COLLABORATIVE RESEARCH AND SUSTAINABLE AGRICULTURAL INNOVATION: THE ROLE OF NON ABSORPTIVE INTERMEDIARY ACTORS. THE CASE OF INDUSTRIAL HEMP AND FLAX SECTORS IN FRANCE

Pauline Caron, Marc Barbier

COLLABORATIVE RESEARCH AND SUSTAINABLE AGRICULTURAL INNOVATION: THE ROLE OF NON – ABSORPTIVE INTERMEDIARY ACTORS.

THE CASE OF INDUSTRIAL HEMP AND FLAX SECTORS IN FRANCE.

Pauline CARON *, Marc BARBIER **

* Union InVivo 83-85 avenue de la Grande Armée – 75782 Paris Cedex 16
pcaron@invivo-group.com

** INRA, UR SenS, Université Paris-Est, Bois de l'Etang, 5 Bd Descartes, Champs sur Marne, F-77454 Marne-la-Vallée, France
barbier@grignon.inra.fr

This work was carried out with the financial support of the ADEME/AGRICE Programme under the project CANNAFLAX. (INRA - MinesParisTech CGS - Institut Technique du Lin - Institut Technique du Chanvre - 2008)

Abstract — Industrial hemp and flax have many uses (paper for hemp, textile for flax, but also agromaterial's opportunities through fibre incorporation in biocomposites or lime blocks). They are facing great technological expectations with the "Green Future" objectives, both because of sustainable end-uses of hemp and flax and because of their respective sustainable cropping properties. With more than 8000 ha of hemp and 80 000 ha of flax cultivated, France is the biggest European producer. Innovation and research French policy is quitting with the "Colbertist state" referential, nevertheless innovation in industrial hemp valorization is not really taking off (Garnier, Barbier et al., 2007). In order to understand this paradox, this communication proposes to establish a diagnosis, crossing a geographical account and a sociological account of facilities and relationships of innovation based on industrial hemp and flax fibres. From an empirical study on innovation in natural fibres valorization, it aims to stimulate discussion on the specific research approaches for sustainable innovation in agriculture. Among many issues triggered by the technical promise of sustainable innovation, we acknowledge for a lack of specific intermediaries (Howells, 2006) to set up organizational forms and combinative capabilities (Kogut and Zander, 1992) for innovative design. Based on interpretative analysis of the observed dynamics in socio-economic order of Natural Fibres Transformation (Aggeri and Hatchuel, 2003), our communication proposes a scientific discussion of what could be "non-absorptive intermediary actors" in inter-organizational innovation processes, contrasting with Cohen and Levinthal (1990). This type of actors seems to represent the missing link to achieve a "Green Future" with industrial crop that are attaching agricultural and industrial entrepreneurships in new configurations of sustainable development.

Key words: Natural fibre, Agromaterial, Innovation, Non-Absorptive capacity, Intermediary actor.

Résumé — (Arial 9) Le chanvre industriel et le lin ont des débouchés variés : traditionnellement utilisés pour le papier et le textile, ils le sont aussi dans le domaine des agromatériaux comme les biocomposites et les mélanges chaux-fibres végétales pour le bâtiment. Ces débouchés innovants correspondent aux grandes attentes technologiques pour atteindre les objectifs d'un « avenir vert », tant en raison des débouchés durables du chanvre et du lin qu'en raison de la durabilité de leur conduite de culture. Avec plus de 8000 ha de chanvre et de 80 000 ha de lins cultivés, la France est le premier producteur européen. La politique française de recherche et d'innovation n'est plus sur un modèle Colbertiste, néanmoins l'innovation dans la valorisation du chanvre industriel ne décolle pas vraiment (Garnier, Barbier et al., 2007). Pour comprendre ce paradoxe, cette communication propose d'établir un diagnostic, en croisant des approches géographique, sociologique et une analyse des réseaux d''innovation dans le domaine des fibres de chanvre industriel et de fibres de lin. Cette étude empirique sur l'innovation dans la valorisation des fibres naturelles, vise à susciter la discussion sur les approches spécifiques de la recherche pour l'innovation pour une agriculture durable. Parmi les nombreuses questions déclenchées par la promesse de l'innovation technique durable, nous mettons en évidence un manque d'intermédiaires spécifiques (Howells, 2006) et la nécessité de mettre en place des formes organisationnelles et les *combinatives capabilities* (Kogut et Zander, 1992) pour la conception innovante. Basé sur une analyse interprétative de la dynamique observée dans l'ordre socio-économique de la transformation des fibres naturelles (Aggeri et Hatchuel, 2003), notre communication propose une discussion scientifique de ce qui pourrait être « des acteurs intermédiaires non absorptifs » dans les processus d'innovation inter-organisationnels, contrastant avec Cohen et Levinthal (1990). Ce type d'acteurs semble représenter le chaînon manquant pour atteindre les objectifs d'un « avenir vert » qui nous amènent à penser de nouvelles configurations organisationnelles dans le secteur entrepreneurial agricole, dans ce contexte de développement durable.

Mots clés : Fibre naturelle, Agromatériaux, Innovation, Capacité Non-Absorptive, Acteurs intermédiaires

INTRODUCTION

Natural fibres of flax and industrial hemp have different uses, from traditional (paper, textile,) to emergent ones (biocomposite, etc.) This sector is facing great technological expectations with the "Green Future" objectives, both because of sustainable end-uses of flax and industrial hemp and because of sustainable cropping properties. France is the biggest producer in Europe; innovation and research French policy is quitting with the "Colbertist state" referential (Mustar and Laredo, 2002), nevertheless innovation in natural fibre valorization is not really taking off (Garnier, Barbier et al., 2007).

In order to understand this paradox of sustainable expectation, this communication proposes to establish a diagnosis, crossing a geographical account and a sociological account of facilities and relationships of innovation in flax and industrial hemp sectors. We propose a mapping of regional actors of flax and industrial hemp innovation (Technical centers, R&D capabilities, research laboratory and innovative cooperatives) and a visualization of networks in R&D projects with Network Analysis software. This geographical approach of organizational relation and links is enriched by a lexical analysis of a sociological qualitative survey within a grounded theory approach of social world analysis based on in depth interviews and participant observation. This kind of approach enables a characterization of the main components of the strategic positions of entrepreneurs in relation to collaboration (Adler et al., 2003). Those materials and interpretation allows developing an analysis of the difficulties to innovate in the world of natural fibres.

The purpose of this communication is therefore to sketch out empirical and grounded evidences of the existing dynamics of knowledge and relation in networks of entrepreneurship and innovation in the hemp sector. Based on this work, the purpose is to ground an interpretative analysis of the observed dynamics and to propose a scientific discussion of what could be "non-absorptive intermediary actors" or even "desorptive capacities" in inter-organizational innovation processes.

