Abstract
Recent studies re-underline the role of localised inter-firm networks in innovation dynamics and economic performances of small firms. Farmer-owned co-operatives are supposed to benefit from local networking, but research has still to be done. In this paper we propose to combine economy and economic sociology to assess the structure and the role of specific informal inter-firm relations in a cluster of co-operatives: the advice networks between co-operative managers. Our study is based on the case of 31 co-operatives, constituting a wine cluster around Beziers (Languedoc, South of France). Using both sociometric and economic data, we find correlations between co-operatives relational and economic scores. The networks structure allows inter-firm co-operation on technical topics, but seems to limit exchanges in other strategic domains like marketing. Our results lead to action perspectives in co-operatives clusters and call for further collaboration between economy and sociology to analyse the relational and cognitive bases of co-operatives innovation dynamics and performances.

1. Introduction
Farmer-owned co-operatives have been playing a crucial role in French agriculture development, especially in added-value creation and marketing activities, contributing to more than fifty percent of farms outputs in sectors like milk, meat, cereals or wine. The reasons of this co-operatives successful expansion have been analysed by many authors. Historical studies report the favourable combination, during thirty years after the 2nd World War, between the increase in national and international demand for food, public policies in favour of co-operatives, technical progress in farms, co-operative social movement, relevant strategic decisions of co-operatives managers (Mauget, K oulychtizky, 2003). Economic analyses put also the emphasis on the advantages that marketing co-operatives may get in such a context of national and European economic regime, referring to scale economies, long term joint investments or transaction costs reduction (Nilsson, Van Dijk, 1997; Coté, 2001).

However, internationalisation of markets, CAP reforms, quantitative and qualitative changes in consumers demand, new technological waves… prompt farmer-owned co-operatives to change their organisation and strategies. In the two last decades, innovation appears as the “key factor” of co-
operatives performance, favoured by their ability to develop cognitive processes and relevant networks at both local and sectorial (global) levels (Draperi, Touzard, 2003). Most of current economic, sociological or management studies on French agricultural co-operatives are exploring these (new) cognitive and relational conditions of innovation and performance, focusing on strategic alliances (Guillouzo et al., 2002; Filippi, 2002), co-operative governance (Couret, 2003; Lambert, 2003), social capital management (Chiffoleau, 2004).

In parallel, a recent set of works on clusters and industrial districts re-underlines the key role of localised inter-firm networks in both individual and collective performances, thus defining highly competitive firms and areas (Porter, 1998; Amin, 1999). In the context of “knowledge-based economy”, scholars point out those relations as bases of firms cognitive capacities development, then innovation and performance (Carbonara, 2002). However, in most cases, relations that are taken in account are either not well defined, more theoretically supposed than practically proved, either mainly of formal or economic nature.

Following these two sets of studies, we propose in this paper to assess the structure and the role of a specific informal inter-firm network in innovation dynamics and performance of a co-operatives cluster. As innovation is construed as both a relational and cognitive issue, we assume indeed the crucial role of advice exchanges between co-operatives managers about diverse innovation topics. Our contribution is based on a case study in the Languedoc region (South of France) where wine co-operatives manage 75% of the production and geographical wine firms concentrations may be identified (Chiffoleau et al., 2003). Using both sociometric and economic data, we will show how this network approach gives tools to complete an analysis based on economic assets, thus proposing a fruitful link between economy and sociology for the interpretation of economic phenomena.

The paper is organised as follows. The second section presents theoretical issues on innovation and roles of networks in clusters, stressing the promising contribution of economic sociology and its possible application for agricultural co-operatives studies. In the third section we present the material and the method of our fieldwork. Both economic and networks data on the studied cluster are exposed in the fourth section, then correlated with wine co-operatives innovation dynamics and performances. Empirical, theoretical and operational contributions of the research are discussed in the last section.
2. Theoretical background

2.1. Innovation within clusters: a relational and cognitive issue

Over the past decade, there has been an increasing interest in local industrial agglomeration and specialisation, not only by economic geographers but also by economists and policy-makers. All inspired by Marshall’s definition of an “industrial district” (1891), many concepts have emerged from this new-found focus, but Porter’s work on “clusters” has proved by far to be one of the most influential. According to him, a cluster refers to a localised group of small and medium-size firms acting in the same branch, both competing and co-operating, and showing a high level of collective and individual performance (Porter, 1998). This efficiency is supposed to be linked with a high degree of interactions between the firms. The California wine industry constitutes a famous example of cluster.

There has been indeed an increasing evidence from innovation economics that close interactions between firms are the major determinant of technological development and competitiveness (Lundvall, 1993). These interactions prove to be often geographically concentrated (Storper, Harrison, 1991). As innovation is construed as a non-linear process, based on the cumulative or path dependent creation of new knowledge, or novel recombination of existing knowledge, it supposes indeed learning by doing, by using and above all, by interacting with “peers”, developing the same activities in the same conditions, that allows to learn “what works”. More and more, in the context of knowledge-based economy, social scientists are prompt to assess innovation as a localised learning process (Antonelli et al., 2002), which allows the production of specific assets throughout internationalised markets (Porter, 1998).

