The Dynamics of the French Hemp System and Its Stakeholders

Estelle Garnier
Martino Nieddu
Marc Barbier
Bernard Kurek

ABSTRACT. In France the activities and knowledge concerning the hemp economic sector are historically regulated by an organization dedicated to the paper industry. However, the current context (saturation of the principal outlet and uncertainty regarding the maintenance of the European Union subsidies), makes it necessary to enhance the added value of the hemp crop by diversifying its outlets and by using the whole plant. Also, since the middle of the 1990’s the stakeholders of the hemp milieu have important and varied expectations regarding possible new hemp markets, particularly in the fields of plastics processing and the building construction industry. On the basis of data collected during talks with the main stakeholders of the French hemp system, and based on various articles, publications, books, and the Internet, we will describe the organized French hemp system starting from the representation that the stakeholders of the hemp milieu themselves have given. We will begin our analysis with the organized character of this system. Then we will present the data which give information about its dynamics: first the surfaces used for the production and the levels of produc-

Estelle Garnier is a student in Economic Sciences, ESSAI-OMI (Etudes sur les Systèmes et Structures Agro-Industrielles–Organisations; Marchés, Institutions), Université de Reims Champagne-Ardenne.
Martino Nieddu is Economist at ESSAI-OMI (E-mail: martino.nieddu@univ-reims.fr).
Marc Barbier is Senior Researcher at INRA (E-mail: barbier@grignon.inra.fr).
Bernard Kurek is Biochemist at INRA (E-mail: bernard.kurek@reims.inra.fr).
Address correspondence to: Estelle Garnier, UFR de Sciences Economiques et de Gestion, Université de Reims Champagne-Ardenne, 57 bis rue Pierre Taittinger, 51096 Reims, France (E-mail: estelle.garnier@etudiant.univ-reims.fr).

Journal of Industrial Hemp, Vol. 12(2) 2007
Available online at http://jih.haworthpress.com
© 2007 by The Haworth Press, Inc. All rights reserved.
doi:10.1300/J237v12n02_05
tion, then the forms of organization of the transformation industry, and finally the structuring of research through the publications of patents and the commitment of research groups. doi:10.1300/J237v12n02_05 [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <http://www.HaworthPress.com> © 2007 by The Haworth Press, Inc. All rights reserved.]

KEYWORDS. Hemp, innovation, technological expectations, hemp system, structuring organisation, hemp primary transformation, hemp research, business model

INTRODUCTION

The economic literature on innovation insists on the fact that the expectations around new potential products generate important effects on the organization of stakeholders (Brown et al., 2003). In spite of the modesty of its cropping surfaces, hemp is probably one of the crops which has created the most varied and the highest expectations since the middle of the 1990's, from the point of view of the so-called "technological expectations" (Eames and McDowell, 2005) of a sector. In particular, the beginning of the developments in the fields of plastics processing and building construction since the 1990's have helped to understand why, in spite of the saturation of the paper market and the uncertainties concerning the maintenance of the support of the Common Agricultural Policy (CAP) of the European Union (EU) for this crop, we witness an increase in its cultivated surfaces in France and Europe.

France remains currently the largest European hemp raw material producer, and the crop is largely transformed within the country. We may wonder who are the stakeholders capable of contributing to the transformation of these technological expectations into products and new markets and how they can do it.

In this article we describe the French hemp system, we will start our analysis with the organisations which structure this system. Then we will present the data on hemp production, hemp primary transformation and hemp research, which give information about the dynamic of the entire system.

1. The Organizations Which Structure the Hemp System

In spite of its small size, the French hemp system is organized into a dense network of associations, cooperatives, trade unions, professional and interprofessional structures as we see in Figure 1. There are sometimes structures which have very similar objectives and functions. The interactions with the other elements of the system are described in Figure 2.

Four of them are localised at Le Mans (Département Sarthe):

- **La Fédération Nationale des Producteurs de Chanvre--FNPC (National Federation of Hemp Producers)**

In the hemp system, the FNPC is both a national union of hemp producers and the only structure to have an activity of breeding of new varieties of hemp which can be registered on the European list of officially authorized varieties.

