THE ROLE OF INFORMATION DIFFUSION ON FARMERS GOOD AGRICULTURAL PRACTICES: A SOCIAL NETWORK POINT OF VIEW – THE CASE OF THE FRENCH AGRO-ENVIRONMENTAL PRACTICES

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Abstract

Many recent researches focus on the sustainable agriculture and the advantage of the adoption of good agriculture practices for farmers, consumers and for the environment. In this work, we agree on one thing: better information diffusion leads to better adoption of good agricultural practices by farmers. The objective of our article is double. Firstly, we aim to propose an analytical model of the relevant factors which can help to better understanding the process of adoption of these practices. Our framework is developed around three main elements: the individual level (the information seeker), the economic level and the social network level. Secondly, we aim to test empirically this model, by confronting it to some field experience in agro-environmental practices. Our first empirical results put a lot of emphasis on the importance of the formal network in knowledge transfer. Finally, we discuss the implication for theory and practice and present the next steps of this ongoing research.

Keywords: Network; good agricultural practices; information diffusion; knowledge.

1. Introduction

Sustainable agriculture is concerned with the ability of farmers to adopt good agricultural practices. They are defined as practices "that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products" (FAO COAG 2003 GAP paper). Adopting them creates new market

opportunities for farmers, helping them optimizing their use of inputs (e.g. water, fertilisers, pesticides) yielding to safety and security products, which consequently leads to best health of the plant and for the environment.

In this study we focus on the adoption of recent innovative practices that benefited from the existence of a historical and pioneering one as the organic farming. " In France, it is a well-known symbol of agro-environmental practices. From a political standpoint, the French national strategy considers the agricultural area engaged in organic farming as an official indicator of sustainable development. The development of this forerunner practice, for nearly half a century has greatly influencedthe context for agri-environmental practices. And recent innovative practices will be illustrated by the High Environmental Value (HEV) and the conservation agriculture (CA), both launched in France in the middle of the 2000's.

More specifically, we look at the role of the information diffusion on the process of adoption of new agro-environmental practices. A review of the academic literature makes sure that this adoption process is a complex process that includes many factors. These factors could objective such as the increasing consumer willingness to pay environmental friendly products, and the institutional context, and subjective/intrinsic such as the psychological features of the farmer and his education level. All these factors are interconnected, and not easy to measure.

As far as agro-environmental practices can be considered as a combination of technological and organizational innovation, the social network approach could be a pertinent framework to the comprehension of the information diffusion and the adoption of the agricultural innovation. That's why, in addition to these elements mentioned earlier, we mobilize a new approach which is not addressed by agricultural researchs: the social network. For indeed a farmer isolated is not able to get useful information. Farmers who are less isolated than others (they are members of cooperatives, members of networks, etc.) obtain useful knowledge either from colleagues, from other members of their networks or also from neighbours and friends. This view of farmers put a lot of emphasis on the importance of the network in knowledge transfer, incorporating both formal and informal dimensions.

Then in this paper we consider that the adoption of good agricultural practices is not the result of the unilateral farmer alone, but the result of a combination of many interconnected factors. Information is the "lifeblood" that connects all these elements; it is also making the link of farmers with other actors. Until recently, the subject of good agricultural practices interest many researchers in different disciplines. The dominant concern of studies was on the impact of the use of inputs on the environment (Van der Werf and Petit, 2002; Hansen, Alrøe and Kristensen, 2001). Economic and management sciences studies have focused more specifically on the financial-economic concerns of good agricultural practices (Mccann et al., 1997). Sociological and psychological literature have focused on the farmer profile such as the farmer's personal characteristics, farm operation characteristics, and farm's perception of agricultural practices (Willock et al., 1999; Greiner and Gregg, 2011; Greiner, Patterson and Miller, 2009).

There is however no unified framework to guide debates and methods for helping farmers achieving sustainable agriculture. Little is said about how farmers have got access to information. Nevertheless, it is evident that the adoption of good agricultural practices largely depends on the access by farmers to information. In social science and economics the challenge then is to examine how farmers could obtain useful knowledge about good agricultural practices. Our key question in this research is: What are the determinants of the information diffusion within farmers leading them to adopt good agricultural practices?

