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**How does information diffusion contribute to the adoption of good agricultural practices? A social network point of view.**

**The case of the High Environmental Value certification in France**

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**Abstract**

Despite the growing interest in social network, this approach remains not enough used in the agriculture context. The aim of this work is to understand the role of the social network on information diffusion and on the adoption by farmers of good agricultural practices. We analyze two different case studies: one individual and a collective approach of implementing High Environmental Value HVE certification in France. The implications for practitioners are clear: Through a better understanding of the mechanisms of knowledge transfer and assimilation, this work can help stakeholders to focus on ways to improve knowledge diffusion, especially by networking activities.

**Keywords:** social network, good agricultural practices, innovators, information diffusion

**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, fertilizers, pesticides) yielding to safety and security products, which consequently leads to best health of the plant and for the environment.

Good agricultural practices have been at the heart of several multidisciplinary studies. The dominant concern 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 farmers 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).

In this academic context, available knowledge has helped to formalize that the process by which the information diffusion contributes to the adoption of good agricultural practices is a complex one, and includes many factors (Cherni et al., 2016). These factors could be objective such as the increasing consumer willingness to pay environmental friendly products, the institutional context and subjective/intrinsic such as the psychological features of the farmer, his education level, etc. All these factors are interconnected, and not easy to measure.

The social network approach has been used in different and large scope of scholars. It has been used firstly in the field of sociology to explain access to information to get a job (Korpi, 2001; Granovetter, 1988), to explore the association between the context of social relationships and individual creativity (Perry-Smith and Shalley, 2003). Then the social network approach has been transposed to the business network between firms or managers to explain some phenomena such as the internationalization of small to medium-sized manufacturing firms (Chetty and Holm, 2000).

In the agriculture context, some scholars attempted to understand the process of information diffusion by using different approaches such as information systems and electronic data (Premkumar et al., 1994). The ambition of this paper is to mobilize the social network which is not addressed enough by agricultural researchers. This approach is particularly important because as far as information diffusion is concerned, being a member of cooperatives, several agricultural associations, getting involved in family or neighborhood relations can make a difference. More precisely, emphasis has been put on the importance of social network in knowledge transfer, incorporating both formal and informal dimensions (Allen and Gamlen, 2007).

This paper aims to better understand the process by which the information diffusion contributes to the adoption of those good agricultural practices. More particularly, we are interested in the role of the social network as a vector of information diffusion within farmers helping them adopting good agricultural practices.

To do this, we, first, formulate a structuring hypothesis that good agricultural practices can be considered as a combination of technological and organizational innovation. Indeed, the social network approach could be a pertinent framework to characterize the process that links information diffusion and the adoption of the agricultural innovation.

This is how we have developed an analytical model (Fig. 1) which will be presented in Section 2. The model highlights the link between information diffusion and adoption of good agricultural practices with emphasis on the role that could have the formal and informal network on this link.

Second, the model has been confronted with the field experiences. We mainly choose to study the case of a recent agricultural good practice named HEV (High Environmental Value). The availability of quantitative and qualitative data, and the intensity and rhythm of its adoption has led to the choice of mobilizing the High Environmental Value (HEV) certification case.

The results of this confrontation, which will be presented in Section 3, have been used to improve the model and to refine the understanding of the process linking the information diffusion and the adoption of good agricultural practices.

Then, the section 4 presents the main concluding results of the two case studies analyzed, limits of this work and ideas for future research.

## **2 Theoretical background**

First of all, we need to understand what it means the term adoption. According to Rogers (1995), the term adoption means the process that a person passes through because he/she first hears about an innovation before others. Adoption is then the result of a dynamic decision-making process (Oghogho, 2013) which need the collection of information or the experimentation. The author distinguishes 5 categories of innovation adopters: innovators, early adopters, early majority, late majority, and laggards (Rogers, 1995).

Before examining the case studies, we explain here the theoretical background of our conceptual model before testing it. The model presented below (Fig1.), shows the theoretical relationship that could exist between the information seeker (the farmer) and sources of information.

### **Farmer motives to adopt good agricultural practices**

Literature review reveals two main motivations for the adoption by farmers of good practices: psychological related and economic related factors.