1. MATERIAL AND METHODS

The empirical objective was to investigate and produce a set of grounded data on the actors involved in research, development, promotion, use and marketing of products made from flax and industrial hemp fibre and by-products. By data, we mean here a general word, which encompass documents, informal discussion, web pages, structured information in databases (articles, patents) but also the results of formal sociological interviews based on classical qualitative approach and of participant observation in meetings. These data were used to allow mapping innovation actors, not

only for their localization but also for their territorial and functional positioning relative to each other on one hand, and, on the other hand, to allow lexical computer assisted analysis of discourses.
In order to identify these networks of actors, skills and projects linked to hemp and flax fibres and co-products, we chose to leave a large place to field work, including the semi-directive interviews. The idea of this approach was to give a space for free expression, while guided by the points of interest in our study, its activity, its positioning in the industry, projects, partnerships, strategy and critical vision of the development of agro-materials plant fibre-based in the context of sustainable development. For the investigator, the semi-directive has the advantage of repositioning the actor in its environment, and to have her subjective perception of development in the field of agro-materials: this information can be crossed with those collected through the approach literature previously done, those collected through interviews and other observations made on site by the investigator.
In practice, forty persons (researchers, R&D engineers, project managers) were interviewed, one part in the agricultural sector (flax and hemp), and second part in the world of Agricultural R&D. These actors have been identified either because of their involvement in the development of these new opportunities, either by the high importance they attach to such opportunities with a desire for involvement in this sector. Interviews were conducted face to face, and depending on the type of actor interviewed, a specific interview guideline was prepared. The interviews were recorded and most all have been transcribed, either in the form of taking notes. The goal of this systematic process of transcription of oral material was then to have homogeneous and enough robust materials for a mapping of innovation actors and, on the other hand, bear with lexical analysis software treatment. The software Alceste is one of the tools used to exploit our interviews. Alceste (Lexical analysis of context by a set of text segment) is a morphosyntaxic and lexical analysis software, which aims to separate the major opposition in a speech corpus (Reinert, 1990). This method of textual analysis allowed us to make a useful representation of interviews.
A second order analysis of interviews was deployed. We realized a systematic hypertext annotation of interviews in order to capture and describe the affordance in context of social ties and relationships in innovation process, collaborative project or simply relations in purpose. This method is less intrusive than classical surveys setup to enhance structural analysis in the tradition of the sociology of network. In might contains some cognitive bias since it relays on the narrative of actors in relation to the questions that were asked, but this possible bias is for a use a property of narrative about innovation process in the sense of Actor-Network-Theory and reflect narrative infrastructure on which socio-technical expectation and innovation are grounded (Deuten and Rip, 2000). The result of this hypertext annotation was then to be transformed in a matrix of non symetrical relations. In order to visualize this kind of citation network in discourses about innovation and R&D relation, we mobilized the Visone software (Brandes, Raab and Wagner, 2001)[1].
Not only this tool enabled us to visualize declared ties and relation in innovation process, but we have also mined database of research and R&D projects that had been funded by public/private national or regional programs. Based on a structure of data, we created matrix of collaboration in innovation and R&D projects and also visualize links thanks to Visone.
Assembling these methods into a unique grounded methodology represent a kind of “bricolage”, which also translates the hybrid nature of sociotechnical networks and the social dimension of entrepreneurship for innovation (Nohria and Eccles, 1991).

[1] We would like to thanks Thomas TARI and Philippe BREUCKER for their precious help in using this software in relation to the type of data that were available.

2. MAPPING OF NATURAL FIBRES ACTORS: A GEOGRAPHICAL APPROACH OF INNOVATION IN FRANCE

2.1. Main characteristics of natural fibres agri-chain

France produces close to half of the European industrial hemp production (more than 8000 ha in France, 18 000 ha in Europe) and more than 60% of the European flax fibre production (80 000 ha in France, 120 000 ha in Europe) but the use of these plants for agro-materials is lags behind other country as Germany (Kurek, 2002)[2]. For many years, French Natural fibres actors have focused on textile valorization for flax sector, and paper mill valorization for hemp sector. However, the context has changed because of the increased costs of production and processing and because of uncertainties linked to production and processing supports of Common Agricultural Policy. In this context, flax and hemp sectors have recognized the need to provide greater added value to their production by diversifying markets and through the valorization of the whole plant (fibres and co-products). Confronted to specific problems, this awareness has not manifested at the same time for both sectors.
Nevertheless, flax and hemp products are closer in terms of composition and properties and innovation opportunities are closer too for these two sectors. The emergences of new uses, in direct applications (insulation) or in composite materials (in combination with lime, or in plastics ...) are presented as hopeful opportunities for automotive industry and construction (see Fortenbery and Bennett, 2004 for Hemp). Therefore, the dynamics of development is initiated regarding to the use of natural fibres in materials or composites.

Table 1. Flax and Hemp valorizations: the main differences between the two subsectors

	Raw material	**Valorization**
Flax fibre *Source: ITL*	Long fibres (1,4 €/ kg)	100% textile
	Etoupes (short fibre)	80% textile 20% composites materials (non woven…)
	Anas	50% wood panels 40% litter/bedding 10% mulching
	Seeds	100% Seeds and oil
Industrial Hemp *Source: EIHA Conference 2007*	Fibres (0,5 €/ kg)	70% paper mill 20% insulation and 10% composites material
	Chènevotte	70% horses and small animals bedding 17% Building 13% Mulching, garden…
	Seeds	95% bird food and 5% oils

Source : Barbier, Caron et al., 2008

The flax and hemp subsectors wish to develop and insure the permanence of these activities in relation to traditional activities (paper, textiles), taking into account the approaches of eco-design and sustainable development in the field of emerging innovation. Table 1 proposes a description and a mapping of flax and hemp sectors to better understand the main differences that characterized these two agricultural subsectors seeking for the same opportunities. This mapping indicates first elements to explain the strategic paths of valorization used by each fibre sectors.

[2] See the DataBase about fibres NOVA-FIBRE (DE). http://www.N-FibreBase.net

2.2. The landscape of Industrial Hemp and flax subsectors in France: Actors and territorial dispersion

2.2.1. Flax subsector

The flax industry in France is organized around a highly structured professional organization called *CIPALIN* composed by representatives of private and cooperative production and processing, and also by the *Institut Technique du Lin (ITL)*. This professional structure was historically built on the development of linen for textile markets. They began to pay attention on new outlets in 2005 after a year of crisis during which the flax french actors were under pressure of long fibre prices by Chinese. The risk of mono- outlets took its meaning.

Geographically, most of flax actors in France (producers, private processing industries and cooperatives industries) are territorialized: mainly of them are located in Haute Normandie and Picardie. In terms of new outlets, flax actors from Picardie and Haute Normandie one's don't have the same development strategies: the first aims a development on the whole plant valorization; the second is exclusively on the long fibre valorization, for high added-value products.

In terms of achievements, we can identify different processing actors for new outlets: *Technilin* valorize flax co-product in non woven for cars, *Linéo* is young processing actor which produce flax pre-impregnated composits for sport and recreation outlets (bike for example), and *Dehondt* is an agricultural machinery which also work on on the preparation of flax fibre to be integrate in composites. *Dehondt and Lineo* are positioned on long fibre valorization for high added-value products.

