South Africa and Niger.

Subervie and Galtier (2012) as well as Courtois and Subervie (2014) carried out an initial analysis of the ESOKO MIS impact in sub-Saharan Africa and found that this MIS improved prices for maize and peanut producers respectively of the order of 10% and 7%.

According to Galtier and Egg (2003), the mismatch between the information demand of the actors and the information offer of the MIS limits their effect on the performance of the markets. According them, again, this inadequacy may force private operators to have their own sources of information.

When MIS work properly, they can help improve the prices and incomes of market participants, improve their trading capacity and their market share.

MIS development and expansion for providing agricultural market's information in sahelian countries, have evolved into two phases: a first phase or first generation of MIS (MIS1G) from 1980 to 2000 marked by manual and semi-automated collection and dissemination of information (collection by individuals and broadcast by radios and newsletters), and a second phase or second generation of MIS (MIS2G) from 2000 to now marked by intensive use of mobile telephony and the internet for the collection and dissemination.

For the production and supply of information for the transparency and efficiency of agricultural markets, there are a total of 25 MISs for all of these 7 countries, including 23 national MISs and 2 regional MISs covering hundreds of agricultural and livestock markets physically existing and spread over all these countries (CILSS, 2017).

African countries in the Sahelian zone allocate important budgets to produce information to meet the demand: 2 758 621 US dollars allocated each year to the functioning of the agricultural and livestock public MIS (CILSS 2017).

Despite efforts to innovate and invest to improve the supply of agricultural market information in these Sahelian countries, MIS2Gs remain poorly used by agricultural households to obtain transparency and better market efficiency: only 3 out of 10 farm households in the Sahel use MIS2G for their decisions on business transactions in the markets (CILSS 2017).

Thus what would be the economic or socio-economic factors that would favorably or unfavorably affect the use of these MIS2Gs as market transparency innovation?

Most of the studies carried out on the factors affecting the adoption of technical innovations have mainly been devoted to innovations of the private type: the adoption of horse traction and improved seeds for the development of agriculture in Burkina Faso, for example.

The present study makes the particularity of being interested in technical innovations of public type (belonging to the government) such as MIS2G representing devices for providing information to small farmers to improve the transparency and efficiency of agricultural markets. The objective is to identify and analyze the factors that affect the adoption of this

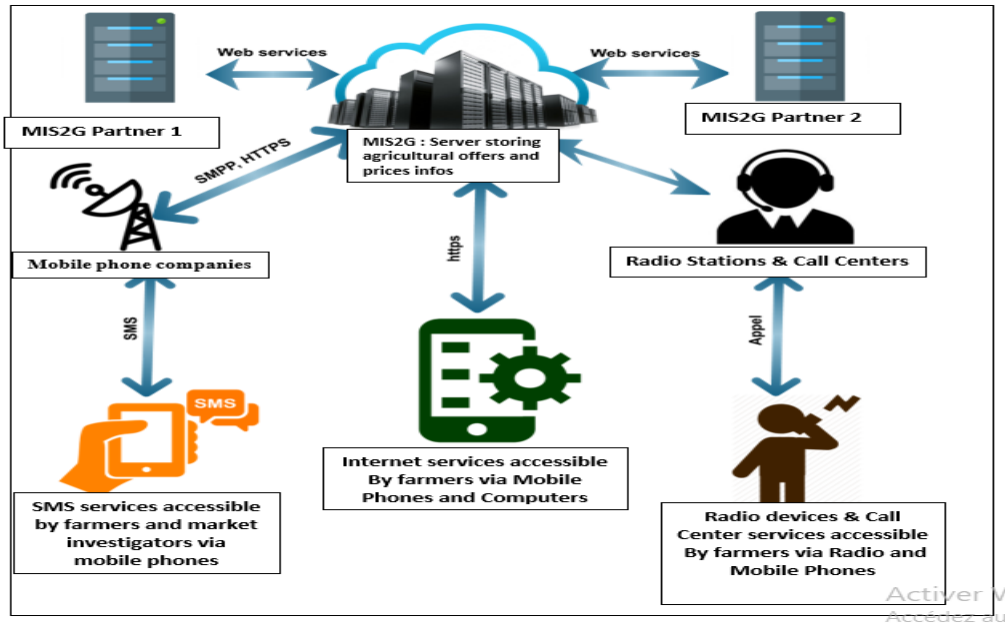
public good, taking into account its non-rivalry and its non-exclusion in order to know and characterizing the consequences.