- **La Coopérative Centrale des Producteurs de Chanvre--CCPSC (Central Cooperative of Hemp Producers)**

The CCPSC is the only cooperative multiplying French hemp seed. It also intervenes in the process of certifying varieties.

- **Le Comité Economique Agricole de la Production du Chanvre--CEAPC (Agricultural Economic Committee of Hemp Production)**

The CEAPC is an association consisting of the FNPC and all the departmental unions which carry out checks of the THC content in the
FIGURE 2. The interactions between the structuring organisations and the French hemp system according to the best available information

Interchanvre is an "association à but lucrative" which has two members: the FNPC and the UTC. It is currently the French interprofessional hemp body. Its work consists of lobbying institutions which have an influence on the system (ministries, commissions ...).

Two structures are localised at Troyes (Département Aube).

L’Institut Technique du Chanvre–ITC (Hemp Technical Institute)

The role of the ITC in the hemp system is to coordinate and use existing knowledge and to produce knowledge adapted to the new challenges arising in the system.

L’Union des Transformateurs de Chanvre–UTC (Union of Hemp Transformers)

This association has three members who are also the three largest French producers: LCDA, Interchanvre and PDM. It apparently ensures for them the necessary bonds with the ITC and Interchanvre.

One structure is located in the département Yonne: the association "Construire en chanvre" (Building with Hemp). This association is active in identifying gaps in the development of the hemp building construction sector, such as the lack of regulations and standardization, and in initiating actions to reduce these gaps. It has nearly seventy members at the moment, all linked, sometimes closely, to the hemp system (researchers, farmers, transformers, architects, entrepreneurs, industrialists ...).

Finally, at the European level there are two structures: La Confédération Européenne du Lin et du Chanvre CELC (European Flax and Hemp Confederation) and l’Association Européenne du Chanvre Industriel–EIHA (European Industrial Hemp Association).

The CELC, based in Paris, was created in 1951 under the name of CILC. It gathers more flax stakeholders than hemp stakeholders, but the FNPC takes part in it. The EIHA started in Wolfsburg (Germany) in 2000. According to its documents of 2001, it brought together all the major European players in primary processing of hemp. Apparently the large French processors have left it.

The principal features of the French organisations which we have just presented are that:

hemp crop on behalf of the administration and which collect duties according to the ONIC and ONIOL 3 conventions for the control of THC contents.

These three organisations contribute to ensure the safety of the system vis-a-vis the risk of the production of psychotropic hemp, whereas in other countries, like the United States, hemp production is prohibited in order to avoid this risk.
They are numerous relative to the small size of the system (ten organisations for 9000 ha, a thousand of producers and four approved transformers),
They are some structures with very similar objectives and functions (EHIA and CELC for example),
In many cases, the same person directs several structures (for example the director of the FNPC is also director of CCPSC and Interchanvre),
As we see in Figure 2, all its structures are very closely linked, they can have bonds with the “hemp research” stakeholders and with large-scale transformers.

We will elaborate later on the weakness of the interactions between the structuring organizations and certain elements of the system such as the small processors: we will see that this can not be interpreted as a weakness of these companies, but that this corresponds to their economic model.

2. The Production of Hemp

After having fallen to a level of only a few hundred hectares in the 1960’s, the hemp production area in France has clearly progressed since the beginning of the 1990’s and at the moment it is estimated that about a thousand French hemp producers occupy between 9000 and 10,000 ha. Over fifteen years the hemp area in France has almost tripled (Figure 3). Nevertheless, the importance of the sector has remained always very marginal if one compares the 9068 hectares of hemp grown in 2005 to the 29,556,652 hectares of the French agricultural area for the same year.

Moreover, over the period 1990-2005, except for the years 1994 to 1996, the average hemp yields were rather stable between 6000 kg/ha and 7500 kg/ha (Figure 4).

This stability of the yield level over the last fifteen years may result from:

- The absence of important innovations with respect to varieties or regarding agricultural equipment or cultivation methods which could have improved yields.
- The lack of strong pressure of French hemp producers and hemp transformers to find solutions which bring higher yields.

The low yields over the years 1994 to 1996 can be linked to the fact that during these years the CAP5 assistance, which was still completely related to the surface, reached such levels (on average 740 Euros per hectare of hemp), that we can suppose that the farmers were motivated only by this assistance and neglected the crop’s yield level.