The objective of this study is double. First, we aim to understand the mechanisms and the process that conduct a farmer to adopt these good practices. This requires the examination of

all indicators of information diffusion such as external and intrinsic indicators. Second, our ambition is to mobilize a social network approach to the comprehension of this process, which is used in management literature but not yet explored in agriculture studies (this point will be developed in further researchs).

This work follows in 3 further parts. In the first section we try to identify the main factors that are relevant to explain the adoption of good agricultural practices. In the second section we will explain the methodology that will be used in the next steps of this ongoing research. Finally, int the third section we present our first results in focusing on agro-environmental practices in France and the network level.

2. Literature review

The aim of this section is to develop an analytical framework capturing the main elements that could explain information diffusion and lead to the adoption of new good agricultural practices. This framework could help us to understand the relationship between the knowledge seeker (the farmer) and the knowledge source (agricultural institutions, electronic and paper-based sources of information, persons, etc.).

2.1. Psychological-based explanation

The first actor concerned with the adoption of good agricultural practices is the farmer. Information access depends largely of intrinsic characteristics of the farmer. Agricultural science researches have offered clear evidence of the role of the farmer's profile and psychological aspects in adopting good agricultural practices.

The attitude of the farmer toward risk is identified as important in deciding whether to adopt or not a new good agricultural practice. This decision is considered as risky because farmer cannot be sure about outcomes (Greiner et al., 2009).

Economic analysis showed that farmers are generally risk averse (Willock et al., 1999), which can slow the agricultural innovation process and the adoption of new practices. But, if economical approach profit maximization is the principal motive of farmer's adoption of innovation, farmers could be driven by non-financial motives such as "life-style" and "social motivation (Greiner et al. (2009). Greiner and Gregg (2011) support the idea that "personal and family well-being" and ethical considerations are also motives for farmers to adopt innovation. In the same line of idea, for Traoré, Landry and Amara (1998), farmer's concern for personal health is an important determinant to his decisions. In addition, other intrinsic factors can influence the decision of a farmer of whether to adopt or not good agricultural practices such as his age, education level (Gould, Saupe and Klemm 1989), and prior experience.

2.2. Economic-based explanation

We consider organic farming as a pioneering and forerunner event in the sense that its development has impacted the whole context surrounding the agro-environnemental practices. For that, we can focus on the consumer's willingness to pay the "environmental" quality of produced goods and on the presence of many institutions that encourage environmental practices. In this section we develop these elements that are important for the launch and adoption of other environmental benefits associated practices such as conservation agriculture and HVE.

The evolution of the final consumer demand

The long term development of organic farming has positively influenced the context surrounding societal demand on agro-environmental practices. Organic farming has spread

the idea that one could simultaneously satisfy a nutritional need and do not destroy the environment. Despite the tensions between the different movements that constitute the french organic farming, a consensus ariseed around the fact that it has greatly contributed to education and information of consumers on environmental quality, in a context of globalization and standardization of production.

In industrialized and developed countries such as France, consumers are searching for identity and diversity (Brodhag, 2000) in accordance with the principles relating to environmental, social and ethical preoccupation (Mathe, 2009). This is reflected to the consumer awareness about environment issues and the development of a new behaving, such asthe willingness tu search and to pay an environmental quality.

In France, according to a national survey conducted by the research center for study and observation of conditions of life (CREDOC) in 2009, French consumers are interested to products with specific qualities. That brings a significant number of them to consider accepting to pay more to obtain products environmentally and animal welfare (67%).

The role of institutions in diffusing information

The contextual environment can play an important role on the diffusion of knowledge. That means that the capacity of individues (or organizations) to get useful information depend on the context where they are. More specifically, at the institutional level, the national systems of innovation play a considerable role in the diffusion of information and encouraging networking activities. It is evident that formal institutions can make knowledge transfer easier. By institutions we mean the "legal system, the banking and finance system, the structure of labour markets, the education system and the political system" (Grandori and Soda 1995).

Normally, all farmers are similarly concerned with the institutional environment. But they do not equally benefit from opportunities and information diffused by these institutions. Access by farmers to information can be influenced, among others, by their profiles, localizations, etc.