Industrial and institutional economists highlight other more general arguments about the effects of local ties between geographically close firms: combination of scale and scope economies (Amin, 1999); reduction of transaction costs when looking for labour force or information, due to trust linked with ties (Carlsson, 1997); solving of principal-agent problems; access to local public goods (Bellandi, 2002). But which kinds of networks are efficient when innovation and performance are challenged? Economists argue several kinds of ties (Bijman, 2003), from financial ties to formal relations sustaining collective action. A call is thus made to sociologists to progress in the identification of the relevant networks in such phenomena.
2.2. The perspectives open by network sociology

As cluster performance is supposed to be linked with inter-firm ties, economic sociology may be mobilised to progress in the understanding of the nature and role of networks in processes. The concept of “embeddedness”, formalised by Granovetter (1985), refers to the process by which social relations shape firms economic action and results in ways that some mainstream economic schemes overlook or mis-specify. Uzzi, for instance, shows how firms embeddedness in social ties constitutes an exchange system which offers opportunities to the firms and increases their performance until a threshold where the positive effect reverses itself (Uzzi, 1996). Burt highlights the links between firms innovation dynamics and performance on one hand, their “position” in the socio-economic system in which they are involved on other. Positions are assessed as specific relational profiles towards others: whereas firms in the same position are likely to behave (and especially innovate) in the same manner (Burt, 1987), those managing “structural holes” (i.e. not connected contacts) are supposed to be more competitive, due to their control of information flows (Burt, 1992).

Moreover, as innovation proceeds from a cognitive process, it prompts us to refer to sociologists trying to combine networks and knowledge issues in their analysis of innovative situations in organisational contexts. Networks are not only vectors of diffusion of novelties, but social locates of new knowledge production when routine is not sufficient and innovations have to be implemented (Darré, 1996). Within all kinds of ties that may be developed by organisational agents to get resources for action, Lazega underlines the exchanges of advice between “peers”, belonging to the same professional community and developing the same activities in the same conditions: that allows them not only to master their activity when routine practices are challenged, but also to co-ordinate their actions with their colleagues, thus promoting a collective capacity of innovation that may benefit to every member of the community. Within a firms cluster, the advice network between managers may then be assessed as the basic form of inter-firm co-operation and the essential condition for firms and local area competitiveness. Advice is indeed laden with trust and value, then is more than information and may be capitalised as a form of knowledge (Cross et al., 2001). However, advice relations shape an informal hierarchy insofar as people usually refer to others they assess as having a higher status than themselves (Lazega, 2001). In that sense, the advice network provides crucial resources for innovation as well as it builds power distribution and authority positions in the social system (Blau, 1964).

2.3. Clusters: alternative organisational forms for farmer-owned co-operatives?

Farmer-owned co-operatives constitute a priori well suited cases to the economic and sociological research agenda on cluster and innovations. The specific role of co-operatives has been mentioned in
Mainly proceeding from local associations of farmers, agri-food co-operatives have been developed through different ways of organisational changes and integration:

- In the main agri-food sectors (milk, cereal, meat production), we note that merging, development of subsidiaries or federated co-operatives, inter-firm contracts... have led to horizontal and vertical high integration (or quasi integration) process, building in many cases powerful co-operatives groups, that are competing in European and international markets (Guillouzo et al., 2002). Economic arguments coming from industrial economics have been applied to explain the expansion of co-operatives: economies of scale at both technical and marketing level, search for a stronger control along the supply chain, diversification of activities, development of subsidiaries to catch external founding, etc... (Nilsson, 1998).

- But in other regions or sectors (wine, olive oil, fruits and vegetables, farm equipment...) co-operatives remain small or medium-size firms, mainly co-ordinated by political or technical federations, but also by networks that present formal and informal dimensions (Chiffoleau et al., 2003). Numerous economists or experts predict that these small co-operatives may follow the integration way of the others or will disappear. Nevertheless, between the “pure market” and the different ways of integration, cluster could be an alternative organisational form for co-operatives.

This cluster may have different forms according to the agricultural production collected by the co-operatives, the extension of the agricultural area, the local market share of the co-operatives, the characteristics of the communities, the institutions or the networks that generate interdependencies between the co-operatives... We can thus distinguish i) co-operatives within a cluster dominated by investor-oriented firms, ii) co-operatives themselves as hierarchical clusters (through federative marketing co-operatives) or iii) clusters of co-operatives, where co-ops are both dominant within the agricultural area and not driven by one firm.

Thus, specific linkages between these clusters and co-operatives organisational forms are questioned. In one hand, we suppose that small and medium farmer-owned co-operatives could benefit from belonging to clusters, on other hand we expect that these clusters may be influenced by co-operatives specific status, property rights and functioning. At least four arguments may be suggested:

- Co-operative property rights and the agricultural origin of its board could explain specific management, as aversion to risk strategies, collective and deliberative decisions, specific
(complementary?) roles of the director and the president (Lambert, 2003). These feature can influence formal and informal local networks of the co-operatives.

- Agricultural co-operatives are associated with a strong “territorial anchorage”, that means a multidimensional relationship based on co-operatives material and immaterial investments but also on farmers involvement both in geographical space (land) and local communities (Draperi, Touzard, 2003). This relation deals with the “site-specific assets” associated to transactions between the co-operative and its members (e.g. technology adapted to local agriculture, investment in origin marketing…). Territorial anchorage may be a factor of cluster geographical stability. It seems also to be strengthened with the new issues about rural development that challenge farms and co-operatives.

- Common co-operative values, rules and culture are supposed to play a significant role in alliance or networks strategies. This factor is pointed out by many observers or researchers, underlying that co-operatives are more inclined to co-operate with other co-operatives (or co-operative owned firms) than with investor-owned firms (Mauget, Koultychizky, 2003).