By combining the data on the yields and the areas one can note an upward trend regarding the quantities of hemp produced per annum. From 1990 to 2005, France multiplied its production by more than three (Figure 5).

There has been a steady growth of hemp production in France for several years. Recent events show that for various reasons, such as the

**FIGURE 4. Evolution of the average stem yield of hemp in France since 1990 (Source: Agreste)**
fall of demand in the paper market, the absence of new markets, low yields due to repeated droughts and the lack of solutions to facilitate harvesting, the production of hemp can strongly fluctuate. The example of PDM illustrates this phenomenon: up to 2005 PDM harvested roughly 2000 hectares per annum, but in 2006 it harvested only 500 ha.

Therefore the development and the marketing of new products based on hemp, and thus the dynamics of the entire hemp system, are directly related to the existing production capacity and to its stability over time and its growth. As usual, the decision of farmers to produce hemp is made by deciding the allocation of their farm area to the various crops they might grow. This decision is based on two main factors, namely financial margins and the ease to sell the crop.

1. The financial margins that they hope to obtain according to the crop that they grow.

   For hemp, the elements which constitute these margins and which make it possible to carry out this arbitration are:

   i. Costs of production, seed, material, working time . . .

   ii. Income from the sale of seed and stems (the price of stems and seed depends on quality)

   iii. European Union public aid and its evolution (hemp farmers can presenty, under certain conditions, get support from the CAP for their production).

At the moment, for one hectare of hemp in the Aube département hemp producers have an average semi-net margin of 720 euros (Table 1).

2. The ease to sell the crop compared to the prospects of markets for other crops.

Questions arise here about the characteristics of the market for the crop (mass market, niche market, expanding market, saturated market). Currently, existing markets are on the whole mainly saturated markets (paper), marginal markets with a low capacity for growth (feed for fish, birds), and niche markets (building construction and plastics processing).

Other factors which play a secondary role regarding the choice of the crop by farmers are:

1. Agronomic benefits to be expected from growing hemp rather than another crop. The agronomic qualities of hemp are widely recognized.

2. The technical conditions of hemp production compared to those of other crops: while hemp is a crop which doesn’t require much work at sowing and during the growing season, its harvest raises difficulties.

Specific administrative constraints related to hemp production. The cultivation of hemp has important administrative constraints because of very strict legislation regarding THC contents. Moreover, the strict administrative framework also comes from the legislation on CAP assistance.

<table>
<thead>
<tr>
<th>Gross income/ha</th>
<th>Variable costs/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 t Hempseed at 300 euro/t</td>
<td>300 Seed</td>
</tr>
<tr>
<td>8 t straw at 85 euro/t</td>
<td>680 Fertilisation</td>
</tr>
<tr>
<td>Producing subsidies</td>
<td>410 Harvesting</td>
</tr>
<tr>
<td>Total income</td>
<td>1390 Miscellaneous (storage...)</td>
</tr>
<tr>
<td>Semi-net margin</td>
<td>Total costs</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
If the motivations to grow industrial hemp are thus multiple, the transformers have in effect expressed in interviews the idea that it would be necessary to secure the possibility of a sufficient supply of raw materials for the new hemp markets.

3. The Transformation of Hemp

In the majority of cases, seed and stems are destined to be transformed. According to the finished product, the transformation is more or less important. Currently, the secondary transformation towards plastics processing is still in an embryonic stage. Certain transformation units have thus been maintained in research centers, even if these structures declare to have another ambition in the future. We will treat here only primary hemp transformers. A limit of this study is that some of them maintain relationships with secondary transformation. In 2006, the transformation of stems was carried out by about fifteen transformers across France (Figure 6).