Firstly, the information access and the adoption of innovative practices depend largely on the intrinsic characteristics of the farmer that means his /her age and education level (Gould et al., 1998) profile and psychological aspects. Research about adoption and use of technology showed that other personal characteristics have positive impact on the adoption and use of technology. These characteristics are, among others, literacy, urban contact, socio economic status, leadership, task orientation, intelligence and extroversion (McGregor et al., 1996), entrepreneurial orientation (Sipilainen, 1994). Moreover, Solano et al. (2006) argue that « the human component of the farming system plays an important role in management practices and that this fuller representation of farmer behavior and motivation is key to understanding differences in management practices and performance across farms » (p. 425).

The attitude of the farmer towards risk is also defined as important in the decision-making process of adopting or not an innovative agricultural practice (Pennings and Leuthold, 2000) because of the incertitude of the outcomes (Greiner et al., 2009),

While economic and agribusiness scholar consider that the farmer is risk averse (Willock et al., 1999), recent scholars reveal a new category of farmers who are more entrepreneur and more innovative than others. The literature generally opposes two main types of manager behaviors: the entrepreneur-proactive and the follower-reactive (Very, 1991). According to Lagarde (2006), the follower-reactive manager shows an aversion to change and any form of risk that would compromise his family business and focuses on weakly innovative activities. Conversely, the proactive entrepreneur is opportunist, apprehends change and is motivated by financial growth and opportunities.

The principal motivation of a farmer to adopt a good innovative agricultural practice is profit maximization. But besides this economic motivation, farmers are also driven by non-financial motives such as « life style » and « social motivation » (Greiner et al., 2009), personal and

family well-being (Greiner and Gregg, 2011), farmer's concern for personal health (Traoré et al., 1998)

Secondly, economic related motives concern specially the consumer's willingness to pay the environmental quality of produced goods and also on the presence of institutions encouraging environmental practices. The role of consumer is fundamental in the environmental practices. In a context of globalization and standardization of production, consumers are informed and aware about the ecological impact of agriculture products. In a context marked by an increasing of societal demand of agro-environmental practices, industrialized and developed countries try simultaneously to satisfy nutritional need and environmental norms. In this context of social and ethical preoccupation (Mathe, 2009), consumers are searching for identity and diversity (Brodhag, 2000). According to a French survey conducted by the research center for study and observation of conditions of life (CREDOC, 2009) this trend is reflected, in France, by the interest of French consumers to obtain environmentally product and animal welfare (67%).

### **The Social network as vector of information diffusion**

The contextual and social environment of the farmer play an important role on the information and knowledge information. At the institutional level, it is evident that formal institutions can make knowledge transfer easier by diffusion information and encouraging networking activities. 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.

At the social level, the role of the social network in diffusing information and knowledge is highlighted by an increasing number of scholars. By promoting social interactions, trust and reciprocity (Almeida and Kogut, 1999), the social network helps people to develop innovative capabilities (ability (Duysters and al., 2003), to get information (Burt, 1992; Borgatti & Cross, 2003)) and to stimulate knowledge diffusion (Rogers, 1995). Within a social network, "opinion leader" personalities can play a considerable role in the decision of a farmer to adopt good agricultural practice. The idea of opinion leaders, called also "influentials" (Merton 1968) occupies a central place in the literatures of the diffusion of innovations (Rogers 1995; Valente 1995), communications research (Weimann 1994), and marketing (Coulter, Feick, and Price 2002). In adopting innovation context, Rogers (1995, 281) stated the following: "The behavior of opinion leaders is important in determining the rate of adoption of an innovation in a system ». Watts and Dodds (2007) noticed that opinion leaders are not "leaders" in the usual sense. In other words, opinion leaders do not head formal organizations nor are they public figures such as media personalities. But opinion leaders have direct influence on others because they are more informed than others, respected or simply « connected ».

### **3 Methodology: two case studies analysis**

In this step we 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).

For this empirical part, two examples of farming environmental initiatives in the High Environmental Value (HEV) certification were investigated. 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) and support organizations and websites. Especially for HVE program, interviews of pioneers' farmers (first HVE certified farmers) were analyzed. 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.

### **Summary description of the case studies**

The HVE is seen as an approach which meets the society demand of sustainable food production with various benefits for farmers and the environment. This approach is marginally used in France but on progress. 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 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, 33 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. In 2016, France records 300 farms certified level 3 of HVE (Ministry of agriculture, 2016).

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.