- Conditions of founding are limited regarding research-development activities, due both to the size of the firm and legal constrains that face (traditional) co-operatives in matter of external founding. In the current context of multidimensional innovations in agri-food supply chains, local or regional networks allow to share experience and advice, substituting partially to specific R&D departments.

In this paper we carry out the analysis of a “cluster of co-operatives”, focusing on the inter-firm networks that are supposed to structure the cluster and benefit to innovation and economic performance. Research on co-operative networks and clusters is still very limited. Economic arguments of hierarchical networks have been explored in the case of a federated co-operative (Lazzarini et al., 2001). The formal dimension of inter-co-operatives networks has been also analysed trough their financial ties and strategic alliances (Guillouzo et al., 2002). Research on personal interdependencies between co-operatives (Gargiulo, 1993; Bijman, 2003) and interlocking directorates (Karantinis, 2003; Filippi, Triboulet, 2003) are developing, opening fruitful collaborations between institutional economics and networks or economic sociology. Our paper follows this exploration by focusing on one kind of possible interdependency between co-operatives highlighted by economic sociologists: the advice networks between managers.

3. Material and method

3.1. Presentation of the empirical field : the wine cluster of Beziers (Languedoc)

Our fieldwork has been implemented in a geographic area located around the city of Beziers, 70 on 40 kilometres wide, where terroirs are mainly plain. This area was considered in the 70s as the core of the Languedoc table wine industry (Auriac, 1983). Ninety percent of its wine was basic (raw production),
paid according to its alcohol degree, processed and marketed by 45 village co-operatives cellars that
had reached a dominant position (80% of the local wine production, 95% of the vine growers).
Nowadays, the area is still specialised in wine (85% of local agri-food production, in spite of a 25%
reduction of the vineyard) and co-operative cellars have kept their processing and marketing share.
Nevertheless, local wine industry is radically changing. Vine growers and their co-operatives cellars
are following divergent directions: some of them try to keep producing table wine without changing
the inherited mass technological model. But the majority engages in “innovation trajectories” which
consist in a large diversity of combinations between new activities (along the processing and
marketing value chain but also in tourism and local development), new wines (AOC or variety wines),
new internal rules and new economic or marketing alliances or mergers (Touzard, 2002).

In 2003, the area includes 31 co-operative cellars (15 have been concerned by mergers since 1988),
very diverse in matters of size, specialisation, turn-over, innovation dynamics... (table 1, appendix).
Small wine estates and wineries, institutions dedicated to wine industry and co-operatives (2nd step
marketing co-operatives, oenological centre...), suppliers (e.g. bottles and caps production) and wine
merchants are also located in Beziers area, some of them recently attracted by the development of
quality wines.
This area presents the apparent characteristic of a cluster: geographical concentration of specialised
small firms, formal institutional ties and long common history materialised through shared values and
rules, testified by historians and experts (Dugrand, 1963; Gavignaud-Fontaine, Michel, 2003).

3.2. Definition of relevant information

The fieldwork has been based on the collection of primary data at the co-operative level: economic
information on production and investments, indicators of technological and organisational innovations,
relational data concerning exchanged advice about innovations. General economic criteria (volume
and value of production, investments...) are easy to define, whereas analysts are questioned by the
relevant data to assess economic performance scores and strategic domains of innovation.

a) Ratios of economic performance must take in account the double dimension of “traditional” farmer-
owned co-operatives: they are both firms competing in the agri-food sector and associations of
member-user-patrons remunerated through the payment of their agricultural delivery. Then, we
adopted three kinds of criteria:
- co-operative turn over growth, including the possible merging with another co-op;
- average members’ income per hectare (current level and evolution), key issue for the sustainability
  of both farms and co-operative (Touzard et al., 2000);
- average price of wine (current level and evolution), expressing the capacity of the co-operative in adding value.

b) Relevant domains of innovation have been defined from previous fieldworks at the regional level. We delineated six strategic items where innovations have now to be implemented:
   a) grape production and wine-making (technical process issues),
   b) grape classification and payment system (organisational innovation),
   c) merging, formal alliances with other co-ops,
   d) marketing (product innovation, pricing strategy, contracts, new selling point…),
   e) human resources management of staff and members,
   f) landscaping and involvement in local development.

These items structured our selection of elementary innovations that may be developed in co-ops: scores of innovation have thus been defined from the number of innovations implemented. These items were also considered as strategic domains of advice exchange between co-ops managers.

3.3. Collection of economic, structural and relational information

The economic and structural information on co-operative cellars have been collected from two studies which were carried out at the regional level and included the 31 co-operatives of our fieldwork:

i) The analysis of co-operatives trajectories, proceeding from their accounts evaluation between 1989 and 1996 (Laporte, Touzard, 1998). It gives detailed economic information on wine co-operatives at a “starting situation”, defined as the average of 1994 and 1995 campaigns;

ii) A regional census of wine co-operatives in 2002: it yielded, through direct enquiry, detailed economic and technical information about all the 360 cellars of the region and for the two years 1999 and 2000 (Touzard, 2002).

From this material, we formalised a data base relative to the 31 co-operatives of Beziers wine cluster, featuring the evolution of structural and economic criteria (between 1994 and 2001), and technological and organisational characteristics in 2001-2002.

