What lies beyond geographical proximity: an investigation into multirelational networks[1]

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1. INTRODUCTION

In the literature on innovation and organisational learning, the focus on informal learning has become increasingly evident. This trend is based on the recognition that informal learning is the dominant mode of learning in smaller and locally operating firms, as well as being important for large corporations. Typically, in small organisations the financial and opportunity costs of formal (i.e. institutional or planned) learning are often perceived by the owner-managers as too great to bear. This is where informal learning comes to the fore, as ad-hoc or unplanned learning is undertaken to meet the immediate needs of the organisation. Theoretical and empirical studies suggest that such informal learning makes extensive use of peer and personal networks (see among others: Slicher von Bath, 1963; Jovanovic and Rob, 1989; Ellison and Fundenberg, 1993, 1995; Bala and Goyal, 1995, 1998; Morone and Taylor 2004a, 2004b).

However, it remains quite difficult to untangle formal and informal learning. Whereas formal learning can result in the establishment of informal networks based on shared career paths (e.g. school, university, college, former employment), informal networks can influence the establishment of formal cooperation (e.g. hiring routines and links with institutions). Furthermore, there is an alternative path to enhancing the organisational knowledge-base: hiring knowledgeable employees. Although this clearly suggests that many sources for learning are to be found outside the organisation, the

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predominant view of the firm is that of the large organisation, meeting these challenges of innovation and learning from within.

This research aims at understanding the link between formal networks and informal learning by means of a case study, investigating how knowledge flows among small firms and the numerous supporting institutions that lie within a particular sector of the economy. We shall concentrate our attention on a backward area located in the south of Italy (i.e. the province of Foggia) where we will consider a group of 16 formal institutions which support organic food production and a group of 66 firms which are directly involved in the production of organic food.

This sector was deliberately chosen in order to investigate the existence and extent of such informal mechanisms within a scenario of nominally formal relations. The research question is centred on the impact of informal interactions and the importance of geographical proximity in determining the knowledge flows among heterogeneous agents operating in a similar area.

We look at the impact of informal learning mechanisms upon the capability of these local institutions and firms to implement appropriate local development strategies. In other words, we investigate whether the geographical proximity of firms and institutions is generating an Industrial District (ID) kind of development. In fact, the Industrial District model, characteristic of certain areas of central and north-eastern Italy, has recently been considered by some scholars as a viable way for the economic take-off also of the backward areas of the Italian Mezzogiorno. Nonetheless, this idea has generated, among some researchers, a substantial scepticism as for the reproducibility of such models in local contexts which differ from the original ones.

By means of questionnaires we collect information upon the connections existing among these local actors. The analysis of the data will allow us to study the network structure connecting firms with other firms, firms with institutions and institutions with other institutions.

Once the geographical network within which firms and institutions interact has been described we shall turn our attention to the core question of this study: i.e. how knowledge flows within this network. From our investigation it appears that the industrial district experience, advocated by some scholars as a possible solution to promote economic growth in backward areas of the south of Italy, seems to be rather complicated to be replicated in local areas which lack critical requirements for

development (i.e. good infrastructure, access to modern technologies, endogenous capabilities to accumulate and innovate).

In other words, the core finding of this research is that the existence of networks is a necessary condition to promote informal knowledge flows, yet not a sufficient one. Several obstacles to activate knowledge interaction have to be removed before expecting to see the positive effects of geographical clustering and proximity.

2. A BRIEF REVIEW OF THE LITERATURE

More than a century ago the development model associated with the so-called Industrial District (ID) had attracted the attention of many scholars, beginning, rather unnoticeably, with the study of Marshall (1890), when the term Industrial District had acquired a meaning which goes beyond its descriptive role. Marshall's study represents the turning point in which the term ID had started to be treated as a socio-economic concept. As pointed out by Frank McDonald and Fiorenza Belussi the Marshall's concept of industrial district was "based on the importance of external economies to understand the development of agglomerated cluster of small and medium-size firms" (2003: 6). This idea was then reinterpreted in the "literature on Italian industrial districts on the learning issue. These works focus on the benefits of external economies emerging from the close proximity of actors in the process of economic activity" (McDonald and Belussi, 2003: 6).

This line of research was mainly developed by the Florentine school and most notably, by the economist Giacomo Becattini who has reorganised Marshall's observations into a more consistent outline; a work which, to a certain extent, has resulted in the reinterpretation of Marshall's writing. These researchers elaborate upon the "Marshall's concept of industrial atmosphere that consist of a business and social environment conducive to the acquisition of the benefits of proximity deriving from imitation, vicarious learning, quick adoption, and technical change and innovation introduced thanks to the generation of collective new knowledge" (McDonald and Belussi, 2003: 6).