Concerning the impact of the first transformation on the dynamics of the entire hemp system, it should be noted that several stakeholders mention the lack of homogeneity of the products sold by the transformers. For example, the shives used in building construction are sold under many names according to different type of products. Thus “white

FIGURE 6. French hemp transformers “to the best of our knowledge”

TABLE 2. "Well ordered" summary table of the characteristics of hemp transformers:

<table>
<thead>
<tr>
<th>Transformer</th>
<th>LCDA</th>
<th>TECN</th>
<th>Serac</th>
<th>Cooperal</th>
<th>Apinor</th>
<th>Groupe de Loire - Atlantique</th>
<th>Eurocanva</th>
<th>APCI</th>
<th>Appro Fibres</th>
<th>Midi-Pyrenees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-house</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For export</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In this table, the characteristics are defined as follows:
1. "New" = the primary transformers of hemp which joined the hemp system after the year 2000.
2. "Small" = the transformers which transform less than 300 ha of hemp.
3. "Traditional" = the transformers which produce, transform and sell hemp on a small scale and/or with not very elaborate means.
4. "Future Traditional" = the transformers which intend to produce, transform and sell hemp on a small scale and/or with not very elaborate means in the future.
5. "Local" = the transformers which work (production, transformation and distribution of hemp) on a regional level.
6. "Short chain" = the transformers which limit to the maximum the intermediaries between the agricultural production stage and the finished products.
7. "Basic Products" = the transformers which market less transformed products.
8. "Front" = the present which have the legal status of a firm (SARL, public limited company), SNC or cooperatives.
9. "Cap" = the primary hemp transformers which are approved and receive CAP subsidies.
10. "Advancing while cooperating" = the transformers which cooperate and/or which want to say that they cooperate with other transformers.
11. "Working with structuring organizations" = the transformers which adhere to or have regular contacts with the trade union of the producers, the inter-professional organisation, the Technical Institute.

1. "NI = non informed"
This problem must be linked to the characteristics of the different transformers and to the differences in the economic models mentioned before. Indeed, by taking the main information which characterizes the transformers, obtained during the interviews, and by crosschecking this information, two big types of stakeholders with very different behaviors emerge (Table 2). It is necessary to think about the consequences of the fact that hemp transformation is based on two “business models,” that we call the “agro-industrial model” and the “agro-traditional model.”

In terms of the dynamics of the hemp system, the mere existence of these two “business models,” shows us that the transformation subsystem is highly unlikely to have a federative objective. While it clearly emerges from our interviews that these two types of transformers are interested in the “technological expectations” of hemp due to their possible contributions to sustainable development, they don’t share the same point of view on the significance and the practical application of this sustainable development.

On the one side the agro-industrial transformers think that the environment must be taken into account by the hemp system within the framework of “green chemistry” (Colonna 2006; Demirdjian 2005); where the environmental specificity of the products is integrated into an industrial process; and where the ecological advantage over competing products includes the certification of industrial processes and the realization of Life Cycle Analyses, which allow them to market industrial mass products based on hemp with a sustainable development product identity. On the other side, the “agro-traditional transformers” think that environmental and social factors must be constantly taken into account at all levels, within the framework of short production chains, applying traditional practices, and using trade outlets based on short circuits; and they also think that products with a sustainable development identity are basic products having undergone little transformation.

Each one of these “business models” presents specific elements which may affect the dynamics of the entire hemp system. For example: For the actors of the “agro-traditional model” these elements are:

- That they concentrate on the building construction market. This restricts the number of markets (since it excludes for example plastics processing). It allows them to concentrate all their forces on a single objective, in particular on a market with beneficial effects obvious to the public. In fact various advantages of new hemp applications don’t have the same visibility for consumers. It must be said that building construction, which affects a market that is partly individual and based on self-construction, has much more direct links with consumers than plastics processing, which aims an essentially industrial market.
- That for some of them, the absence of structure and standardization of the hemp-based building construction is a choice. Indeed, while there are some transformers belonging to this model which are concerned with questions of the standardization of products and with questions of techniques to be implemented in the building, other transformers aren’t very much concerned by these questions, because they think that what is presently done in this field doesn’t affect them, or explicitly express their wariness of the structuring and standardizing of hemp construction, because they fear that the techniques and the products which they currently sell don’t correspond to future normalization standards, and that such standards will harm their activity.
- That most of them don’t wish to have a considerable development, but simply hope to maintain an activity similar to that which they have currently (traditional, regional, niche, addressed to who build themselves).