Then, following our hypotheses, we enquired in December 2002 the advice networks of both the directors and the chairmen of all the co-operatives located in the delimited area. The 31 co-operatives lead to 67 individual enquiries (some co-ops have several directors). People were asked to tell to whom they have been asked and given advice, for each of the six identified innovation domains, during the two last campaigns (2001, 2002). Following the protocol usually developed in network analysis (Degenne, Forsé, 1994), each interviewee was first asked to explain his links with each of the 66 other people included in the geographic area (technique of “name generator”), then with other persons out of this set. They were also asked about their possible collection of strategic information through professional press, technical books, trade fairs, travels… Network data have been registered in
squared matrices that allow statistical proceedings. Qualitative questions have been associated to assess the point of view of the interviewee relative to its co-op, the relevance of each innovation domain... Interviews have been recorded and used for interpretation and control of the relational data, and discourse analysis.

3.4. Data analysis

Our research aimed at testing correlations between economic and relational data on one hand, innovation and performance scores on other. The elaboration of the final data basis required a previous statistical proceeding of the data about advice networks. Considering the six domains of innovation, only inter-individual advice-asking relations have been proceeded, from which giving-advice relations have been deducted: networks sociologists show indeed a low reliability of spontaneous declarations about giving-advice relations. Relations have been aggregated at the co-operative level, assuming the organic connection of director and chairman ties.

Then, network analysis provides scores or categories that enable us to characterise the cluster as well as each co-op:

- “density index” of the networks refers to the ratio between the current ties and all possible ties,
- “out-degree score” measures the number of asking-advice relations, in each domain and globally,
- “in-degree score” measures the number of giving-advice relations (idem),
- “external openness index” indicates the weight of relations out of the set of the 31 co-ops,
- “prestige score” proceeds from difference between giving and asking-advice relations numbers: prestigious co-operatives receive many advice requests and send few;
- “betweenness centrality score” refers to Burt’s structural holes theory and evaluates the propensity of the co-operative to be a compulsory intermediary between others within the cluster,
- “profiles” (cf. 2.3) are identified as specific sets of relations with others, taking in account both given and asked ties in and out of the 31 co-ops,
- “sub-clusters” feature groups of co-operatives highly connected (n=1) and which consult each other on at least 3 themes.

The final data basis includes all these relational scores and the economic and innovation indicators, allowing correlation tests and multivariate analysis.
4. Results

4.1. Innovation and performance in the wine cluster

Firstly, statistical analyses have been made on economic and innovation criteria, without taking in account relational data. It aimed at testing the possible relations between size, specialisation, innovation scores and economic performances in the co-operatives cluster (table 2). Results are close to those we obtained at the regional level, concerning the 360 wine co-operatives (Chiffoleau et al., 2003):

a) The size of the cellars (volume, turn-over, number of members) is not correlated with any innovation and performance criteria.

b) AOC wine specialisation (mainly carried out by 6 co-operatives in the cluster) is correlated with both a specific set of innovations (maturing in barrels, wide range of wine, bottling and direct selling) and two performance ratios (wine price and turn over growth): it clearly identifies a technological model that allows the firm development through territorial specification of wine, but has no specific positive impact on farmer income. On the other hand, variety wine specialisation is not correlated with specific innovations nor economic performance levels in this area, even if experts present this specialisation as linked with an alternative technological model to AOC.

c) Among all elementary innovations, only one is correlated with the economic efficiency: the level of grape classification. It points out the role of these new rules that radically change the relations between the farmers and their co-operative, for all kinds of co-operative sizes and specialisation.

d) However, combinations of complementary elementary innovations are correlated with all economic performance criteria. We test that proposition with different scores, adding the occurrence of elementary changes. This result is confirmed by a step by step multiple regression analysis, testing the capacity of different combination of elementary innovations to explain the variability of the average income per hectare (Chiffoleau et al., 2003).

So, first statistical analysis shows that co-operatives are innovating in the cluster and that innovation seems efficient whenever it combines and co-ordinates elementary innovative items. Nevertheless, the difficulty to identify structural factors of innovations (and performances) prompts us to investigate the role of social factors and particularly inter-firm networks.
4.2. General characteristics of the advice networks

Secondly, we proceeded the relational data in order to describe the structure of the advice networks:

a) Within the geographical delimited area, 74% of co-operatives advice relations (on the six domains of innovation) are developed between co-ops located in this area, that tends to prove a “cluster” characteristic. Relations with others out of the 31 co-ops set are mainly connected with local institutions or firms (Chamber of Agriculture, oenological centre…), that strengthens a cluster feature. Co-ops are also very few connected to long distance advisers and little practice professional travels or lectures. If the cluster is thus attested, the openness degree (26 %) may be taken with precaution because it doesn’t take in account the intensity of each relation.

b) From a total number of ties of 1 072 inter-individual relations between managers, ¾ are intra-status, that means director to director or president to president. It proves a quite high “homophily” of the advice networks at the inter-individual level of analysis. However, considering the co-operative level, advice relations may link very diverse co-ops, in matter of size or wine specialisation, so that “homophily” can not be attested.

c) The density of presidents and directors networks (21% and 17%), all themes taken in account, is lower than the density of inter-co-ops networks (33%), that means mainly different advisers for directors and presidents. According to the relation between them in each co-op, it may be a source of complementarity or disturbance.

d) However, the density varies largely according to the domain of advice (table 3). Advice in matters of grape and wine production techniques, as well as in grape classification and payment system, are the most developed (density up to 20 %) whereas issues about landscaping are very little exchanged.