### **Operationalization**

In order to verify our conceptual model, we select two (2) cases studies. We focus particularly on the « pioneers » of HVE certification which are firstly an ovine breeding farm belonging to Mr. Yves Chéron which is a crop-livestock farm in the Oise-Picardie (nowadays called Hauts-de-France Region), and secondly the case of the *Vignerons Indépendants* in the wine sector situated in the Aquitaine region. The case studies represent the two possibilities way of HVE certification adoption process, which are respectively in one hand the individual level (initiative of singly farm) and in another hand the collective level (initiated by a producer group, cooperative or association of producer). The objective in this empirical part is to illustrate these two processes of certification. In this sense, we'll check the influence or the impact of the network in (i) the information diffusion and consequently in (ii) the ability of farmers to adopt environmental good practice strategy.

### **Case analysis 1: The single farm**

Analysis of the first case study is depicted in the figure 2 below, which shows the factors influencing the adoption of the good practice and the type of provided information at the individual farm level.

The farm of Yves Chéron was certified HVE on year 2012 and among the pioneers in France. Its certification was initiated by the National Regional Park of Oise-Pays de France which proposed an environmental diagnosis of farmers in the region on year 2010. Further, the objective was to check farms' ability to be certified HVE. Indeed, the National Regional Park of Oise-Pays de France promotes an economic development respectful of the environment and long-term management and preservation of natural resource in the region. This institution elaborated a program of HVE information complemented by a preliminary free audit of interested farms. Then, after this evaluation step, Yves Chéron followed a good practice experiment program piloted by the Regional Chamber of Picardy in partnership with a regional network working in this field area. This network is composed by the Dephy-Farms which counts 2630 farms in France and the Agrotransfert organization. They support farms to improve their practice for example the phytosanitary reduction, but also to adopt such innovation (techniques and materials) for the farm environmental performance. By this way, the sheep farm of Yves Chéron improved his practice and reached the level 2 and 3 of the HVE certification.

### **Case analysis 2: The collective of farmers**

The second case study analysis is depicted in the figure 3 below. The figure explains the various interaction and the factors influencing the adoption of the good practice and the type of provided information at the collective farm level

VIF is an association of viticulture farmers. This association initiates directly their members to adopt good farming systems. For that, it organizes information conference, workshop for their member and establish special training for HVE certification called "HVE passport". It consists in a preliminary audit /diagnosis of the farm as regard to their environmental practice. All actions are managed and piloted by the VIF at collective level. VIF has a strong partnership with institutional level for regional environmental scheme like the program AREA well-known in the region. Members of VIF according to the specificity of the wine sector are already certified by environmental good farming scheme like Agriculture Raisonnée, Qualenvi, AREA, Organic agriculture. Indeed, the commitments to these initiatives is necessary to obtain regional farm funding. But in addition, such programs allow the access to the level 3 of the HVE certification.

## **4 Results and discussion**

The case study analysis highlights key factors which influence willingness of farmers to adopt environmental approach as depicted in the figure 2 and figures 3.

### **The role of the *ex ante* attitude toward good agricultural practices and sustainability**

First of all, we noticed that farmer's attitude and beliefs play a key role in the decision of good environmental practice adoption. Indeed, in the first case study, the farmer before its certification, is already interested into environmental aspect of farming that explains the voluntary engagement of the farmer to innovate and to follow the environmental diagnosis. Besides, in the case of the collective group "Viticulteurs Indépendants de France" VIF, this organization was interesting to such good practice since the creation of the HVE certification. Effectively VIF is in a constant research of environmental performance improvement for their

activity. VIF makes an environmental good practice watch/monitoring and participates continuously in each conference, exchange information about this certification.

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. Some viticulture farmers said that the market exports are more demanding (example of Canada), and the HVE certification is a best way and official way for them to communicate about their practice. In addition, they affirm that this certification “re assure” their customers. For Yves Chéron, his market increased continuously with the mutton labelled HVE.

The farmers already engaged on environmental approach, for example environmental management systems (EMS) ISO 14001, organic agriculture, *agriculture raisonnée* etc.) are the majority of HVE certified. This is the case of the VIF, where its members are already certified with various environmental good practice. Some viticulture farmers are certified both Organic and HVE.

### **The role of the social and contextual environment**

Our case studies reveal that certified farmers are members of farmers association or environmental network (example DEHPY). Interviews which are available on the net with pioneer farmers show that information was provided by the chamber of agriculture or regional institution firstly and also from the farmers’ network (Example in the wine sector, Qualenvi association or independent wine owners, association Viticulteurs Indépendants de France VIF).

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).

Furthermore, information and knowledge are diffused through platform and farmers networks (example dedicated project through DEPHY) which combine both networking and learning.

At the institutional level, it seems then essential to effectively support farmers committing to good farming practice 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 (Szhaller, 2013).