For the actors of the “agro-industrial model” the elements which are likely to act on the dynamics of the entire hemp system are:

- That they are aiming at the two sectors which have the biggest possibility of becoming mass markets: building construction and plastics processing. This strategy of diversification opens up many development prospects, but poses the problem of products competing within the framework of extreme competition of materials which characterizes contemporary economies.
- That they make big investments in R & D in plastics processing. In this precise case, however, the environmental specificity of products which is integrated into an industrial process isn’t very visible for ultimate consumers. In addition, the integration of these products in an industrial production system isn’t very easy, because it implies the substitution of well installed and well mastered products and the modification of an already well established sector organization. Lastly, another obstacle to the development of the whole hemp system according to the agro-industrial model comes from the fact that, according to certain stakeholders, the transformers
don't offer fibres as pure and clean as required by the plastics processing sector.

- That they make a big effort to structure the activities related to hemp building construction. They provide a big support in the field of training, they are large potential prescribers, they can use results of a Life Cycle Analysis (Boutin et al., 2005; van der Werf, 2004) which is favourable to them, they have products of which some are certified by the CSTB\textsuperscript{15} and referred to in specialized stores.

4. Hemp Research

The first element which affects the dynamics of the entire hemp research system is the administrative constraint related to the acceptable contents of THC in the crop. In fact, any research on cultivars must take account of THC content before even considering an improvement or a selection on the basis of characteristics which are more specific to the new applications. With constant means, this limits the capacities of varietal research and innovation and, in fine, influences the development of the entire hemp system.

Beyond these legal aspects, elements which are more related to the characteristics, behaviours and strategies of the entities which enter into the subsystem of hemp research will also have impacts on the dynamics of the entire hemp system.

A short analysis of patents can be interesting. The principal role of patents is not to protect technologies, but to announce a real and serious investment in a field, and thus, in a complex technological universe, in order to identify economic partners more effectively (Nieddu, 2006). The study of French patents relating to hemp can supply information on the innovation dynamics of the hemp system. For the period 1990-2005, the data base EPODOC created by the European patent bureau\textsuperscript{16} has made it possible to identify a list of fifty-four patents whose link with hemp appeared in the title or the summary, and whose applicant was French.

From the study of these patents two periods can be identified (Figure 7):

- 1990-2000, where French hemp innovations are at a low level (on average 2.4 patents/year).
- 2001-2005, where the rhythm of the French hemp innovations accelerates (6.4 patents/year on average).

![Figure 7. Number of hemp patents registered per year in France Between 1990 and 2005](image)

It is estimated that a patent appears in a public data base three or four years after the research was initiated. The increase in the number of hemp patents since 2000 can have various origins:

- A change of the strategy of inventors who have decided since 2000 to patent their research, whereas they didn’t do it before,
- The successful conclusion of pilot research projects based on concepts developed in the 1990’s,
- The creation of new companies on new hemp markets.

Moreover, we learn through the study of the patents that a large number of all the possible hemp applications were the subject of an actively applied R & D policy, because patents have been identified in fifteen distinct fields of application (Figure 8). Nevertheless, apart from construction and plastics processing, there are no really emergent topics; there are no topics which generate a regular deposit of patents. Indeed, this graph clearly underlines that in hemp research the most active fields of research (or at least those which give the most patentable results) are those related to plastics processing and building construction. However, with some differences between these two fields: building construction research has been regular and has existed since the beginning of the studied period, whereas plastics processing is more recent (2000) and more sustained.

This study counts 44 applicants for 54 patents, indicating that there is no real concentration of applied hemp R & D in France. Some applicants hold several hemp patents: AFT (four patents); Dehon Technology, LCDA, Hurdequint and Arkema (three patents each).
Moreover, from the study of the characteristics of patent holders as a whole, it arises that:

- Public research isn’t present among the applicants,
- The hemp transformers (La LCDA, La chanvrière du Belon, L-Chanvre as well as the Daifa industrial platform), the plastics processors (AFT, Arkema, Saint Gobain), the stakeholders of the building construction sector (Balthazar and Cotte, Strasservil) are active in research and the registering of patents.

The study of the activity of the French research laboratories which work on hemp makes it possible to complement the first vision of “hemp research” in France obtained by the analysis of the patents. The identification of French research laboratories which carry on a hemp activity wasn’t exhaustive; about twenty research centres working on hemp were nevertheless identified (Figure 9).