<table>
<thead>
<tr>
<th>Domain of innovation</th>
<th>grape production and wine-making</th>
<th>grape classification and payment system</th>
<th>merging, alliances with other coops</th>
<th>marketing</th>
<th>human resources management</th>
<th>landscaping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network density</td>
<td>20%</td>
<td>25%</td>
<td>11%</td>
<td>14%</td>
<td>11%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Table 3. - Networks density according to innovation domains

These results are consistent with our statistic observation on the role of grape classification (see 4.1). But our qualitative approach also points out the different perceptions of managers concerning each domain: technical issues are now entering in routines, main problems have been solved, whereas
alliances or commercial items are highly strategic then induce rivalries and confidentiality. Landscaping is assessed as a secondary item, whereas human resources is often evoked as “the most important domain”, but for which “there is no efficient solutions”, according to our interviewees, that make exchanges about this topic as “a lost of time”.

4.3. Relational scores, positions and sub-groups within the cluster

a) From in-degree and out-degree scores, theme by theme or all items taken in account, we can identify polyvalent vs. specialised “experts” (appendix 1). Coops 1 and 16, for instance, give advice on every theme and ask quite few, thus emerging as polyvalent prestigious advisers in the cluster. The co-op 20 has also a high score of prestige, but mainly due to its giving-advice relations in technical domains (graph 1). Others coops do not emerge as prestigious but with a high intermediary centrality, as the coop 18, whereas others distinguished themselves by their openness, as the co-op 9. That leads to identify several roles within the cluster that we, in a second step, are going to compare with economic or structural assets.

b) Five profiles have been then identified, taking in account all advice relations.

<table>
<thead>
<tr>
<th>Profile</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-ops</td>
<td>1,11,22,24,25</td>
<td>18,21,28</td>
<td>2,3,6,8,10,13,17,19,27</td>
<td>4,5,7,9,14,15,16,20,23,29,30,31</td>
<td>12</td>
</tr>
<tr>
<td>Main characteristics of the relational profile</td>
<td>Ask and give advice in landscaping, do not ask any advice in human resources</td>
<td>Ask advice in human resources, in grape classification</td>
<td>Ask advice on commercialisation, alliances and grape production</td>
<td>Give advice on grape production and classification, on human resources</td>
<td>Isolated</td>
</tr>
</tbody>
</table>

Table 4. - Advice relational profiles within the co-operatives cluster

Some profiles emerge as linked with specific assets and previous dynamics, as we will see in the next paragraph. Above all, according to Burt’s theory, these profiles may distinguish coops likely to behave in the same manner, especially relative to innovation. That calls to identify the three domains of human resources, landscaping and commercialisation as the most strategic items where new practices may be implemented, thus likely to differentiate firms in a close future.

c) Firms in the same position are not supposed to be directly linked. A second approach of the cluster is to identify cliques, as sub-groups of co-ops highly interconnected, about several topics. Two cliques may be identified : the first one is quite dense and gathers the coops 14,16,8,24,20,6, the second one is
weaker and made by coops 1,2,18,30. These two cliques appear as groups of geographically close firms, all or at least a part of them belonging to the same producers group. More largely, six types of co-ops may be assessed according to their level of direct connectivity with others in the cluster.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-ops involved in a high density clique</td>
<td>Co-ops in a medium density clique</td>
<td>Co-ops involved in a strong bilateral relation</td>
<td>Bridges between cliques with medium connection</td>
<td>Co-ops in periphery of the cliques, low connected</td>
<td>Co-ops very little interconnected to others or isolated</td>
</tr>
<tr>
<td>6,8,14,16,20,24</td>
<td>1,2,18,30</td>
<td>4,22</td>
<td>17,23,28</td>
<td>3,5,9,10,11,19,21,25,26,27,29,31</td>
<td>7,12,13,15</td>
</tr>
</tbody>
</table>

**Table 5.** – Firms direct connectivity with the other co-operatives in the cluster

Firms insertion in a clique may either limit or stimulate their innovation capacity, according to the degree of social pressure and competition inside the group (Burt, 1992), whereas bridges between cliques may benefit from their strategic position.

**4.4. Correlations between relational scores, innovations and performances**

In order to identify possible relations between the managers networks and the structure, innovations and performances of their co-operatives, we proceed a second correlation test completed by general discriminant analysis (to test cliques and profiles influences).

a) Significant correlations are found between relational scores and structural characteristics of the co-operatives (see table 6)

- Co-operative size is positively correlated with many in-degree scores (human resources, grape production, grape classification, total). The biggest co-operatives seem to have a specific adviser role in these domains, whereas they have no significant higher score in matters of global prestige, openness or betweenness centrality.