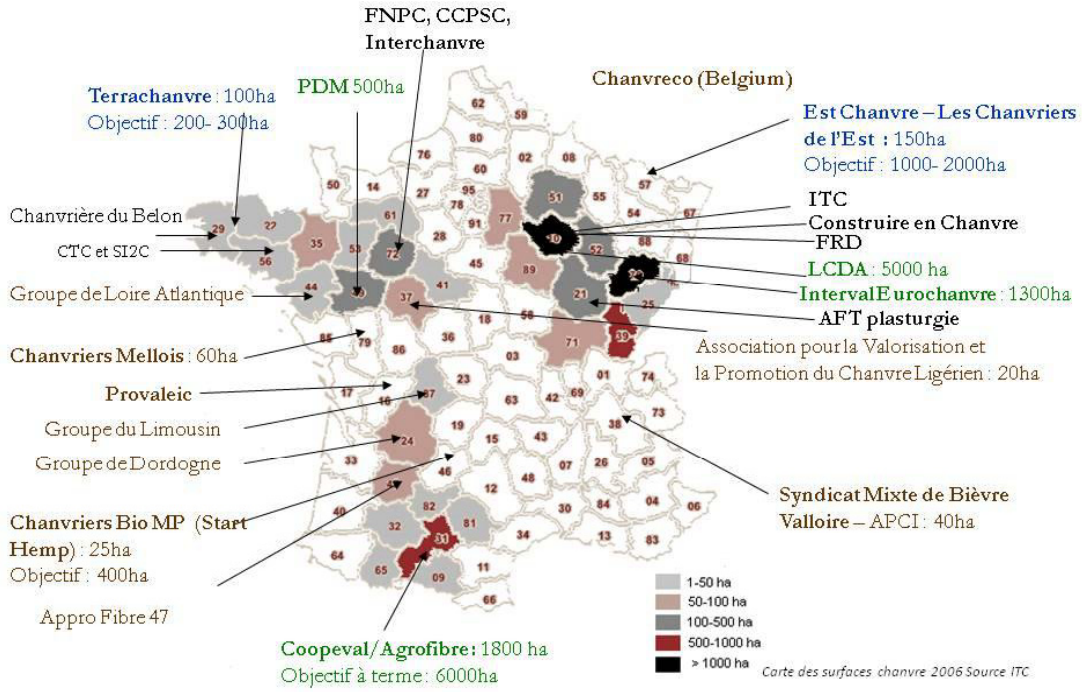
Our interviews suggest that this path for innovation is much more resulting from a willingness to explore from local innovators (*Technilin, Calira, Dehondt, Linéo*) than a deliberate orientation of the whole agrichain itself since valorization of flax fibre in textile remains the main source of value. Late investments of regional actors could change this landscape (*FIMALIN* project for example).

2.2.2. Industrial Hemp subsector

Industrial hemp sector in France is a small agricultural sector in terms of harvested areas (8000-9000 ha in 2007). This sector is also characterized by the heterogeneity and the « atomisation » of its actors dispersed in very different French territories (cf. *Figure 1.*). We propose to present relevant major oppositions to describe this heterogeneity: Industrial or semi industrial actor *versus* crafts actors, Actors affiliated to professional organizations *versus* independent actors, Historical actors *versus* new actors following a first typology issued by Garnier, Barbier et al. (2007). Values and aims of those actors can also be highly variable, in terms of opportunities and activities.
At geographical level, the production of hemp extends throughout all over the French territory, with higher levels of production in Aube (Champagne-Ardenne) and Haute-Saône (Franche Comté), close to historical transformation firms (La *Chanvrière de l'Aube* and later *Interval, Eurochanvre* with respectively 5000 and 1300 ha of production). They target different valorizations, from the traditional such as paper or animal bedding to emerging markets such as hemp limes blocks and plastics (they have participations in *AFT Plasturgie firm*, the unique industrial producer known which commercialize plastics reinforced with hemp fibres). Elsewhere, hemp surfaces cultivated rarely exceed 100 ha, often with a territory development model and focused on building valorization (*Terrachanvre* develops organic hemp in Bretagne, *Start Hemp/Chanvriers Bio* try to develop organic hemp in Midi-Pyrenées, *Chanvriers Mellois* develops hemp in Poitou Charente, for example)
In 2007-2008, while the historical actors join forces and investments in research and development into new markets through the creation of *FRD* (*Fibre Recherche Development* - structure supported by the cooperatives *LCDA*, *Nouricia*, *Interval*/*Eurochanvre* and Chambre d'Agriculture de l'Aube), the hemp sector has seen the emergence of new actors: We have witnessed in 2008 with the emergence of a new industrial actor *Coopeval* / *Agrofibre* in southern France, which aims is reaching a capacity production close to *LCDA* one. Local initiatives are also increasing to an economic activity at local scale: a hemp industry in eastern France (*Est Chanvre*) is emerging with

the support of a German industrial, the *Filière Chanvre d'Isère* is emerging for very close model of *Est Chanvre* one, and the experience of *Chanvre Mellois* is diffused in other local territory such as in Touraine. Many other examples can be identified.