2.3. The contribution of a social network approach

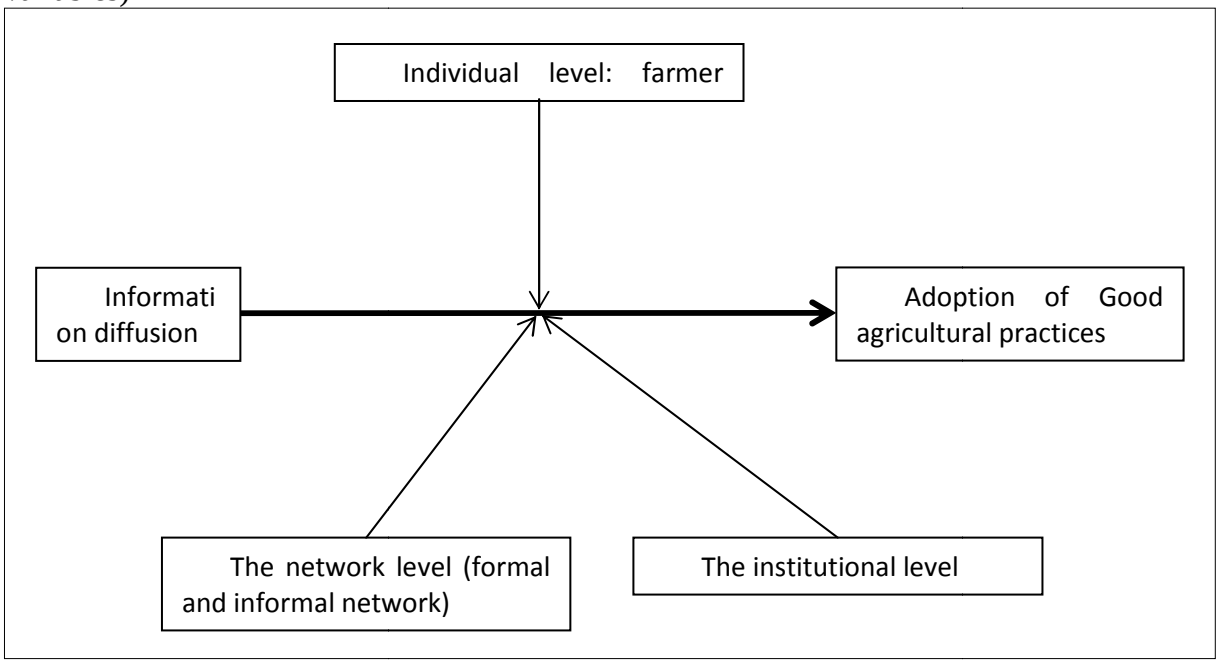
The social context is also important to consider when to speak about information diffusion. In the literature, many authors have clearly demonstrated the role of the social network in information and knowledge diffusion, in particular in helping individuals to develop theirs innovative ability (Duysters and al., 2003), to get information (Burt, 1992; Borgatti & Cross, 2003)) and to stimulate knowledge diffusion (Rogers, 1995).

Networking promotes social interactions which generate trust and reciprocity that facilitate knowledge transfer between people (Almeida and Kogut, 1999). For entrepreneurs, networking enhances the success rate of entrepreneurial initiatives (Baum and al., 2000), because it allows partners to access to other resources and also to gather informations and advices (Smeltzer and al., 1991). It appears also that, when they need information, people prefer seek it from other people. Because searching information could take a lot of time, people prefer using less documentation. For Cross (2001), even people who have access to paper or electronic sources of information, tend to seek information from their colleagues. That is the case also in the research done by Allen (1977) on engineers and scientists.

The social network approach is also concerned with the identification of local cultures and "opinion leader" personalities that can play a considerable role in the decision of a farmer to adopt good agricultural practice. The presence of key personalities in the network of a farmer can influence his way in doing agriculture. The idea of opinion leaders, called also "influentials" by (Merton 1968), is occupying a central place in the literatures of the diffusion

of innovations. For example, Coleman (1966) who developed the theory of cognitive processes in adults, showed that the adoption of a new behavior results from the interaction between the medical community and the opinion leaders who are members of the same community but are able to influence other opinions or decisions. In this context of knowledge sharing, interpersonal trust has a crucial role (Abrams and al., 2003).

Figure 1 - Conceptual model (This is a simplified version of the model. It does not show all variables)



3. Methodology

The methodology was conducted in two steps.

First step: Case study

This step is about starting to characterize the relationship between the information diffusion, the social network and the adoption of good agricultural practices *in confronting the model with the field experience in agro-environmental practices* (Poux, Faure and Villien, 2015)**.**

Agro-environmental practices mainly address environmental and economic sustainability. They take sources in the concept of agroecology, first defined in 1930, studied and highly enriched up in the 1990s to become a strong orientation of French agriculture over the last twenty years (Schaller, 2013).