- Wine specialisation is correlated with several in-degree or out-degree scores : AOC co-operatives give less advice than others in strategic domains (marketing and alliances) ; table wine co-ops appear as not asking advice on landscaping whereas variety wine co-operatives ask and give advice on this topic ;

- Social structure of the board of directors seems to have influence on managers advice networks. For instance, the ratio of part-timers in the board is correlated with the out-degree score in marketing issues and the betweenness score of the co-operative ;
- Institutional involvement of the managers and the co-operatives presents many correlations with relational scores: belonging to the union of directors is highly correlated with in-degree scores for technical, marketing and alliances issues, but also with the betweenness centrality. Belonging to a second step marketing co-operative is also correlated with this score.

b) As shown in table 6, we also find significant correlations between relational scores and technical or organisational innovations implemented in co-ops:
- considering the elementary innovations, there is no correlation between the implemented innovation and the out-degree or in-degree score in the advice network relative to the innovation domain that is concerned. However, we note a high correlation between the out-degree score in landscaping and ratios of direct selling, range of wine, grape classification or investment per hectare. “grape classification” is also positively correlated with in-degree marketing score. For each domain, it seems that the “main innovators” are not specifically the main advisers, but that implemented innovation call for new specific innovation, in landscaping for instance.
- By testing innovation scores, we strengthen this hypothesis: the number of “key innovations” within the co-operative is correlated positively with the out-degree score in landscaping and negatively with out-degree score in both human resources and merging.
- We specify these relations by a discriminant analysis run on three categories of innovation score: low, medium, high (see graph 2): low innovation score co-operatives may be identified by their high out-degree score in human resources (urgent issue?), but some of them have few interactions; high innovation score co-operatives have specific requests on “new” domains of innovation (as landscaping), but only some of them provide advice on human resources or marketing (for which they are however supposed to have some capacities); medium innovation score co-operatives have higher in and out degree scores, especially in technical and marketing domains.

c) Relational scores and economic performances have weaker correlation:
- The highest correlations are found between performances in 1994-95 (average farmer’s income) and in-degree scores in marketing, alliances or landscaping. Thus, previous economic performance seems to have kept influence on current advice networks.
- 2000-2001 farmers income per hectare is only correlated with landscaping in-degree score, when 2000-2001 average wine price is negatively correlated with out-degree score in human resources and betweenness position.
- Turn over evolution is positively correlated with out-degree score in landscaping, but negatively with openness.
Thus, economic performance seems to be influenced by (or to influence) few relational scores, mainly those that are higher correlated with innovation scores (see correlation between set of innovations and performance). Specific positions in the network, materialised by openness, prestige or betweenness
scores, seem to have no positive correlation, whereas they are often presented as key factors for innovation and performance.

d) Finally, we test the possible influence of profiles and degrees of connectivity on innovation and performance by a general discriminant analysis (table 7, appendix).

- The involvement of co-operatives in a dense sub-group or a strong dyad is statistically discriminated by only one economic score: the average wine price in 1994-95 and (weakly) in 2000-2001. This effect is clear for the dyad (group 3) which associates two elitist AOC wine cooperatives, having also high scores of innovation and turn-over growth. The two central cliques (group 1 and 2) and their peripheral connections (group 5) seem to be very close as far as economic and innovation characteristics are concerned. We can just note that these groups are closer in 2000-2001 than in 1994-95. The three co-operatives playing a (weak) bridge role between the two central cliques (group 4) are not taking economic advantage of their position. On the contrary, they have lower scores than the others, for all innovation and economic indexes. So, except the elitist dyad, the involvement in sub-groups seems to have no strong influence on innovation specificity or economic differentiation in the cluster. But it doesn’t mean that this involvement doesn’t play any role in the global innovation process and performance of the cluster.

- Relational profiles seem to have more effects on innovation and performances. Four positions are statistically discriminated by both innovation score and turn over growth (the isolated profile 5 is not taken in account in the analysis). Bloc 1 is characterised by the highest score of innovation and performance. On the opposite, bloc 2 is discriminated by the lowest innovation score and wine price growth, and bloc 4 (having medium innovation score) by the lowest turn over growth. Bloc 3 presents scores very close to cluster averages. These results are consistent with our previous correlation analysis between in/out degrees and innovation scores (b) or economic performance scores (c).

- The number of co-operatives (31) is not sufficient to correctly test the possible complementary effects of both relational profile and direct connectivity degree with others. No dependence between profile and type of direct connectivity in the cluster can be found, expressing that numerous profiles are associated in each cohesive sub-group or connectivity degree (table 8). These combinations of different profiles (which have different effects on innovation and turn over growth) may suggest that the cohesive sub-groups are more spaces of information sharing about diverse innovation domains than spaces of strategic differentiation, except the dyad where the two co-ops stimulate each other for more innovation and performance.
<table>
<thead>
<tr>
<th>Profile</th>
<th>Profile 1</th>
<th>Profile 2</th>
<th>Profile 3</th>
<th>Profile 4</th>
<th>Profile 5</th>
<th>Total</th>
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<tr>
<td>1: clique 1</td>
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<td>2: clique 2</td>
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<td>1</td>
<td>1</td>
<td>0</td>
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</tr>
<tr>
<td>5: co-ops in periphery</td>
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<td>6: isolated</td>
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Table 8. - Relations between firms profile and direct connectivity

5. Discussion

5.1. Features of the co-operatives cluster

Advice relations between managers are proved to be as an essential component of the co-operatives cluster: by giving, diffusing or asking at least few advice, more between them than with external actors, geographically close firms both co-operate and compete, thus assuming different roles in the cluster. Advice relations appear to be linked with innovation dynamics, but either resulting from yet implemented strategies or predicting future choices, thus contributing to firms differentiation within the cluster. Such a complexity can not be construed by a linear diffusionist model of innovation. Moreover, if the most topical domains are little exchanged, a widely diffused discussion about grape and wine production, classification and payment systems, allows incremental improvements in firms and then the recognition by experts, at the regional level, of this area as the most in advance in these domains. In that sense, advice networks between co-operatives produce collective assets from which every firm benefits, as argued by Porter (1998).