Figure 1. Localisation of actors of industrial hemp subsector



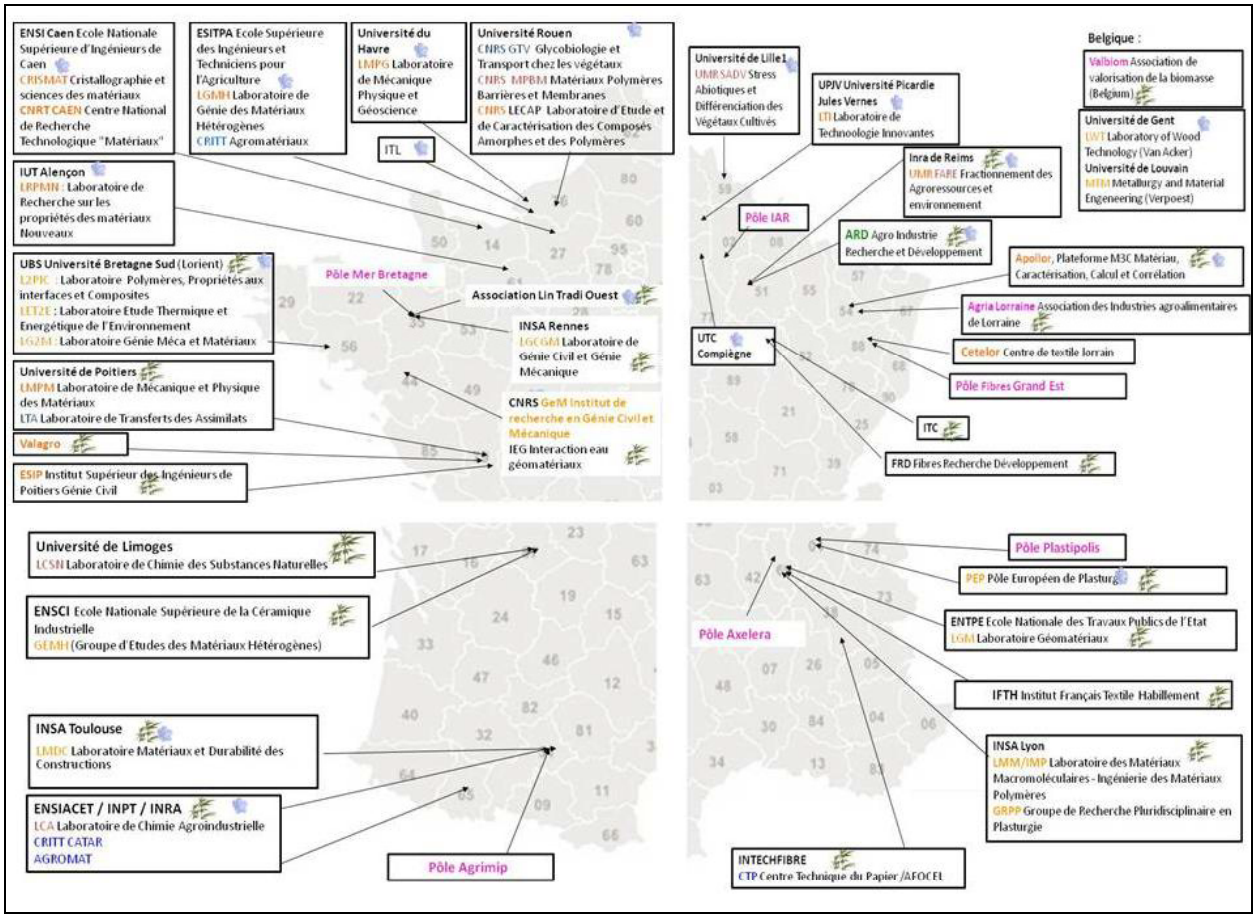
Source : Barbier, Caron et al., 2008

Despite the small size of hemp sector, there is a multitude of professional structures, with upstream producer representative *FNPC* (National Federation of Hemp Producer) in charge variety obtention and *CCPSC* (Central Cooperative of Hemp seeds producer), which insure seeds production. Located in Le Mans (Mayenne) there is no other producer of industrial hemp seeds in France. Hemp sector has its own technical institute in Troyes (Aube) created in 2003; and which aims to support agronomical and mechanical questions related to hemp production. The hemp sector has also its own representative (*Interchanvre*) to defend their interests towards public authorities. Among this multitude of actors in production and professional structures, we identified a structuring associative actor (*Construire en Chanvre* association), which has succeeded in creating an area of exchanges and sharing knowledge about the use of hemp for building: This space has grouped some of the hemp actors but also actors out of agricultural sector (building, craftsmen, producers of binders, institutional). This structure was formed on the common belief of the potential of this new material, and they manage to build professional rules guide for hemp concrete building (Caron P., Barbier M.et al 2008). Sustainable Development in this context was additional argument to support the development of the material.

2.3. The geography of Knowledge Organization: University Lab., Research Centers, Research Institutes, R&D Platforms

A final geographical approach is to map the mains Knowledge organization and centers that are involved in the dynamic of innovation processes and R&D (see *Figure 2.)*. This work is a prolongation of a previous survey of actors (Garnier et al., 2007).

Figure 2. Localisation of Research actors on flax and hemp themes or valorization



Source : Barbier, Caron et al., 2008

Geographical analysis of actors showed a world of innovation in the utilization of hemp and flax that is very heterogeneous both in terms of size (craft structures, semi-industrial or industrial structures), and in terms of the types of operators (public, private, professional, consular or cooperative, associations) and objectives (Production, Processing, Research, Research and Development, Transfer, and Training Council).

The *Figure 1* allows us to locate knowledge actors and different skills in relation with flax or hemp agromaterials works. We identified mechanical and material laboratories but also biochemical, chemical and vegetal biology skills, who work on hemp and flax project for agromaterials. There is an imbalance between the quantity of laboratories which studies focus on materials / polymer / composite (with any kind of characterization: chemistry, physics, mechanics) and laboratories which studies focus on fibre plant knowledge. Hemp plant knowledge is less advanced in comparison with fax plant knowledge, in which genetic work, cell wall setting up.

3. THE LEXICONS OF INNOVATION PROCESS AND R&D IN FLAX AND INDUSTRIAL HEMP VALORIZATION

3.1. Discourse analysis

The analysis of parts of interviews related to discourse produced by actors about their activities toward innovation and R&D, aims at extracting mains lexicons in use about innovation and R&D. Using the relevant oppositions of discourse we interpret the classes of specific lexicons as the main preeminent views available in discourses. The interpretation is based on a precise work on the composition of lexicon of actors' discourses; this work was realized with Alceste Software. In this way, we make the hypothesis that a characterization of oppositions within the discourse of actors delivers a relevant strategic landscape of the social world of innovation in the use of plant fibres (hemp and flax).
One think to bear in mind is that discourse are personal talk in the context of qualitative interviews, though we have labelled persons with the name of the organization they belong to, discourse remains sociologically situated in the scene of the interview and as far as the person is speaking in the name of his/her function in this organization.
A second think to be noticed is that we are not using a representative sample of the social groups that are contributing to the field under study in this research. When we capture all interviews together we implicitly assume that our empirical and grounded strategy is potentially covering the whole social world that we are studying. This assumption is quite heavy but it correspond to the type of work based on embeddedment and using social network to identify all the actors with a view of building the "sample" thanks to self saturation of references.

3.2. Results

The synthesis of the results is completely available in the final report of this research (Barbier, Caron et al., 2008).

By questioning all of actors of innovation process about how they define and view their activities we highlight an obvious distinction between agrichain subsectors and R&D discourse. We noticed that the flax sector is much more characterized by lexicon referring to professional question and to a mainstream orientation of valorizing raw materials in textile. Going deeper in the composition of lexicon and contribution of actors to classes, we noticed that sustainable new agro-product are considered as options of agrichain development for flax subsector when they are considered as strategic outcomes for hemp subsectors.
Concerning their discourse about project, the strongest characteristic is about discourses that are questioning organizational forms of R&D, and discourses are thus not necessarily precise in terms of contents. Actor of Flax subsectors are contributors. Then, we obtained a class in which actors refers to their relation and point of views to the product and to the physical and biochemical properties of fibres. Actors of research are contributing to this class. A private actor like *Aft Plasturgie* is phrasing description of project as entrey-point to mention a network of relations, either informal or formal in existing project networks. Many of the firms of the "sample" tackled the lexicon of project with references to project fit to market and appropriate valorization (particularly Hemp actors) and talk about emerging market, expectation and investment.

We compared the discourses of agricultural actors when they consider their own activities. The discourse analysis confirms the difference of the two subsectors in the way they describe their activities in relation to innovation process and R&D. The flax subsector appears to be described by actors themselves has more traditional and embedded in an economy of proximity, though almost all flax is hackled nowadays in China…
Concerning research's actors discourse about how they phrasing the issues of new products, we observed different visions: On one side we have a discourse built on lexicons dealing with markers of networking for project design in order to favour purposeful collaborations. This type of discourse characterizes a kind of intermediating activity. On the other side we have scientifical vision of

projects: the use of industrial hemp for plasturgy understanding the interface between fibre and matrix, the use of fibres for building materials.

Are the discourses of flax and hemp actors about projects different? The analysis confirms the difference in positioning of actors of both subsectors. Actors of hemp subsectors are referring to reflection and work about process of transformation in relation to market niches. Flax actors did not develop much the content of their project, but much more referred to the context of the project) and to the willingness to design new frameworks and collaborative relations. We can notice that actors of hemp subsectors like *LCDA, Interval Eurochanvre, Construire en Chanvre* do not reflect a specific lexicon and contribute to all discourse. This has certainly to do also with their social position in the hemp subsector.