1. Methodology and data

1.1. Characterization and shematization of MIS2G

The MIS2G device has as constituent elements: (i) a coordination and management unit (statistician, economist, IT specialist) equipped with a server storing processed and validated information on the offers and prices of agricultural products, (ii) partners for collecting data on the markets, in particular the investigators, (iii) partners for disseminating validated information such as mobile telephone companies, radio stations, call centers, (iv) users of the information disseminated mainly made up of farm households or small farmers receiving information via mobile phone (SMS and Internet), call center or radio devices.

Figure 1: schematization of a MIS2G



1.2. Choice of model and variables of interest

The objective of this study is to identify and analyze major determinants of transparency and information asymmetries on agricultural markets in Sahelian countries.

According Nicholson and Snyder (2008), any entity is said to be driven by its utility maximization when adopting a new technology farmers are expected to make decisions on technologies using based on their expected maximum utility. Farmers will look for necessary production technologies with minimum costs while expecting to attain increased levels of well-being: maximization of production and profits.

The utility function is expressed like that :

$U_{iy} = X_i B_y + n_{iy}$ $y = 1, 0$; $i = 1, \ldots n$ (1)

where,

X_i representing a farm-specific function; B_y a parameter for estimation; n_{iy} an error term with zero mean and a constant variance.

The analysis is done using a probit model to identify variables that have significant effects on the probability of adoption of MIS2Gs by farm households (y_i). Indeed, the dependent variable is a binary variable that takes the value 0 if the farm household has not adopted MIS2Gs and the value 1 if the farm household has adopted MIS2Gs.

$Y_i = 1$; if $U_{i0} < U_{i1}$ and $Y_i = 0$ if $U_{i0} > U_{i1}$ (2)

where,

U_{i0} is utility obtained from no adopting MIS2Gs; U_{i1} is utility obtained from adopting MIS2Gs

Suppose that there is a latent variable y_i^* such as:

$Y_{i=1}$ if $y^*_i \geq 0$

$Y_{i=0}$ if $y^*_i < 0$ (3)

In addition, suppose that depends on a certain number of explanatory variables grouped in a vector X. We thus have: $y_i^* = \beta' X_i + \varepsilon_i$ (4)

With β' a parameter vector and ε_i the error term that follows a centered-reduced normal distribution. As y^*_i is an unobserved latent variable, the probability of y_i taking the value 1 can be defined as follows:

$$\begin{aligned} \Pr ob(y_i = 1) &= \Pr ob(y^*_i \geq 0) \\ &= \text{Prob}(\beta' X \geq -\varepsilon) \end{aligned} \quad (5)$$

The probability that the farm household has adopted MIS2Gs (P_i) is affected by the X factors; So we have:

$$\text{Prob (y} = 1) = \varphi(\beta' X_i) \quad (6)$$

With φ the distribution function of the normal centered-reduced law. By exploding X into its components, we obtain the empirical model. The estimation of this model makes it possible to identify determinants factors of adopting MIS2Gs in Sahelian countries

The variables characterizing probably the farm household adopting MIS2Gs in Sahelian countries are: his age, his sex, his education level, his sale offer, his selling price of its products on the markets, his belonging to peasant organization, his access to web or internet (web), his knowing to use sms, his radio device owning or using.

***The age of the head of household (Age)*:** this is a quantitative variable expressed in number of years lived.

It is assumed here that older people have more experience in using market information and age is expected to be positively related to the probability of adopting MIS2Gs. The probability of adopting these innovations is expected to increase with the age of the head of household. The older the head of household, the more he will tend to use MIS2Gs. And the younger the household head, the less inclined he will be to use these innovations. Here we predict a positive relationship between this variable and the probability of adoption of MIS2Gs.

The level of education of the head of household (Education): this is also a quantitative variable expressed in number of years of instruction or learning in training centers.
It is assumed that more educated household heads have more capacity to use MIS2Gs. Educational attainment should be positively related to the probability of adopting these innovations. In other words, the probability of adopting these innovations should increase with the level of education of the head of the farm household. The more educated he is, the more ready he will be to embrace MIS2Gs because he understands the rationale very well. Here we also predict a positive relationship between this variable and the probability of adoption of MIS2Gs.