Before analyzing the characteristics and the behaviour of the identified research centres, we can specify that:

- The communicated “strictly hemp” research budgets$^{17}$ varied between 57,000 and 234,000 Euros,
- The duration of the research projects varied between 6 months and 3 years,
- The research teams were made up on average of two persons per project in full time equivalents,
- They responded to regional tender invitations, or European projects, AGRICE projects, projects with hemp transformers, or projects with the FNPC,
- They were financed mainly by public funds (DRIRE, region, ANVAR, ADEME-AGRICE) and by self-financing.

On the basis of information obtained during interviews, from various publications, books and on the Internet, it is possible to study more closely the characteristics of the research centres which can affect the dynamics of overall hemp system. Thus, “to the best of our knowledge”:

- all of the actors in hemp research publish very little on their work (publications strictly on hemp were identified for 4 hemp research centers only),
- they don’t register patents (there is just one hemp research center which had registered a patent),
- their work depends mainly on contract opportunities and they generally have multifibre activities (for plastics processing) or multiproduct activities (for building construction) rather than specific hemp activities (11 research center have multifibre activities or multiproduct activities).

Thus, finally, they don’t seem to create a very favourable context for the establishment of a real field of innovation by research concerning hemp.

French hemp research includes public and private research, both generate specific elements which may impact the hemp system. For the majority of public research actors, the reference to hemp doesn’t constitute a specific research program, but an activity belonging to a wider generic subject. Thus,

- either they develop a strategic behaviour with regards to materials. In this case, the specific crop isn’t important, and the fact of working on hemp is not important in itself. The public research structures then apply their knowledge and their know-how to hemp, as well as to other fibrous plants (wood, flax . . . ),
- or they work on hemp because hemp is integrated in their field of research, in particular agronomy, physiology, biochemistry and vegetable physicochemistry in the broad sense. In this manner, work on hemp represents an example among other crops or products. Hemp doesn’t constitute a field of thematic research on its own, but seems to be a cross-disciplinary field.
Is it possible or desirable to go towards a specific framing of hemp research? Observation leads one to think that there is a very dynamic scene, where specific research on one of the aspects of hemp can be stopped or given up rapidly. Consequently a structure is perhaps missing which carries out, alone or in a network, an in-depth study of the plant, and which has a strategy of positioning the work in accordance with the questions which animate the hemp system.

For the private hemp research, the elements which affect the dynamics of the system are:

- that their research is focused more specifically on hemp, with a more continuous activity;
- that they try to centralize and coordinate work which makes it possible for them to address the consumer or the end-user;
- that they are mobilized on specific and specialized activities directly related to their professional group (for example AFT works only on plastics processing);
- that they have the financial capacity to invest in R & D, in particular for the plastics processing sector where research requires major means which small structures cannot afford.

**CONCLUSION**

The components of the hemp system seem to be relatively autonomous; some of its elements have their own logic, which goes beyond the system itself. The plastics processing industry can replace hemp fibres by flax fibres; farmers can grow other crops. But the strategies of organisations of the stakeholders nevertheless contribute to the existence of links and complementarities through the hemp system such as, for example, the installation of hemp scientific research programs.

This mixture of complementarity and autonomy of the subsystems with the duality of the economic models thus seem to be the two principal lessons to be drawn from this study of the dynamics of French hemp. These characteristics can generate economic and technical uncertainties and instability, which can finally limit the initiatives, investments, innovations and block the development of hemp-based products. However, they can also have positive effects in terms of the continuity of the hemp system, due to its flexibility and adaptive capacity while new products are still in research or adaptation phases.

**NOTES**

1. Approximately 9,000 ha in France and 15,000 ha in Europe these last few years
2. There are two foreign transformers, one in Spain (Agro-Fibra who works with Coopeval) and the other in Germany (BAFA who works with Daifa), collaborating with French producers for marginal quantities.
3. Certain employees share their working time between several structures
4. In the Sarthe department we find the third largest transformer of hemp in France: PDM. 500 ha of hemp are grown in this area.
5. ONIC: Office National Interprofessionnel des Céréales; ONIOL: Office National Interprofessionnel des Oléagineux, protéagineux et cultures textiles.
6. A particular French legal form which authorizes a "not-profit" association to have commercial activities, subjected to the commercial taxes (VAT, company tax, professional tax and training tax).
7. In the Aube department, 5000 ha of hemp are grown. The largest hemp transformation structure in France, the LCDA, is also in this area.
8. The EIHA has seven regular members: Badische Naturfaseraufbereitung GmbH (BABA) (Germany), CANABIA, a.s. (Czech Republic), Gruppo Fibranova (Italy), Hemcore Ltd (UK), HempFlax BV (The Netherlands), NAFGO GmbH (Germany), YUNNAN INDUSTRIAL HEMP INC, (China). http://www.eiha.org/