### **The importance of integrating formal networks**

Finally, two major facts appear: (i) the role of the network which can be categorized into two groups: network as “drivers” or leader of innovation, and the network as “partner” of the innovation. The leading network is the initiator of the adoption or the innovation (example of the National Regional Park Oise Pays de France and the VIF group). The partner network aims to follow up improvement (information, technical training, innovation and learning process etc...). (ii) The study put lights to the complementary information which is crucial to the process of adoption. For example, the complementarity between the information from the institutional level and the network level or the complementarity between formal and informal network level.



## 5 Concluding comments

The aim of this work is to contribute to the understanding the contribution of the social network on information diffusion within farmers and how this could help them adopting good agricultural practices such as High Environmental Value.

The approach of social network was not used enough in the agriculture context. Nevertheless, it is a pertinent approach which highlights the adoption of good agricultural practices by considering it as a result of a process of information access and interactions between farmers. This approach allowed as to construct a conceptual framework which summarizes 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

Then, we attempted to test this conceptual model by using a case study methodology. We choose two different case studies which allow as to examine the adaptation of good agricultural practices made individually and collectively by the farmers.

At the individual level, while Innovators purchase the product at the beginning of the life cycle, pioneer farmers adopt innovative practices at the beginning of its diffusion, before others and with few information access. According to the social network approach, Yves is a gate-keeper, an opinion leader who have experience and information which enable him to provide information and advices about HVE adoption to other farmers within its community. Such role may be formal, within the cooperative and the formal network DEFI in which Yves is member, or also informal within his peers.

At the collective level, the second case study shows the importance for some agriculture of the collective movement to adopt good agricultural practices. According the interviewee, farmers don't like to go it alone, they need to feel accompanied.

The collective case study reveals that collective movement is often synonymous with confidence, insurance and serenity for farmers. Our results are coherent with other scholars which highlight the fact that, in the context of adoption of good agricultural practices, confidence is linked to risk and incertitude due to the lack of information. Confidence has been described as the "degree of belief in a given hypothesis" (Griffin and Tversky, 2002). This definition argues that confidence is the level of belief that one can have about a decision. Then, the context of HVE, which is recent innovation, is full of incertitude because of the lack of information. In that vein, Petrusic et al. (2003) posit that in conditions of high contextual difficulty, the decision maker will try either to be certain about the information he/she has collected, and if not, he will try to be more cautious. This is why collective approaches are important for them.

Besides the theoretical contribution of our work, it also offers 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.

The two specific case we studied in this work provokes important discussion of many issues related to the adoption of good agricultural practices and access to information. In future

research, interviews will be conducted in both cases to better understanding the process of information diffusion and the perception of farmers to formal and informal networks.

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## Appendix

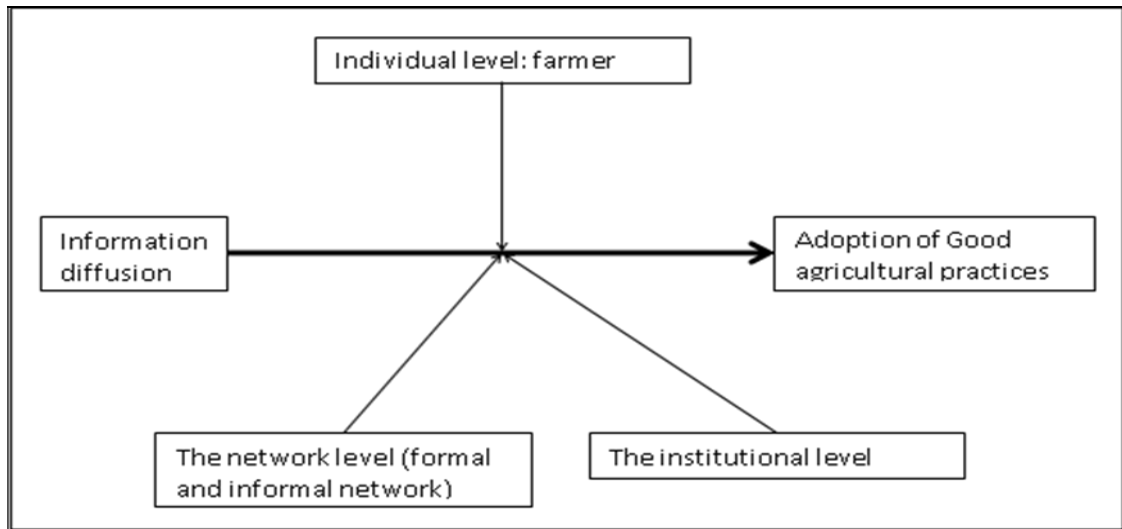


Figure 1 - Conceptual model (This is a simplified version of the model. It does not show all variables)