Knowledge in using short message service (sms) (knowing to use sms): This is a qualitative variable called binary because expressed yes if the head of the farm household can use short message service (sms) with a mobile phone and not when he cannot. We expect here that knowing to use sms with mobile phone is a factor that will increase the probability of adopting innovations, hence a positive relationship between this variable and the probability of adoption.

The selling price of agricultural products (Selling Price): this is a quantitative variable expressed in local currency, the CFA Francs. This is the value in CFA Francs of one ton of agricultural goods sold in the market.
We expect here that an improvement in the prices of the selling prices of farm household products and in turn their level of monetary income will increase the probability of adoption of MIS2Gs. The more prices and incomes rise, the more farm households are ready to adopt transparency innovations. Here we predict a positive relationship between this variable and the probability of adoption.

The sale offer of agricultural products on the markets (Sale offer): this is a quantitative variable expressed in tons of agricultural goods for sale in the markets.
Here we hypothesize that an increase in surplus or marketable production will increase the probability of adoption of MIS2Gs and therefore a positive relationship between this variable and the probability of adoption.

Belonging to peasant organization (Peasant_org.belonging) : This is a so-called binary qualitative variable because it is expressed yes if the head of the farm household is a member of a peasant organization and no when he is not a member. Farm households that are members of farmer organizations are expected here to be those who know the rationale for using MIS2Gs and therefore a positive relationship between this variable and the probability of adoption.

Web or Internet access (Web_internet): It is a binary qualitative variable expressed by yes if the head of farm household has access to the Internet by his mobile phone, his computer or by a cybercafé, and by no when the head of household does not have access to it at all. It is assumed here that Internet access positively influences the probability of adoption of innovations.

Radio device owning or using (Radio device owning or using): It is a binary qualitative variable expressed by yes if the head of agricultural household is in possession of a radio device and by no when the head of household is not in possession of type of equipment. We assume here that owning a radio positively influences the probability of adopting market transparency innovations.

Belonging to the male or to the female sex (Sex): It is a binary qualitative variable expressed by 1 if the head of farm household is a man and by 0 when the head of household is a woman. It is assumed here that male farmers positively influence the probability of adopting market transparency innovations.

Table 1: Definition of explained variables

Variables explained		Unity	Expected sign of the probit model
Age	Age of the heads of farm households: quantitative variable expressed in number of years lived	Years	-+
Sex	Breakdown by sex: binary variable 1 = male and 0 = female		-+
Educational level	Education level variable quantitative: number of years spent in school	years	-+
Knowing to use sms	Possession of a phone or mobile phone: binary variable 1 = yes and 0 = no	Dummy	-+
Selling Price	Sale price of farm products: quantitative variable expressed in FCFA	XOF	+
Sale offer	Offers (supplies) for the sale, quantitative variable expressed in tons	Tons	+
Peasant_org. belonging	Belonging to a peasant organization: binary variable 1 = yes and 0 = no	Dummy	-+
Web internet	Internet (web) access, binary variable 1 = yes and 0 = no	Dummy	-+
Radio device owning or using	Possession of a radio, binary variable 1 = yes and 0 = no	Dummy	-+

Source: author from literature review, 2021

1.3. Sampling a data source

The data used in this study come from CILSS surveys 2017 of 175 farm households of 7 Sahelian countries using MIS2G for their decisions on business transactions in the markets. These countries are: Burkina Faso, Mali, Niger, Senegal, Mauritania, Gambia and Tchad. These CILSS databases has been used for statistical analyzes and maximum likelihood estimates.

To carry out field surveys, CILSS with the financial and technical support of the Africa Development Bank (AfDB), used a questionnaire that was administered to 175 farm

households identified as potential MIS2Gs users in the 7 countries studied. The 175 farm households surveyed are made up of men for the majority, 82%. This is understandable since the surveys have mainly affected heads of households and in the Sahel the heads of farm households are for the most part men who claim to be the best able to always answer questions of common interest.

These farm households are supposed to belong or not to agricultural professional organizations considered representative in the 7 countries. From the 175 farm households surveyed, data of 141 farm households surveyed are valid for our econometric analysis.