Our analysis suggests the overlapping between advice relations and some institutional relations as common belonging to a union. The two identified cliques, for instance, clearly overlap with formal producers’ groups, yet often accused to be “empty structures” dedicated to subsidies capture. Nevertheless, in the present case, beyond their formal dimension, these groups distinguish themselves by a specific “strong” collective project, which, according to them, is making them closer whereas they were not particularly linked before. In the current heavy debate about relevant forms of network organisation for firms, the structure may indeed not be thought without/before its content. Beyond these few cliques, co-ops’ advisers appear as changing according innovation domains. That prompts us to a new approach of expertise and leadership in a productive firms cluster, in the “economy of quality” context where radical and multidimensional innovations may be performed both in value chains and territories (Allaire, 2002), thus stimulating co-ops to develop specific choices and skills. It
also confirms and illustrates the principle of “distributed cognition” highlighted by cognitive sciences in organisational settings (Conein, Jacopin, 1994).

5.2. *From network positions to innovation and performance dynamics*

As far as organisational innovation and performance are challenged, networks or economic sociologists point out specific positions in social networks. However, in our study case, prestige or betweenness centrality, for instance, are not significantly linked with high levels of innovation and competitiveness, at least at a global level. Several hypotheses may be argued:

a) co-ops managers do not act and react as the highly strategy-oriented actors, involved in a constant quest of relevant social relations, as the agents considered by Burt, Uzzi or Lazega. They may not be able or inclined to use their strategic positions in social networks for the interest of their co-operative. That prompts us to consider both cultural and human capital issues. Lazega stresses indeed the need for a “strategic culture” in the efficient building and management of relevant social capital (2001), whereas Burt points out the impact of education (1992). In Beziers cluster, only few co-ops managers, including presidents and directors, have been trained in firm management;

b) exchanged advice have a low quality level and/or are not directly useful. It may express a high level of competition between co-ops managers, reluctant to diffuse “what works”. The numerous historical references to petty local quarrels, as well as the low insertion of the more competitive co-ops in the networks, strengthen this hypothesis. However, in one case, a director coming from Bordeaux and managing a very efficient co-op (profile 5, cf. 4.3) would want to integrate but is rejected by locally born and anchored others. Human capital and psychology also condition the capacity to be aware and able to valorise practices or projects. Our qualitative approach shows indeed a low self-esteem, little charisma and/or a weak awareness within managers about yet interesting innovative choices they made;

c) the advice network between managers is not the most relevant nor efficient social network relative to firms innovation and performance. Indeed, as a co-operative consists in both an enterprise and an association, we chose to assess the networks of its president and director, but either only one is statistically significant or the two ones disturb each other, either the role of the board of directors, even of basic members, is much more efficient in the catch of relevant knowledge resources. Our previous works showed indeed the essential role of part-time members in innovation development (Chiffoleau, 2001). Moreover, our current works lead to prove an effective impact of another network, built by marketing ties and partnerships with market professionals, ranging from wholesalers to wine writers. Further works are going to be done on this topic.
We also have to precise the methodological limits of our work in considering statistical results: innovation and performance scores proceed from the firm long trajectory, are path-dependent, whereas networks may have changed a lot during the last years. Indeed, sociologists point out the rather high stability of (advice) networks in routine situations but not in radical innovation contexts, where outsiders may emerge as advisers. In that sense, the distribution of advice relations may appear as rather randomly structured, whereas the low number of the sample (31) limits statistics efficiency.

5.3. Beyond innovation and performance, the challenges of status and quality models

According to Blau (1964) and Lazega (2001), advice relations within a professional community shape the informal hierarchy of power, as well as they build status and authority positions, both due to the authority dimension of knowledge (Conein, 2003) and higher status recognition when asking advice to someone. In our case, prestigious co-ops appear as the biggest ones, early involved in the quality revolution, even if they did not follow (because they did not want or were unable) the “prestigious” strategy of AOC wines. Managing innovations in several domains is indeed surely more complex in these types of structures than in little co-ops located in AOC areas: experience thus appears as the basic source of status, more than economic assets or results alone.

As mentioned before, the most competitive and innovative co-operatives do not emerge as particularly prestigious whereas some low competitive ones do. Consistent with Lazega’s results, discussion with managers highlights a part of managers preoccupied by their status: some of the most efficient clearly consider the others “below them” and do not even want to get some compliance from them, preferring to build and stabilise their status in other networks. The competitive dyad, for instance, belongs to a club of “big wine producers” gathering co-operatives from the more prestigious vineyards of Bordeaux and Côtes-du-Rhône. On other hand, managers of low competitive co-operatives recognise they try to compensate low performances notably by giving advice on alliances or mergers they are often envisaging as a solution in their difficult situation, or by diffusing advice they catch out of the cluster, even if they do not apply them in their co-op.

Moreover, in such a geographical cluster dominated by plains where AOC trajectory is limited, the nature of these prestigious advisers is rather logical, but it also reveals the touchy debate about the relevant “quality models” for the Languedoc wine region. Indeed, new strategies are now implemented towards environment-friendly or organic production, insertion in a wine route… that may be efficient for such a region where, dramatically, alternatives to AOC or basic variety wines have to be found to compete with other wine producers from both Old and New World. As mentioned before, the landscaping issue about which innovative and competitive co-ops, AOC but also non AOC, ask and give advice, may differentiate the firms in a close future. We thus plan to follow innovation and
performance evolutions of the cluster during the next two years, in order to assess the possible impact of the current advice network structure.