As a whole the analysis of lexicon deliver a set of point of views that acknowledge of a world of actors that are heterogeneously involves in innovation process as far as their position in subsector is given, but also as far as some of them adopted position that do not necessarily reflect their institutional position (cooperative, private firms, knowledge organization, R&D organization). The two subsectors show differences and the lexical analysis, confirm the key position of knowledge actors as they seem to easily move from a subsector to another.

3.2. Crossing discourse and Structural ties

The *figure 3* is a visualization of types of links that have been declared in interviews of actors from Hemp subsectors and research actors (links in projects, links of information exchange, and links evoked during the interview). The size and colour intensity of nodes indicate the centrality of actors.
In *figure 3* about hemp subsector, important central actors are: *INRA REIMS, UBS, AFT,* then the cooperative *LCDA*, the association *Construire en Chanvre* and *VALAGRO*. Networks are showing less density of ties in Figure 4. Still actors of research *UBS and INRA Reims* appear as central in the system of relation as they are in the Hemp Subsector. Two other actors also appear: *University of Havre and Rouen* and a private company (*Dehondt*).

Figure 3 Mapping of the Relations declared in interviews after hypertext annotation: hemp subsector

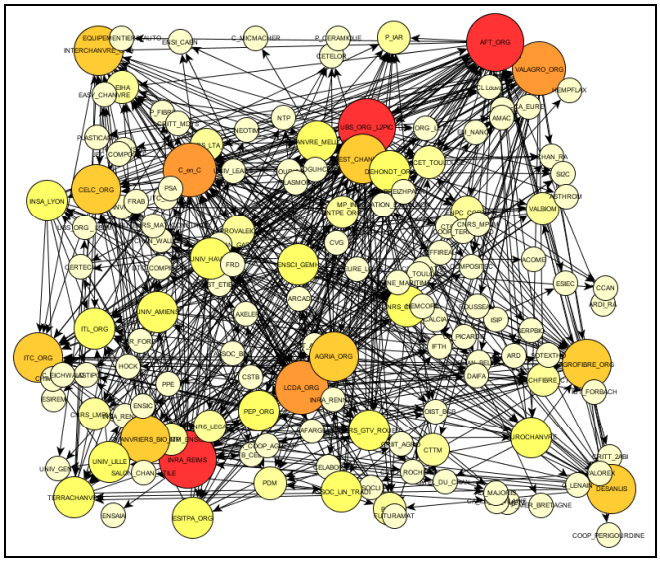
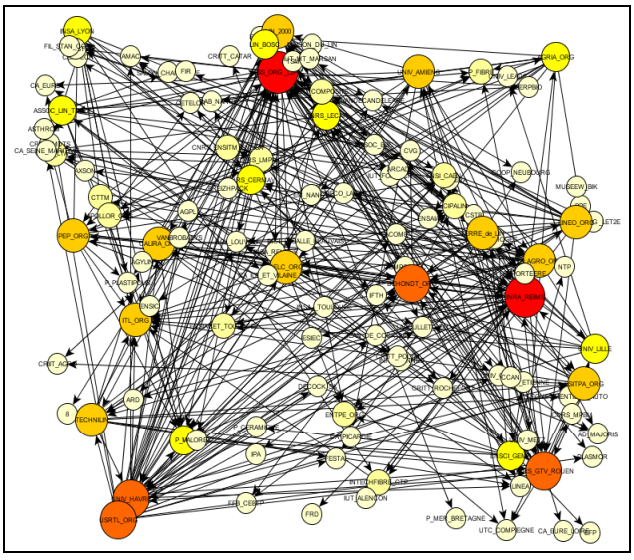


Figure 4 Mapping of the Relations declared in interviews after hypertext annotation: flax subsector



Source : Barbier, Caron et al., 2008

Reading the two figures in the following pages can be done by through a synthetic table (*table 2*) that identifies the significant actors in terms of their visual centrality in social networks on one hand (*Figure 5*) and in terms of their visual centrality in involvement in Research and R&D projects on another hand (*Figure 6*).

Table 2. Significant actors in term of visual centrality in social networks

	Institutional links		Links of sociability	
	Regional Project	National Project	Formal	Informal
AFT		+++		++
Dehondt	++	++	+	+
Valagro	+++			
ESITPA	++			
UBS	+++	+++	++	++
INRA Reims	+++	+++	++	++
Construire en Chanvre			+++	+++
Interchanvre				+++
CELC			+++	