2. Results

2.1. Descriptive statistics

Descriptive statistics show that out of a sample of 175 farm studied households, 60% are between 20 and 49 years old and 40% between 50 years and over. The average age is 46 years with a minimum and a maximum equal to 20 and 78 years old respectively. This relatively younger age group of 20 to 49 years old and large in terms of numbers (60% of the total population of agricultural households studied) could weigh in favor of the adoption of SIM2G

Table 2: Age of farm households investigated

Minimum	Maximum	Std deviation
20	78	11,4

Source: CILSS, survey data 2017

The table below indicates that the proportions of farm households that are members of farmers' organizations and have a radio, telephone or mobile phone are relatively high in the Sahel: 77% belong to farmers' organizations, 89% have radio devices, and 99% have landline or mobile phones.

These factors could weigh favorably on the adoption of MIS2G in Sahelian countries.

Table 3: Proportion of farm households belonging to a peasant organization, owning or using radio device and mobile phone

Countries	**Belonging to a peasant organization**	**Owning or using radio device**	**Owning or using mobile phone**
Senegal	64	94	100
Gambia	77	92	98
Mali	97	88	100
Burkina Faso	85	97	100
Niger	100	69	97
Tchad	75	79	92
Mauritania	31	95	100
Study area set	**77**	**89**	**99**

Source: CILSS, survey data 2017.

2.2. Results of econometric estimation

The results of the estimates are summarized in tables 4 and 5 below:

Table 4: Probit of adopting MIS2G in Sahelian countries

Probit regression — Number of obs = 141; Wald chi2(10) = 26.37; Prob > chi2 = 0.0033; Log pseudolikelihood = -81.61845; Pseudo R2 = 0.1454

MIS2G adopting	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sale offer	-.1202094	.0471956	-2.55	0.011	-.212711	-.0277079
Selling price	.082866	.0405345	2.04	0.041	.0034198	.1623122
Web_Internet	-.0784927	.0686701	-1.14	0.253	-.2130836	.0560982
Knowing to use sms	.5519905	.2933902	1.88	0.060	-.0230438	1.127025
Radio device owning	-.0264798	.31918	-0.08	0.934	-.6520612	.5991015
Peasant_org.belonging	-.1259058	.3673683	-0.34	0.732	-.8459345	.594123
Educational level	.019124	.1003329	0.19	0.849	-.177525	.2157729
Age1	.1362948	.0749436	1.82	0.069	-.010592	.2831816
Age2	-.0013681	.0007768	-1.76	0.078	-.0028907	.0001544
Sex	-.4145341	.3486691	-1.19	0.234	-1.097913	.2688448
_cons	-2.786177	1.841054	-1.51	0.130	-6.394576	.822222

Table 5: Marginal effects of adopting MIS2G in Sahelian countries

Probit regression, reporting marginal effects — Number of obs = 141; Wald chi2(10) = 26.37; Prob > chi2 = 0.0033; Log pseudolikelihood = -81.61845; Pseudo R2 = 0.1454

MIS2G adopting	dF/dx	Robust Std. Err.	z	P>|z|	x-bar	[95% C.I.	]
Sale offer	-.0461313	.0181097	-2.55	0.011	4.40174	-.081626	-.010637
Selling price	.0318004	.0156427	2.04	0.041	10.5712	.001141	.06246
Web_Internet	-.0301221	.0263124	-1.14	0.253	11.3233	-.081694	.021449
Knowing to use sms	.2090385	.1084671	1.88	0.060	.510638	-.003553	.42163
Radio device owning	-.0101618	.1224772	-0.08	0.934	.929078	-.250213	.229889
Peasant_org.belonging	-.0483173	.1410641	-0.34	0.732	.851064	-.324798	.228163
Educational level	.007339	.0385094	0.19	0.849	2.59574	-.068138	.082816
Age1	.0523041	.0288186	1.82	0.069	47.4965	-.004179	.108787
Age2	-.000525	.0002986	-1.76	0.078	2377.95	-.00111	.00006
Sex	-.1590805	.134023	-1.19	0.234	.893617	-.421761	.1036
obs. P	.4113475						
pred. P	.3902796	(at x-bar)					

The results of probit model estimates by maximum likelihood have shown (see table below) that the age of the household head, the prices and the level of his products sales offers have significant effects on the probability of adoption of MIS2Gs by farm households. However, the effects of variables such as educational level, peasant organization belonging (Peasant_org.belon), Web or internet (Web_internet) access, sex and radio device owning or using are not significant.

We note that prices, knowing to use sms and age1 (over 50 years old) coefficients are positives, while the coefficients associated with the age2 of the heads of farm households (between 20 and 49 years old), their level of education, and their products sales offers on the

markets are negative. The results obtained from the estimation of these two models are globally significant.