Second step: Comparative analysis

This step is about conducting a comparative analysis to complement the results on the network level and focus on the producer and institutional ones, in focusing on other types of good agricultural practices

3.1. Data

The empirical study will be done in two steps. First, a qualitative research will be conducted in two regions in France: Aquitaine (10 operations of Hight Environmental Value “HEV” in Viticulture sector) and Picardie (2 operations of HEV in polyculture-breeding farms). Second,

a quantitative survey will be conducted. A questionnaire will be administered to all farmers from these regions.

The study will include surveys and data collect. We propose a multi-level approach which includes:

- Analyzing of data-bases
- Other Case studies, in particular in two geographical areas in France (Aquitaine and Picardie) on adoption of Organic Agriculture (Bio), Conservation Agriculture, and the High Environmental Value (HVE)

For the empirical part, to test our conceptual model, two case studies of farming environmental initiatives were investigated: the Conservation Agriculture (CA) and the High Environmental Value (HEV) certification. Case studies information was collected from technical documents and reports, various dedicated press communications related to the both practices and existing interviews of farmers (adopting HVE or using CA) and support organizations and websites. Especially for HVE program, interviews of pioneers' farmers (first HVE certified farmers in year 2012) were analyzed composed by 2 farmers from Champagne region and 1 farmer from Picardie Region). We used firstly a qualitative method which must be further complemented by a quantitative method within a questionnaire emailed to conventional and certified farmers, and also some semi directive interviews of institutional operators. The data analysis focuses on the adoption process (by responding to following question how and why), thus and also the motives and barriers of adoption of such practices.

3.2. Summary description of the case studies

The CA and HVE are seen as an approach which meets the society demand of sustainable food production with various benefits for farmers and the environment. The both approach are marginally used in France but on progress. France records an increase of the area dedicated to the CA from 400,000 hectares in 2001 to 630,000 hectares in 2006, according to Shaller (2013). The HEV approach, launched in the end of 2011, accounts 138 certified farms on 2014 against two dozen on year 2012 (France agricole, 2014)

The Conservation Agriculture according to the Food and Agriculture Organization (FAO) is an approach to managing agro-ecosystems for improved and sustained productivity, increased profits and food security while preserving and enhancing the resource base and the environment. The CA principle is based on a strong reduction, even an abolition of the ground labor, a permanent soil cover and crop rotations.

The HVE is an official environmental approach stemming from the environmental law «Grenelle environment number 2 "and set up on the end of 2011. The HVE certification is a progressive approach and includes 3 levels of environmental requirements: the first level (1) including requirements to access the approach. The second level (2) includes a set of best practices regarding the biodiversity, the use of phytosanitary products and fertilizers and the water management. Farmers implementing already specific environmental approach can reach directly the level 2 of the process. Indeed, 22 environmental approaches (example organic agriculture, ISO 14000, etc.) are officially recognized equivalent to the level 2 of the HVE certification process.

The level (3) allows the obtention of HVE certification conditioned by an external audit by a third certification body. This HEV initiative is in constant evolution although more modest on a national scale. However, regional and sectorial disparities are observed. Some region like Aquitaine or Champagne counts more certified farms than Picardie. In addition, among the certified farms, 85% are from the wine sector but tends to become widespread.

3.3. Case study results and discussion

The case study analysis highlights key factors influing willingness of farmers to adopt environmental approach:

- Farmers attitude and beliefs play a key role in the decision of good environmental practice adoption.
- Meeting consumer behavior towards environmental concerns (more demanding of environmental friendly product) are among the motivation of the conversion of farmers. Indeed, viticulture farmers particularly adopt the HVE approach to improve their image towards the environment conservation and to communicate about their effort about the good agricultural practice.
- The Farmers already engaged on environmental approach, for example environmental management systems (EMS) ISO 14001, organic agriculture, *agriculture raisonée* etc.) are the majority of HVE certified.
- Certified farmers are members of farmers association or environmental network (example DEHPY).
- Interviews of pioneers farmers' show that information was provided by the chamber of agriculture firstly and also from the farmers' network (Example in the wine sector, Qualenvi association or independent wine owners association viticulteurs indépendands de France VIF). Indeed independent wine owners' network counts 75 of HVE certified farms within their members.