9. Common Agricultural Policy

10. To obtain support from the CAP, farmers who grow hemp should use certified seeds which respect THC standards, have a contract with an approved primary transformer (there are currently four approved transformers in France: Terrachanvre, LCDU, PDM and Eurochanvre), proceed to make several declarations and accept to be the object of random controls.

11. The gross margin is the balance between the gross income (sale of the production and the compensatory subsidies) and operational costs (seed, fertilizers, pesticides). The semi-net margin is the gross margin decreased by costs directly attributable to the hemp production activity, for example the depreciation of equipment.

12. Model which brings together transformers which deal with big volumes, which have been in the system for a long time, which work in an industrial way for an international market, which use big networks to distribute their refined products and which are well integrated within the framework of the hemp system.

13. Model which brings together small transformers which joined the hemp system recently, which currently work in a traditional way, which sell basic products, which sell their products locally through short production chains, which have a total freedom vis-à-vis the structuring organizations or the framework of the system.

14. By definition “green chemistry” means the design, development and elaboration of products and chemical processes making it possible to reduce or eliminate the use and generation of environmentally dangerous substances, with the idea that the qualification “dangerous” must be taken in its widest sense.

15. Centre Scientifique et Technique du Bâtiment.


17. Projects which include hemp without strictly being hemp aren’t taken into account here.


19. For more information on French hemp transformers see the following Internet sites:
   http://www.chanvre.oxatis.com/
   http://www.ebusinesstools.net/chanvre-mellos/index.html
   http://www.terrachanvre.com/
   http://lachanvre.buzzkompny.net/accueil.html
   http://www.chanvrebio.fr/
   http://www.dafia.fr/
   doc/bataille.pdf

20. For more information see the following Internet sites:
   http://www.cttn-lemans.com/
   http://www.aft-plasturgie.com/f_accueil.htm

Garnier et al.

http://www.poleplasturgie.net/
http://www.valagro-nd.com/
http://www.construction-chanvre.asso.fr/
http://www.enipe.fr/

21. Data supplied by the Institut Technique du Chanvre (ITC) for the 2005 growing season.

REFERENCES


doi:10.1300/J237v12n02_05
CONTENTS

EDITORIAL
Welcome to the Journal of Industrial Hemp
Robert Clarke, David Watson, Hayo van der Werf

PEER-REVIEWED PAPER
Influence of Temperature on the Water Retting Process of Hemp (Cannabis sativa L.) Cultivated Under Swedish Climate Conditions
Karin Magnusson, Bengt Svennerstedt

OTHER CONTRIBUTIONS
Traditional Cannabis Cultivation in Darchula District, Nepal—Seed, Resin and Textiles
Robert C. Clarke

The Production Chain of Hemp and Flax Textile Yarn and Its Environmental Impacts
Lea Turunen, Hayo M. G. van der Werf

The Dynamics of the French Hemp System and Its Stakeholders
Estelle Garnier, Martino Nieddu, Marc Barbier, Bernard Kurek

Fourth International Hemp Conference: Hemp Industry on a Global Course of Expansion
Michael Carus

COLLECTIONS CORNER
Traditional Nepali Hemp Textiles
Robert C. Clarke

THE WIDE WILD WORLD OF HEMP
Hemp Paper: 2,000 Years On
Kenyon Gibson

CANNABIS CLINIC
Longhorn Beetles and Botryosphaeria: A Future Epidemic?
John M. McPartland, Karl W. Hillig

HEMP RECIPES
Winter Menu
Kenyon Gibson

BOOK REVIEW
Building with Hemp, by Steve Allin
Reviewed by Kenyon Gibson

1537-7881(2007)12:2

The Haworth Press, Inc.
10 Alice Street, Binghamton, NY 13904-1580
www.HaworthPress.com