3. Discussions

The negative sign of coefficients means that the age2 of the household heads, and their products sales offers has negative effects on the probability of adopting market transparency innovations. The negative of age coefficient, means that MIS2Gs are requested by young producers (60% of farmers aged 20 to 49) who know them and master their use.

The negative sign associated with the sales offers coefficient means that the probability of adopting market transparency innovations increases inversely with farmer size.

The level of adoption of market transparency innovations decreases with the size of farmers. The large farmers who sell large quantities of agricultural goods in the markets are those who make less use of the State's MIS2G devices for their transactions. They have their own more efficient information circuits for their usual transactions.

However, small farmers who can only sell small quantities of agricultural products in the markets are those who use MIS2G more for their transactions. MIS2G are used by small producers (farmers). They generally have neither the market power nor the means to develop their own market information circuit. They use the information disseminated by government MIS2G to optimize their business activities.

The use of a private good by one consumer leads to its deprivation and exclusion for other consumers. This leads to scarcity and an increase in the quality and value (increase in price) of this good.

The adoption by a farmer of MIS2G as a public innovation does not deprive or exclude other farmers from using this innovation and therefore has no positive effect on its valuation (increase in price) and its quantitative and qualitative improvement.

Thus with the increase in the number of users due to free use, the network of the MIS2G device itself could become congested (negative externalities) and become inefficient in the long term.

The positive sign associated with the price means that the price level has positive effects on the probability of adopting market transparency innovations.

Prices increase with the increasing the probability of adopting market transparency innovations by farm households. The search for better prices therefore leads farm households to become interested in the information disseminated by the MIS2G. Price increasing has a positive effect on the probability of adopting market transparency innovations. The probability of adopting market transparency innovations increases when prices rise. Price stability is irrelevant to the adoption of market transparency innovations. A high price of agricultural products increases the chances of adoption of MIS2G. A low price of agricultural products is a barrier to the adoption of MIS2G.

As the prices of agricultural products are correlated with the incomes of the farmers and given that their improvement can lead to the increase of the incomes of the farmers it is certain that a high level of the income of these farmers would increase their chances of adopting the MIS2G.

The negative sign associated with sales offers coefficient is explained by the fact that MIS are used by small producers (farmers). They generally have neither the market power nor the means to develop their own market information circuit. They use the information disseminated by MIS2G to optimize their business activities. A high level of sales offers can lead to lower prices, a situation that can reduce the chances of adopting MIS2G.

The positive coefficient of the variable *knowing to use sms* means that this factor has positive effects on the probability of adopting market transparency innovations. The probability of adopting market transparency innovations is increasing with farmers who have better knowledge in sms using with mobile phone. Farmers do not need to spend long years in formal school to know the use of sms and to be able to use MIS2G for their transactions. A little literacy training is enough.

The coefficients of the variables of interest such as peasant organization belonging (Peasant_org.belon), Web or internet (Web_internet) access, Radio owning and the educational level are not significant.

Conclusions

African countries in the Sahelian zone allocate important budgets to produce information to meet the demand.

Unfortunately for all of the seven Sahel countries, the level of adoption or use of these MISs as innovations for transparency and improving market competition still remains low.

The objective of this study was to identify and analyze the determining factors of adopting markets transparency innovation for better improvement of their level of competitiveness and efficiency.

The factors identified and analyzed are: the age of the heads of farm households, the level of education, the sex, sale price of farm products, sales offers of agricultural products, sms using, peasant organization belonging, web or internet access radio device owning or using.

The factors that have significant effects on the probability of adoption of market transparency innovations by farm households are: the age of the heads of farm households, the knowing to use sms, the sale prices and finally the level of sales offers of agricultural products on the markets.

The study showed that education, age (for young farmers between 20 and 49 years old), and sales offers are determinant factors that have negative effects on the probability of adopting market transparency innovations. However, sale prices, age (for old farmers, over 50 years

old), knowing to use sms are factors that have some positive effects on the probability of adopting market transparency innovations.

However, the coefficients of the variables of interest such as peasant organization belonging (Peasant_org.), web or Internet access (Web_internet), sex and radio device owning or using, educational level are not significant.

The adoption by a farmer of MIS2G as a public innovation does not deprive or exclude other farmers from using this innovation and therefore has no positive effect on its valuation (increase in price) and its quantitative and qualitative improvement. Thus with the increase in the number of users due to free use, the network of the MIS2G device itself could become congested (negative externalities) and become inefficient in the long term.