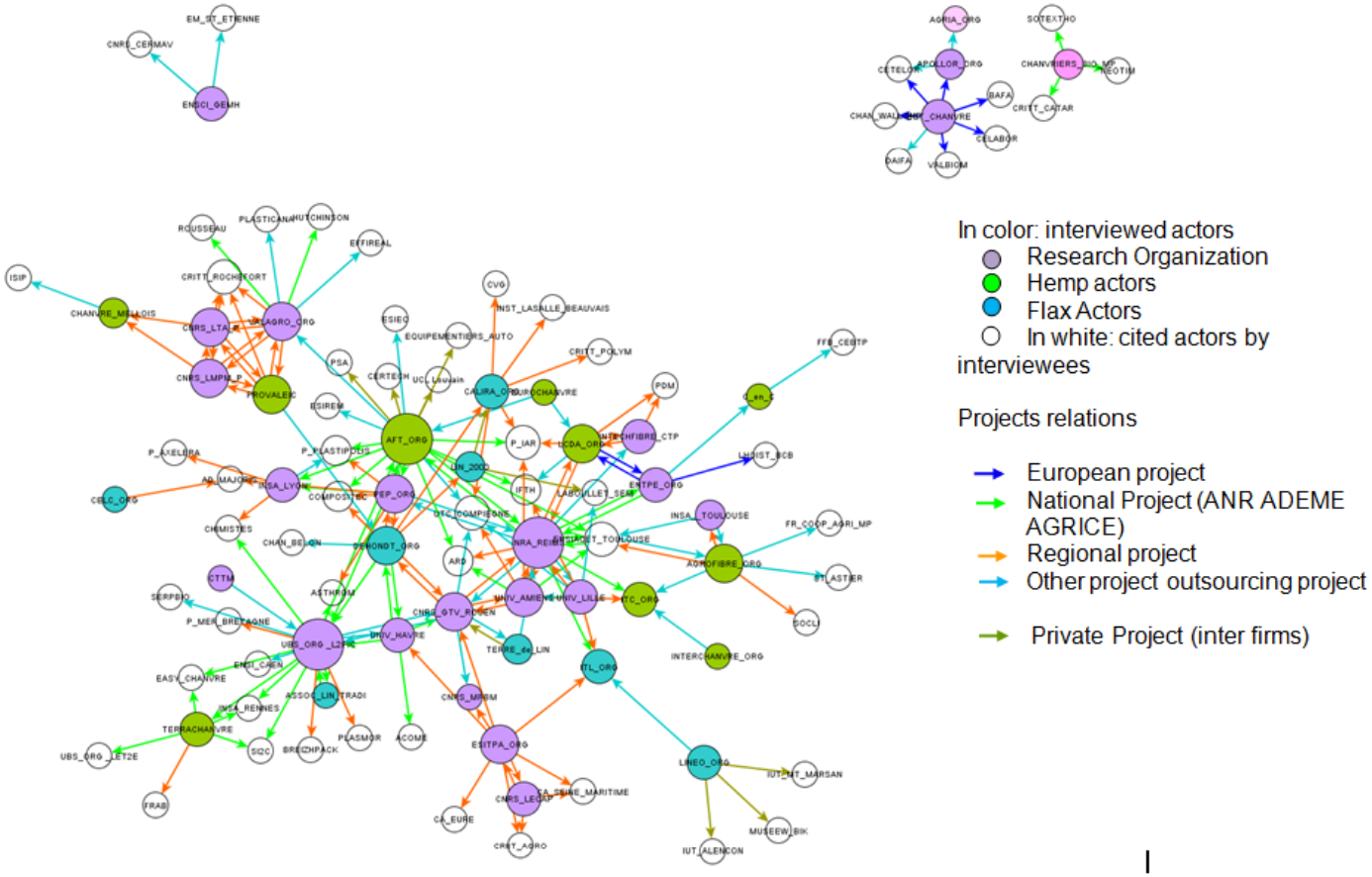
Source : Barbier, Caron et al., 2008

This table shows the presence of actors in both types of networks: networks of collaboration formal or informal, existing or even in purpose that play the role of key organizers because of their centrality and a socializor"; and networks of collaboration in formal projects of R&D or research programs: a research laboratory of INRA and Reims University (*INRA Reims*), a research laboratory of Université de Bretagne Sud (*UBS*).

Some actors are central in both networks of collaborative relations but do not really impulse project impulse and much more assemble strategies (*Construire en Chanvre*, CELC, *Interchanvre)*. On the other hand, some actors play an important role regarding their involvement in projects with regional ties like *Valagro* (private regional research structure) and *Esitpa* (engineering school), they are mainly involved in regional projects, and create clusters throughout at the level of their territory. *AFT, Dehondt*, (industrial actors) are key actors in projects network by their involvement in various types of projects, regional or national, reflecting their industrial logic.

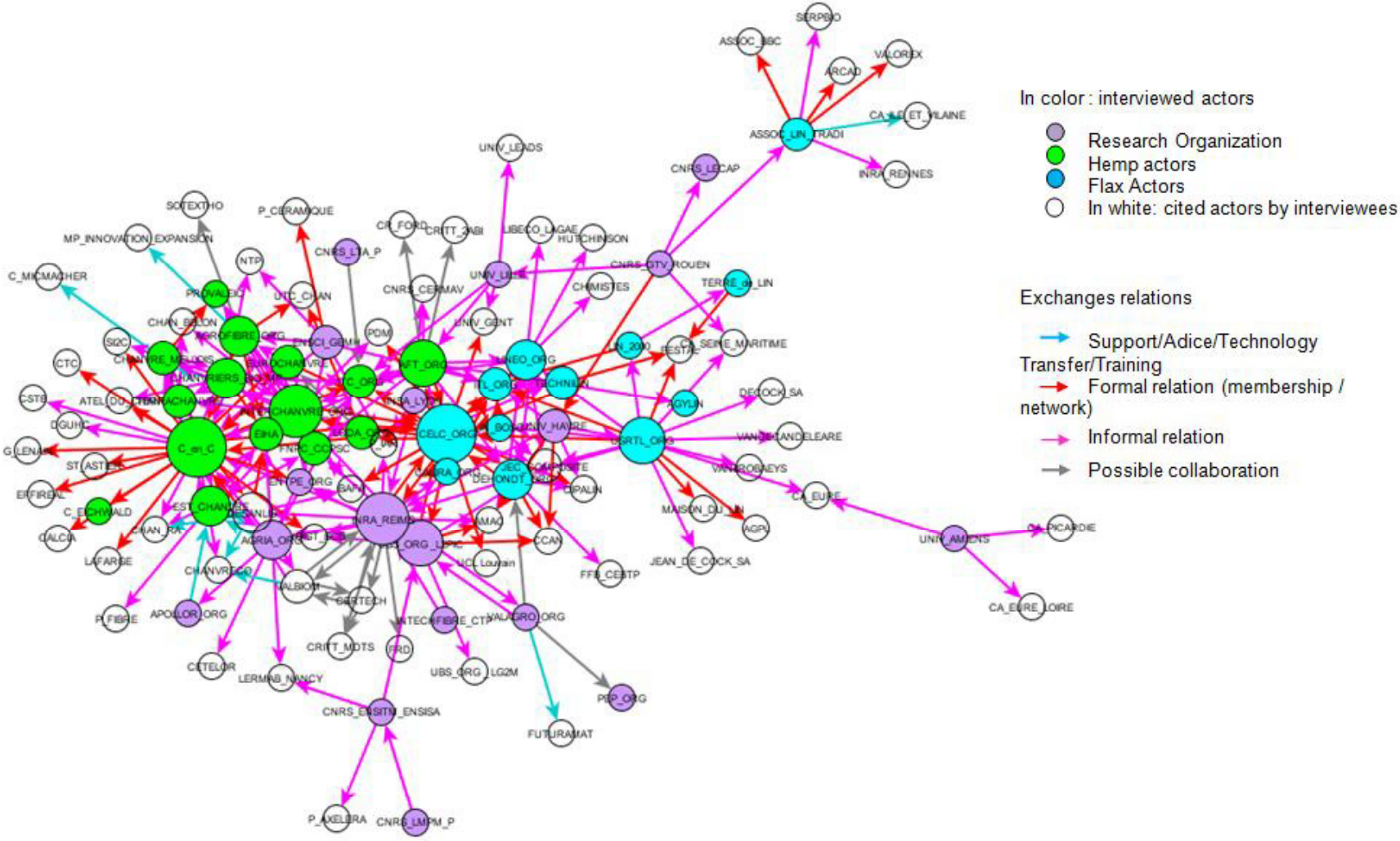
Finally, we can identify two research organizations (*UBS and INRA Reims)* who have drivers capacities in the two types of relations: intermediary's activities in institutional projects, they also play an intermediary role in social relations.