The adoption or conversion was accompanied by the support organization (farmers associations, territorial network like DEPHY and AREA approach etc.). They provide information, learning process and training for farmers. The referee (technician from agriculture chamber) play also an important role (preparation for audit, information diffusion about the certification).

Information and knowledge are diffused through platform and farmers networks (example for CA and dedicated project through DEPHY). The combination of networking and learning. The adoption of CA requires a high management skills for farm management and knowledge that explain the necessity of strong support from dedicated project, and exchange through networking.

At the institutional level, it seems also essential to effectively support farmers committing to conservation agriculture because of their complexity: financial supporting technical advice, training in agronomy, technical references. Mobilizing chain actors is finally necessary to fit crop diversification often requires new markets (shaller, 2013). These systems are subject to numerous projects and research, worn both by non-governmental organizations, national or international institutes, or large groups of agro-industry. In France, several experiments are conducted in partnership with farmers, including through the BASE network (biodiversity, agriculture, soil and environment), Sustainable Agriculture Institute or the cooperative group VIVESCIA.

Finally, confronting our model with the field experiences in agro-environmental practices led in France (Poux and al., 2015) enable to characterize first and foremost the relation between *the formal network,* the information diffusion and the adoption of agro-environmental practices.

*The major role of the French network "Réseau rural" (Rural network):*Agro-environmental policies based on a top-down logic have shown their limits in terms of adoption of good practicess. Indeed, the rural network was built to develop a bottom-up logic. Producers who join the network can participate in any deliberation needed for the construction of the technico-economic "referential" which is the basis for the knowledge and

practices dissemination. "Farmers who participated in the deliberations have a high propensity to adopt practices that they helped to be institutionalized"

The interdependent role of the "Territorial Network" and the "Agricultural Network": The success in terms of adoption of good practices within a territory is assured when these two networks are able to collaborate. The Territorial network is seen as an engine that boosts the involvement of farmers. And the Agricultural one has been identified as a support of group dynamics. It sees the creation and the strengthening of relations and exchanges between farmers and other stakeholders.

The famers' proximity with the "environmental referee": At last and not the least, the famers' proximity with the "environmental referee", which is working closely with the "Territorial, Agricultural and Rural networks". Throughout decades of experimentation, public policy and the different networks have institutionalized a group named "Environmental referent." It is seen as the guarantor of environmental objectives in any agricultural projects. Networks are needed to establish a link between farmers and this group of "environmental referent", to learn about current issues affecting farms, and about how to defend their concerns, and about the associated fundings and European and National supports. Insights from this confrontation are needed to improve our model.

4. Concluding comments

The aim of this research is to contribute to the understanding of the factors determinants the impact of information diffusion on the adoption by farmers of good agricultural practices.

The first result of this work is theoretical. We propose a conceptual framework to summarize the relevant variables of this phenomenon that came out mainly from literature on food and rural studies, economic and management studies. With a focus on the social network concept, our framework is developed around five main items: Information diffusion, adoption of good agricultural practices, the individual level (the information seeker), the institutional and the network level.

Secondly, we provide primary empirical support for the conceptual model by confronting it with some experiences in agro-environmental practices such as the "Rural Network", the "Agricultural Network" and the "Environmental Referent". All these examples show mainly the important role of the formal network on the information diffusion and on the adoption of good environmental practices. That is, while these examples are very useful to understand the role of the formal network, they don't allow us to understand how the informal relationships make easier (or more difficult) the information diffusion. That's why more empirical research needs to be conducted on the complex role of the informal network, notably interviews with practitioners (farmers and institutions).

The project will offer many insights that can be helpful to practitioners (farmers, institutions, etc.). First, it will offer evidence that knowledge diffusion consistently matters in the adoption by farmers of good agricultural practices. Second, it can help understanding the mechanisms of knowledge transfer and assimilation by farmers regarding good agricultural practices. Third, it can help all stakeholders to focus on ways to improve knowledge diffusion, especially by networking activities.

In addition to interviews, it seems important, in the next phases of this research, to compare the two French regions. As previously announced, there are less HEV operations in Picardie than in Aquitaine. Consequently, we need to understand the factors related to information diffusion which prevent farmers in Picardie to adopt HEV practices.

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