5.4. Perspectives for action

Beyond correlation tests and results, the advice network analysis, associated with a precise assessment of economic assets, thus allows a better understanding of the professional community of wine co-ops managers in the South of France, for scientific but also operational issues. Even if advice relations between them seem not very efficient, at least regarding the scores we defined and which may be too general to practically catch their impact, they constitute the major part of their advice sources, whereas the more competitive co-ops are little involved in the networks: both surely limit the capacity of the cluster to progress. It is all the more a pity that co-ops develop contrasted strategies and choices, possibly complementary at the cluster level, about which they should benefit to exchange more. We thus organised feed-backs to let them know about the potentialities they do not valorise, especially in matter of human resources management that they assess as the most problematic domain and in which, however, some co-ops are developing interesting strategies. In such sessions, we notably stress the crucial role played by wine wholesalers who emerge as main advisers for many firms, that may limit their innovation trajectory, towards direct selling particularly.
Bibliography


SYAL, 2002. Systèmes Agro-alimentaire localisés. CIRAD, Montpellier (Workshop Cd-rom)


### Table 1. – Main characteristics of the 31 wine co-operatives in the cluster of Beziers

<table>
<thead>
<tr>
<th></th>
<th>average</th>
<th>minimum</th>
<th>maximum</th>
<th>total</th>
<th>% area</th>
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<tr>
<td>Volume (hectolitres)</td>
<td>76 200</td>
<td>8 790</td>
<td>431 000</td>
<td>2 362 300</td>
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<tr>
<td>Turn over (1 000 €)</td>
<td>4 365</td>
<td>460</td>
<td>19 000</td>
<td>135 320</td>
<td>75 %</td>
</tr>
<tr>
<td>Vineyard (hectares)</td>
<td>1 026</td>
<td>180</td>
<td>5 277</td>
<td>31 830</td>
<td>77 %</td>
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<tr>
<td>Number of members</td>
<td>265</td>
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<td>1 444</td>
<td>8 230</td>
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<td>AOC wine (hectolitres)</td>
<td>12,5 %</td>
<td>0 %</td>
<td>73 %</td>
<td>194 400</td>
<td>71 %</td>
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<td>variety wine (hectolitres)</td>
<td>27 %</td>
<td>0 %</td>
<td>63 %</td>
<td>611 400</td>
<td>82 %</td>
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<td>table wine (hectolitres)</td>
<td>49 %</td>
<td>7 %</td>
<td>81 %</td>
<td>1 249 800</td>
<td>80 %</td>
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### Table 2. - Linear correlations between structural data, innovation and performance

* : p < 0,05 ; **: p < 0,01

<table>
<thead>
<tr>
<th>Variable</th>
<th>Farmer income per hectare</th>
<th>Farmer wine price</th>
<th>Turn over growth</th>
<th>Innovation score</th>
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<td>Volume (hectolitres)</td>
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<td>0.80**</td>
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<td>0.53**</td>
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<td>variety wine (hectolitres)</td>
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<td>-0.36*</td>
<td>-0.26</td>
<td>-0.12</td>
</tr>
<tr>
<td>table wine (hectolitres)</td>
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<td>-0.51**</td>
<td>-0.36*</td>
<td>-0.54**</td>
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<td>Area in grape classification</td>
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<td>0.50**</td>
<td>0.38*</td>
<td>0.32</td>
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<td>Score of innovation</td>
<td>0.26</td>
<td>0.61**</td>
<td>0.51**</td>
<td>1.00**</td>
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### Table 6. – Correlations between co-operatives structures, innovation scores, performance and networks scores
Table 7. Innovation and performance scores for each connectivity group and each relational profile
Significant variable in discriminant analysis *: p <0.05

<table>
<thead>
<tr>
<th></th>
<th>income per hectare 94-95</th>
<th>income per hectare 00-01</th>
<th>Farmer wine price 94-95</th>
<th>Farmer wine price 00-01</th>
<th>Turn over growth</th>
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<tr>
<td>High density clique (G:1)</td>
<td>18500</td>
<td>21644</td>
<td>278*</td>
<td>280*</td>
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<td>Medium density clique (G:2)</td>
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<td>276*</td>
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<td>Bilateral relation (G:3)</td>
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<td>436*</td>
<td>443*</td>
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<td>Bridges between cliques (G:4)</td>
<td>21700</td>
<td>17528</td>
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<td>255*</td>
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<td>Periphery of the cliques (G:5)</td>
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Graph 1. – Advice network between co-operatives about grape and wine production
In green : the highest in-degree score, in blue : the highest out-degree score
Graph 2. – Discriminant analysis of low, medium, high innovation score co-ops (G1, G2, G3)
Racin 1: out-deg human resources (-0.42), out-deg landscaping (+0.32), betweenness score (-0.29), prestige (+0.22)
Racin 2: out-deg marketing (+0.29), out-deg landscaping (-0.29), out-deg alliance (+0.22), out-deg ext (+0.22)
## Appendix 1. Network scores of co-operatives of Beziers cluster

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<tr>
<th>Vine-wine</th>
<th>Clas-pay</th>
<th>Comm</th>
<th>Alliances</th>
<th>Hum res</th>
<th>Landscaping</th>
<th>Total</th>
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