Becattini was the first to assert that the concept of ID could be considered as a new unit of analysis (Becattini, 1987; 1979). In this new framework, the term ID served to describe a unit which is somewhere between the sector and the single firm; a term which could be constructive in explaining the resilience of the small firm sector, and in particular the morphological complexity of the Italian industrial structure. Such an

understanding of the term (as a socio-economic concept) enables a more complete analysis of the industrial organization, an analysis that includes also parameters such as the influence of the external environment and of the local "community" (Becattini, 1990). This reinterpretation of Marshall's work was, to a certain extent, part of a wider academic search for a new analytical economic framework, to stand out against the neoclassical paradigm of the economic theory that sees the firm as a maximiser agent within a context of perfect rationality and complete information (Loasby, 1992; Groenewegen, 1995; Hodgson, 1993).

Several authors, while studying ID, have focused their attention to the web of social interrelations developed by local actors. Studies regarding the performance of ID clearly reveal that the key factors of success are mainly the resources which are socially constructed, defined also as "advanced resources" (as opposed to basic resources, which are already present in the local reality) (Porter, 1990). Hence, the attention of researchers has been focused on two core aspects: first, on the co-operative relations between firms and the productive system as well as the socio-cultural-institutional environment in which they operate (Garofoli, 2003: 14) and second, on how such a system is able to produce positive externalities for local operators (mainly in terms of knowledge diffusion efficiency).

Within this new framework of research, knowledge and the various mechanisms of learning play a central role in determining the development of local productive systems (Lundvall, 1992). Indeed, a considerable part of knowledge, which is involved in production processes is locally contextualized. In other words, it is not transferable from one place to another (as it is hard to interpret) and, as such, it can be defined as *tacit* (Rullani, 2002: 75). This kind of knowledge can be largely transferred in an informal manner by means of interpersonal relations between the operators involved in the production processes or by direct observations, thus becoming accessible only through the local contextualisation. These forms of informal learning were defined as 'interactive learning' or 'collective learning' (Camagni, 1991; Lundvall, 1992) and represent an important part of the competitive advantage of firms that follow the logic of special agglomeration and informal cooperation (You and Wilkinson, 1994).

In this perspective it is clear that the notion of ID appears now strictly related to the process of knowledge diffusion and it is particularly relevant how tacit knowledge flows among local actors. In fact, as pointed out by several authors (Polanyi, 1962, 1966; Bartlett et al., 1990), a great deal of knowledge is still largely *tacit* in its nature

and hence tightly bounded to informal face-to-face interactions. Indeed this assumption holds true also in the era of information and communication technology.

Several empirical studies suggest that at the local level, where firms share the same values and background as well as the ability to understand and handle technical and commercial problems, there is, undoubtedly, a constant exchange of *tacit* knowledge (Nelson, 1987; von Hippel, 1988). The ability to exchange *tacit* knowledge represents an important element of the firms' competitive advantage, following the logic of spatial agglomerations (Maskell, 2003: 357). Hence, in this new theoretical framework, it is obvious that it is the pervasive presence of *tacit* knowledge itself that represents the real competitive advantage of firms' networks and IDs in particular.

Following this line of research, we can maintain that an ID is a cluster of firms which goes beyond geographical proximity and which entail constant flows of tacit knowledge among agents (which could be firms as well as institutions) that share a common language and a similar cognitive structure. In this paper we shall test if the cluster of firms and institutions operating in the organic food sector located in the province of Foggia could be considered an industrial district in the sense described above. We will perform our test by investigating directly the existence of actual flows of knowledge and information within this cluster of firms and institutions. In order to do so we will make use of social network analysis which will prove to be a useful tool to rich our research target.

3. METHODOLOGY OF THE STUDY

Social networks and social network analysis are fields of increasing interest among social scientists. Much of this interest is attributed to the relationships among social actors and to the patterns and implications of these relationships on the economic, political and social environment.

Social network analysis has its historical roots in the disciplines of sociology, social psychology and anthropology, and it focuses on networks' structural description. It represents a distinct research perspective within the social sciences as it is based on the assumption that relationships among interacting units are essential in understanding individual and social dynamics. Therefore it offers theories, models and empirical studies articulated in terms of relational analyses.

The core unit of analysis is, of course, the social network defined as "a specific set of linkages among a defined sets of persons with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behaviour of the persons involved" (Mitchell, 1969: 2). That is, "a social network consists of a finite set or sets of actors and the relation or relations defined on them" (Wasserman and Faust, 1994: 20).

Some relevant basic concepts of network analysis worth mentioning are: (*i*) actors and their actions are viewed as interdependent rather than independent units; (*ii*) relational ties between actors are channels for transfer or *flow* of resources (either material or immaterial); (*iii*) network models focusing on individuals view the network structural environment as a source of opportunities for or constraints on individual action; (*iv*) network models conceptualize structure as lasting patterns of relations among actors (Wasserman and Faust: 1994).

The method of Social network analysis provides an explicit formal way of measuring social structural properties (referred to actors in a given set). In other words, this tool seeks to model the relationships among a set of actors to describe the structure of the group. In this sense it is a valuable tool for studying articulated firms and institutional networks such as industrial districts.

The network analysis method combines two different literatures, that on graph theory and that on matrix algebra.[2] This allows researcher to represent information about patterns of ties among social actors and enables to represent the structure of a system and describe it as a set of interconnected elements. Moreover, using these tools will allow us to evaluate and measure social relations and knowledge flows among individual actors, groups and organizations. In other words social network analysis will allow us to measure the network's efficiency in diffusing knowledge.