Figure 5: Social networks of actors in flax and hemp sectors



Source : Barbier, Caron et al., 2008

Figure 6: Projects networks of actors in flax and hemp sectors



Source : Barbier, Caron et al., 2008

4. INTERPRETATIVE ANALYSIS: NON ABSORPTIVE INTERMEDIARIES ACTORS FOR SUSTAINABLE DEVELOPMENT IN AGRICULTURE

Innovation processes that we have observed in fibres sectors revealed some conditions for the implementation of innovative projects in these sectors. While firms usually tend to capture and internalize knowledge and exploit them to innovate, we have seen the opposite in the case of new plant fibre uses: these innovations address questions which have to be answered collectively through social links, either in collaboration or in formal projects. This requires to share existing knowledge and to produce new ones by explorations and collectives experimentations. This logic of innovation is quite unlike the conventional logic of innovation based on knowledge capture and absorption of competences to innovate and to fuel the firm for increase return on emerging niche market. This logic of innovation is widely recognized as a manifestation of R&D activities that are internalized and contribute to the innovation process by enhancing Absorptive Capacity (Le Masson et al., 2009). This might be true for high-tech firms with property rights on specific assets and idiosyncratic assets (Escribano et al. 200), but Grimpe (2009) shows evidences that innovation regime in low technology is not frankly based on a paradigmatic overall view of absorptive capacities which represent a high-tech industries fascination (Palmberg, 20007) and specific regime of design (Le Masson et al., 2006)

In our interpretation we propose the concept of non-absorptive capabilities (contrasting with Cohen and Levinthal, 1990), featuring the essential role of intermediary actors taking the definition of intermediation from Howells (2006)

Researches on inter-organizational collaborations have rather developed results about their conditions and their impact in terms of efficiency. Apart from the pioneering studies of innovation process (Ring and van de Ven, 1994) or neo-institutionalist studies (Powell and Smith-Doerr, 1996), researches on inter-organizational collaborations are not based on the study of the nature and the configuration of the constitutive process of those collaborations, which lead to value creation. Opening the black boxes of the analysis that have promoted concepts like absorptive capabilities (Cohen and Levinthal, 1990), or combinative capabilities (Kogut and Zander, 1992) or dynamic capabilities (Teece, Pisano G., Shuen, 1997) is much needed. It corresponds to an active field of research in Organization Studies and it is developing in the study of the tensions of competition-cooperation between companies working together to innovate (Bart and Bossink, 2002). These results are consistent with the empirical study of learning projects at the interface of organizations (Defilippis 2002, Scarbrough et al. 2005). A background of work on agricultural development and transformation of the sector, has already undertaken (Barbier, Cerf, et al. 2004). Results have been published about learning at the frontiers in innovative projects led by agricultural technical institutes (Barbier et al., 2006); they show and analyze the difficulties in transferring knowledge gained in these projects toward the establishment of permanent competencies in knowledge intensive organizations.

Research on inter-organizational innovation often concerns international firms and /or market areas in creation or development. In SMEs (Small and Medium size enterprise) cooperation for innovation includes some risks, which induce a networking selection (Puthod, Thévenard - Puthod, 2006). Therefore it's relevant to consider the issue of inter-organizational innovation, when the creation of value (as it is the case for sustainable development) is depending on social ties and exploration in projects and on externs conventions, that have to be internalized in value chain or mobilized to create new ones.

Studies show that collaborations to innovate in agricultural research are particularly sensitive to managerial dynamics and organizational arrangements, implementing the management of environmental issues (Barbier, 2008). Produce operational knowledge about these dynamics and analyze the conditions for their development in areas for green growth becomes a challenge for actors in a reflective governance of agriculture sustainability (Voss, Bauknecht,

Kemp, 2006). The specificity of organization forms in agricultural R & D and particularly in the case of new market products, new jobs and new professional standards.
In connection with the approaches on New Products Management, French research on the innovative design and innovation capabilities management in firms (Hachtuel, Weil, Le Masson 2006) provide very interesting theoretical perspectives about design in innovative companies. However, moving the study of management design activities at inter-organizational level represent a scientific challenge associated with the theoretical question of activities coordination in organizational arrangements with several centers of power. Our case study reflects and takes into account the role and function of intermediate structures on innovation in agriculture. In this way, we can refer in particular to the work on technology transfer modalities in biotechnology (Peerbaye, Mangematin, 2004), on the typology of intermediation process in innovation, carried out by Howells (2006) or on the concept of projects activities led at the frontiers of organizations (Barbier et al., 2005) and the design activities and tools for decision use (Cerf and Meynard, 2006). We also refer to the exploration activity of intermediary actors, and their rôle in the constitution of innovative design platform (Hatchuel, A. *et al.,* 2005 ; Le Masson, P.*et al*., 2009).

It seems that innovation in agriculture involves a variety of R&D actors, intermediary organizations, agricultural actors and industrial actors. The agricultural cooperative companies have been the object of many studies in rural economy and rural sociology: its organization, which is prevalent in the world or agriculture, is characterized by local and territory production system questioned by globalized trades (Touzard, Draperies, 2003; Chiffoleau et al., 2008). This mode of organization is exposed to restructuring issues in relation to current economic constraints and the need to strengthen regional approaches in terms of societal anchorage for value creation (Filippi, 2004). From this point of view Aggeri and Hachtuel (2003) showed that the agricultural economy in France saturated with various stakeholders (agricultural consultants and technicals...), has developed specific mechanisms of coordination, very different from the industrial world. It remains to be better understood so as the innovation potential of this variety of skills is related to the challenges of sustainable development (Agerri et al., 2005).

CONCLUSION

We have proposed a mapping of regional actors of industrial hemp innovation (Technical Centers, R&D capabilities, research laboratory and innovative cooperatives) and a visualization of networks in R&D projects with Network Analysis software. This geographical approach of actors and links is enriched by a sociological qualitative survey, which enable a characterization of the main components of the strategic positions of entrepreneurs. Those materials and interpretation allows developing an analysis of the difficulties to innovate in the world of natural fibres. Based on an interpretation in terms of knowledge regime we finally propose an explanation with evidences-based from empirical work. We identified some actors who have an intermediary activity which can take different forms: formal or informal networks of collaboration, “socializor"; strategic impulsor, involvement in projects… These structures have different status, as research center, association, or cooperative society which play this role of intermediary, but are also polarized by their original activity. In the case of new plant fibre uses, we have seen how innovations leads to answer questions collectively through social links, either in collaboration or in formal projects, which require to share existing knowledge and to produce new ones by explorations.
We acknowledge for a lack of specific intermediaries (Howells, 2006) to set up organizational forms and combinative capabilities (Kogut and Zander, 1992) for innovative design. At the crossroad of regional development and supply chain or niches (Kemp R.et al. 1998), we have tried to propose the concept of non-absorptive intermediary actors (contrasting with Cohen and Levinthal, 1990). This type of actors seems to represent the missing link to achieve a “Green Future” with industrial crop that are attaching agricultural and industrial entrepreneurships in new configurations of sustainable development.

REFERENCES

ADLER N., SHANI A.B., STYHRE A., 2003. Collaborative Research in Organizations: Enabling Change Learning and Theory Development. London: SAGE.

AGGERI F., HATCHUEL A., 2003. «Ordres socio-économiques et polarisation de la recherche dans l'agriculture : pour une critique du rapport sciences/société », Sociologie du Travail.

AGGERI F., PEZET E., ABRASSART C., ACQUIER A., 2005. Organiser le développement durable- Expériences des entreprises pionnières et formation de règles d'action collective, Paris : Vuibert-ADEME

BARBIER M., 2004. « Management Setting as a dynamic and performative agency of actors, objects and rules », Communication to the 20th EGOS Colloquium, Ljubljana, Slovenia, July 1-3, 2004.

BARBIER M., CARON P., KUREK B. *et al.* 2008. Rapport Cannaflax – projet Ademe 2006-2008.

BARBIER M., 2008. Water in bottles, farmers in green. The sociotechnical and managerial construction of a 'dispositif" for underground water quality protection. International Journal of Agricultural Resources, Governance and Ecology (IJARGE), vol.7, N°1/2, 174-197.