Bibliography

- Aker, Jenny C. 2009. "Mobile Phones and Economic Development in Africa." Invited presentation at the Center for Global Development, Washington, D.C.
- Akerlof, G. (1970). «The Market for "Lemons": Quality Incertainty and the Market Mecanism » Quarterly Journal of Economics: 488-500.
- Arrow K. (1962), The Economic Implications of Learning by Doing, Review of Economic Studies, 1962, vol. 29, issue 3, 155-173
- Bowbrick, P. "Are Price Reporting Systems of Any Use?" British Food Journal,1988, 90:2, pp 65-69
- CILSS (2017): Rapport d'études de faisabilité pour la mise en place d'un Système d'Informations sur les Marchés, Deuxième Génération (SIM2G), 500 p
- Coase R. (1960): The Problem of Social Cost, Journal of law and Economics, vol.3, 1960.
- Cotta, A (1968) : Dictionnaire de science économique, Edition Maison MAME.
- David-Benz, H., Egg, J., Galtier, F., Rakotoson, J., Shen, Y., Kizoto, A. (2012), Les SIM agricoles en Afrique sub-saharienne, de la première à la deuxième génération. CIRAD, INRA, AFD, CTA, 89 p. + annexes.
- Fafchamps, M. & Minten, B. (2012), Impact of SMS-Based Agricultural Information on Indian Farmers, World Bank Economic Review forthcoming.
- Jensen, Robert T. 2007. "The Digital Provide: Information (Technology), Market Performance and Welfare in the South Indian Fisheries Sector." Quarterly Journal of Economics, 122(3): 879–924.
- Galtier, F. & Egg, G. (2003), Le « paradoxe » des systèmes d'information de marché (SIM) : une clé de lecture issue de l'économie institutionnelle et de la théorie de la communication, Economies et Sociétés, série F, n°41, « développement », V, 7-8/2003, pp 1227-1260.
- Greene, W.H. (2012) Econometric Analysis. 7th Edition, Prentice Hall, Upper Saddle River.
- Grossman, S. J. and Stiglitz J. (1980). "On the Impossibility of Informationally Efficient Markets." American Economic Review 70(3): 393-408.
- Hurwicz, Leonid (1960), "Optimality and informational efficiency in resource allocation processes", in Arrow, Kenneth J.; Karlin, Samuel; Suppes, Patrick (eds.), Stanford University Press, pp. 27–47,
- North, D. (1992). Transaction costs, institutions, and economic performance. San Francisco, CA: ICS Press. p. 5.
- Porter, M. E. (Ed.). (1986). Competition in global industries. Boston: Harvard Business School Press

- Porter, M. E., Caves, R. E., & Spence, A. M. (1980). Competition in the open economy. Cambridge, MA: Harvard University Press
- Porter, M. E. (Ed.). (1986). Competition in global industries. Boston: Harvard Business School Press
- Sakalaki M. and Thépaut Y., La valeur de l'information : évaluation des biens informationnels versus biens matériels, Questions de Communication 8 (2005) 355-65.
- Shapiro, Carl and Hal R. Varian (1998). Information Rules: A Strategic Guide to the Network Economy, June 2000 The Journal of Technology Transfer 25(2):250-252
- Shepherd, A. W. (1998) : Les services d'information sur les marchés : théorie et pratique. FAO, Bulletin des Services Agricoles N°125.
- Spence, A. M. (1974). Market Signalling : Informational Transfer in Hiring and Related Screening Processes. Cambridge (Massachusetts), Harvard University Press.
- Subervie, J. & Galtier, F. (2012), Systèmes d'Information de 2ème Génération en Afrique Sub-saharienne : Etudes d'impacts. CIRAD, INRA, AFD, CTA, 76 p.
- Staatz, J., Kizito, A., Weber, M., & Dembele, N. (2012), Challenges in Measuring the Impact of Market Information Systems, Cahiers Agricultures, forthcoming.
- Simon, H. (1962). "The Architecture of Complexity." Proceedings of the American Philosophical Society 106(6): 467-482.
- Svensson, J. & Yanagizawa, D. (2009), Getting Prices Right: The Impact of the Market Information Service in Uganda, Journal of the European Economic Association 7(2-3), 435-445.