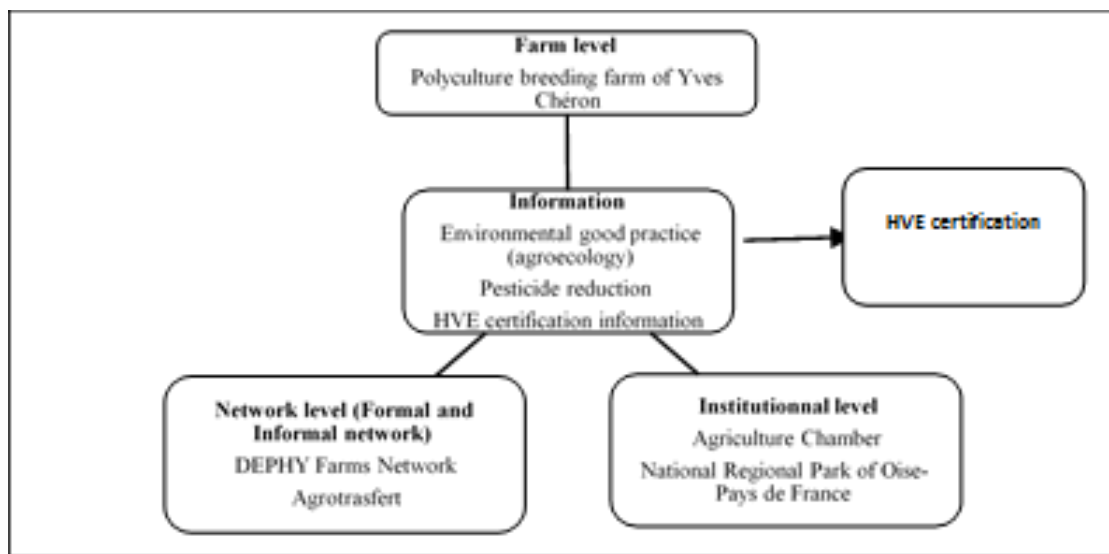


Figure 2. Case study 1: the environment of adoption process of good practice for instance the HVE certification for a single farm

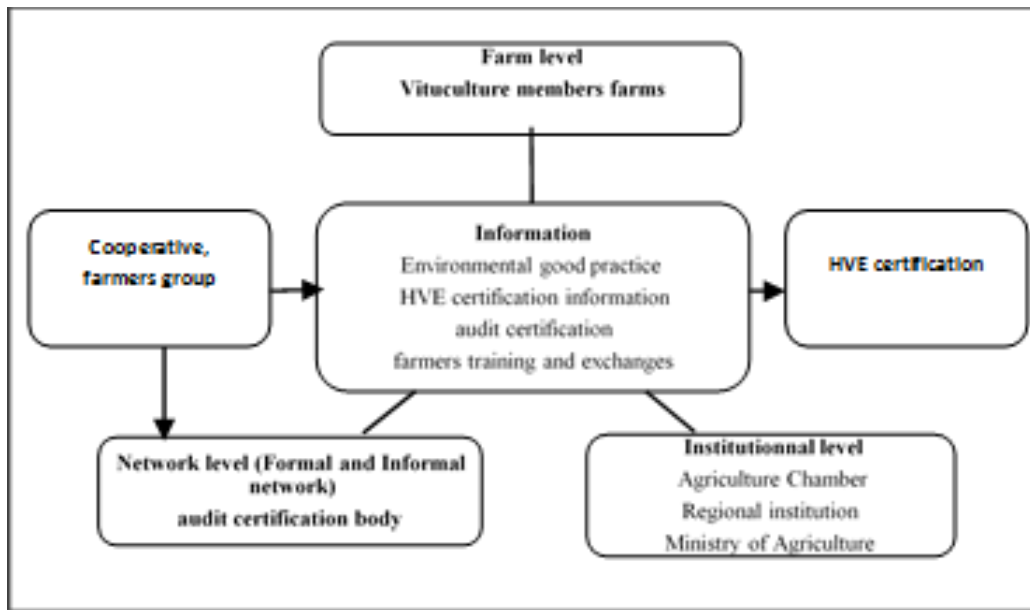


Figure 3. Case study 2: the environment of adoption process of good practice for instance the HVE certification in a collective way