BARBIER M., CERF M., BARRIER J., 2005. Projects as Learning agency at organization borders : a resource for organizational learning ?, In S.Gherardi et al. Eds. Proceedings of the International Conference on Organizational Learning and Knowledge, University of Trento, 9-11 June 2005.

BART A.G. BOSSINK B.A.G., 2002. The Development of Co-innovation Strategies: Stages and Interaction Patterns in Interfirm Innovation, R&D Management, vol.32: 311-320.

BENZECRI .P. et coll. (1981). *Pratique de l'analyse des données, Linguistique et lexicologie*, Paris, Dunod.

BRANDES U., RAAB J., AND WAGNER D., 2001. Exploratory Network Visualization: Simultaneous Display of Actor Status and Connections. Journal of Social Structure, 2(4), 2001.

CARON, P., BARBIER M., LE MASSON, P., and AGGERI, F., 2008. "Elaboration de règles professionnelles et innovation dans les agro-matériaux de construction : le cas de l'association construire en chanvre." Report for the PRODD Project, INRA-SADAPT & Mines Paristech, Paris, pp. 24.

CHIFFOLEAU Y., COELHO A., DREYFUS F. TOUZARD J.M, 2008. Les coopératives de la vigne et du vin : un essai d'analyse comparée à l'échelle internationale, Communication au colloque de la SFER "Les entreprises coopératives agricoles, mutations et perspectives », Paris Février 2008.

COHEN W., AND LEVINTHAL D., 1990. Absorptive capacity: a new perspective on learning and innovation, Administrative Science Quaterly, Vol 35, (1).

DEFILLIPPI R.J., 2002. Introduction: project-based learning, reflective practices and learning outcomes, Management Learning, 32: 5-10.

DEUTEN J.J., AND RIP A. 2000. Narrative infrastructure in product creation processes, Organization, 7 (1): 69-83.

EISENHARDT, K.M., 1989. Building Theories From Case Study Research, The Academy of Management Review, 14(4) : 534-550.

ELMQUIST, M., AND P. LE MASSON. 2009. The value of a 'failed' R&D project: an emerging evaluation framework for building innovative capabilities. R&D Management, 39 (2):136-152.

ESCRIBANO A., FOSFURI A., A. TRIBO J., 2009. Managing external knowledge flows: The moderating role of absorptive capacity, Research Policy 38: 96–105

FELK Y., LE MASSON P., GOGEZ P. 2009. Absorptive or desorptive capacity ? Managing R&D conductors for radical innovation ?; Communication ot the IPMD Conference.

FILIPPI M., 2004. Réorganisation dans la coopérative agricole. Proximité et solidarité territoriale, Economie Rurale, 280:42-58.

FORTENBERY, T. R.; BENNETT, M. 2004. Opportunities for Commercial Hemp Production. Rev Agricultural Economics , 26, 97-117.

GARNIER E., NIEDDU M., BARBIER M., KUREK B., 2007. "The dynamics of the French hemp system and its stakeholders, Journal of Industrial Hemp, 12 (2) : 67-85.

GILSING, V. A., AND G. DUYSTERS. 2008A. Understanding novelty creation in exploration networks-structural and relational embeddedness jointly considered. Technovation, 28:693-708.

GRIMPE C., SOFKA W., 2009. Search patterns and absorptive capacity: Low- and high-technology sectors, Research Policy, 38: 495–506

HATCHUEL, A., LE MASSON, P., and WEIL, B., 2005. "The Development of Science-Based Products: Managing by Design Spaces." *Creativity and Innovation Management*, 14, (4), pp. 345-354.

HOWELLS J., 2006. Intermediation and the role of intermediaries in innovation, Research Policy, 35 (5):715-728.

KEMP R., SCHOT J., and HOOGMA, R., 1998. "Regime Shifts to Sustainability Through Processes of Niche Formation: The Approach of Strategic Niche Management." *Technology Analysis and Strategic Management*, 10, (2), pp. 175-195.

KOGUT B., AND ZANDER U., 1992. Knowledge of the firm, combinative capabilities and the replication of technology, Organization Science, 3.

KUREK B. 2002. Valofibres : Alternatives pour la valorisation des fibres agricoles. Réunion plénière de l'Action ECRIN - NVIA 2002, 61pp - http://ecrin.asso.free.fr/pdf/nvia.pdf

LAURIOL J., 2004 .Le développement durable à la recherche d'un corps de doctrine, Revue française de gestion 2004/5, n°152, p. 137-150.

LE MASSON P., WEIL B., HATCHUEL A., 2006. Les processus d'innovation. Conception innovante et croissance des entreprises. Paris : Hermès – Lavoisier

LE MASSON, P., WEIL, B., and HATCHUEL A. 2009. "Platforms for the design of platforms: collaborating in the unknown." Platforms, Market and Innovation, A. Gawer, ed., Edward Elgar, Cheltenham, UK, pp. 273-305

MUSTAR P., LAREDO, P. 2002. Innovation and research policy in France (1980-2000) or the disappearance of the Colbertist state, Research Policy, 31 (1), p.55-72.

NOHRIA N. AND ECCLES R., 1991. Networks and Organizations, Boston, MA: Harvard Business School Press.

PALMBERG C., 2002. The many faces of absorptive capability in low-tech industries: the case of glue-lam timber and foodstuffs, DRUID Summer Conference on"Industrial Dynamics of the New and Old Economy - who is embracing whom?", Copenhagen/Elsinore 6-8 June 2002.

PEERBAYE A., & MANGEMATIN V., 2005. "Sharing research facilities: towards a new mode of technology transfer", Innovation: Management Practice and Policy, 7(1): 23-38.

POWELL W.W., KOPUT K.W., SMITH-DOERR L., 1996. Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology, Administrative Science Quarterly, 41(3), 116 - 45.

PUTHOD D., THEVENARD-PUTHOD C., Coopération, tensions et conflit dans un réseau d'innovation construit autour d'une PME, Revue Française de Gestion, 2006, 181-204.

REINERT M. 1990, Système Alceste : Une méthodologie d'analyse des données textuelles.

RING P.S., VAN DE VEN A.H., 1994. Developmental Processes of Cooperative Interorganizational Relationships, Academy of Management. 19(1) : 90-118

SCARBROUGH H., SWAN J., LAURENT S., BRESNEN M., EDELMAN L., NEWELL S., 2005. Project-based learning and the role of learning boundaries, Organization Studies, 25/9: 1579-1600.

TEECE DJ, PISANO G., SHUEN A., 1997. Dynamic capabilities and strategic management, Strategic Management Journal, 18(7):509-533.

TORRE A., 2008. On the role played by temporary geographical proximity in knowledge transfer, Regional Studies, 42(6):869-889.

TORRE A., RALLET A., 2005. Proximity and localization, Regional Studies, 39(1):47-60.

TOUZARD J.M., DRAPERI J.F., 2003. Les coopératives entre territoires et mondialisation, Maison des sciences de l'homme d'Aquitaine, L'Harmattan, 2003.

VOSS DE J-V., BAUKNECHT D., KEMP R., 2006. Reflexive governance for sustainable development, Edward Elgar Publishing.

ZAHRA S. A., GEORGE G. 2002. Absorptive capacity: a review, reconceptualization, and extension. Academy of Management Review, 27 (2):185-203.