The graph theory approaches a social network as a social system model consisting of a set of actors and the existing ties among them. For the purposes of this paper, the social network is structured as a network graph consisting of nodes (vertices) and connections (edges). In other words we could define such network as a "nonempty set of elements, called vertices, and a list of unordered pairs of these elements called edges" (Wilson and Watkins, 1990). In our analysis vertices correspond to firms or local institutions and edges are the existing connections. Formally we have $G(I, \Gamma)$, where $I =$

[2] The conjoint use of both of the techniques is required to avoid, as it is likely to happen, graphs of different shapes generated by the same matrix.

$\{1, \ldots, N\}$ is the set of vertices, and $\Gamma = \{\Gamma_i, i \in I\}$ gives the list of vertices to which each vertex is connected.

The graphical display may prove to be inadequate with a growing number of actors and relations. Therefore, in order to get more specific information on the nature of relations and on the network properties a matrix analysis would be a more useful tool (Maggioni, 1994). The mathematical base of the graphical construction is socio-matrix. The two dimensions of the matrix are indexed by the sending actors (the rows) and the receiving actors (the columns). A socio-matrix for a dichotomous relation is the *adjacency matrix* that quantifies the ties between the actors. That is, a two dimensional matrix in which the generic element $a_{ij} = 1$ if among actors i and j a relation exists, and $a_{ij} = 0$ if not.

3.1 Properties of the Network

When studying social networks, we must consider the fact that fully saturated networks are rare, particularly where the population consists of more than a few actors . In this regard, it would be useful to look at how close a network is to realizing this potential. For example, the *density* of a sociomatrix is defined as the ratio of actually present ties to all possible connections. This index goes from *1*, if all possible ties are present, to *0*, if there are no lines present. It could be calculated as:

$$\Delta = \frac{L}{\frac{N(N-1)}{2}} = \frac{2L}{N(N-1)} \tag{1}$$

where Δ is the density of the graph, L the number of lines in the set and g the number of actors or nodes. Another property is *inclusiveness*: it refers to the number of points which are included within the various connected parts of the graph. That is the total number of nodes minus the number of isolated points. The most useful measure of inclusiveness for comparing various graphs is the number of connected points expressed as a proportion of the total number of points. An isolated vertex is a node with no connections; hence it has nothing to contribute to the density of the graph. Therefore, the more inclusive is the graph, the denser it will be.

Furthermore, networks can have one or more kinds of relations existing between pairs of actors. To enhance our understanding of social networks we shall extend the analysis to another variable such as the nature of relations between actors. We can have, and this is true especially for firms, more than one kind of socio-economic relations, as

they relate to different kinds of exchange (Lomi, 1991: 48). In order to deal with this further complication we shall consider *multi-relational networks*, which classify different typologies of social relations in the following two comprehensive categories:

- *material relations* (goods or money exchange, services, labour services, etc.)
- *communicative relations* (information and knowledge exchange).

As a final note it is worth mentioning that we can categorize networks according to the nature of the sets of actors and the properties of the ties among them. The numbers of sets of entities on which structural variables are measured define the mode of a network. A *one-mode network* consists of a single set of actors, where the ties of each actor are enumerated. A *two-mode network* involves two sets of actors or one set of actors and one set of events (Wasserman and Faust, 1994).

In the two-mode network, the first of the two interacting actors can be called the *sender* or *originator*, while the second the *receiver* or *recipient* (or, simply, *actor* and *partner*). Furthermore, we can distinguish between *homogeneous* or *heterogeneous* pairs of actors, depending if they are from the same or from different sets, respectively (Wasserman and Faust, 1994: 85). In the empirical analysis presented below we shall consider *multi-relational* networks as well as *two-mode* networks.

3.2 Empirical Analysis: Sample and Data Collection

As already mentioned we concentrated our attention on a backward area located in the south of Italy (i.e. the province of Foggia) where we considered a group of formal institutions which support organic food production and a group of firms which are directly involved in the production of organic food. We studied a two-mode network, including the set of local firms operating in the organic sector and the set of the local institutions. In particular, we focused on how the firms relate to each other, how the institutions interact with each other and how the local organic firms are connected with the institutions.

In the area of Foggia there are 120 organic industrial firms out of which we chose a sample of 32 units selected with the *focus group* technique. This technique provides qualitative information on a specific theme by playing on the interaction and confrontation of points of view expressed by participants in a discussion conducted by a facilitator (European Commission, 1999). In this study case, participants to the focus group belonged to Local Public Institutions, Research centres, Entrepreneurial associations; Certification agencies (i.e. quality control agencies) from which

interaction we obtained a draft of the *organic firms' network* whose structures was checked and corrected during the direct survey. In particular, the *firms' network* structure was subsequently augmented to 66 units following a *free recall* approach.[3]

The institutions supporting productive structures and activities of the organic sector in the area of Foggia consist of 33 units, out of which we chose a sample of 16 institutions.[4] Also formal institutions' relational data were collected with the *focus group* technique in order to obtain the roster of observable actors. This list included also actors external to the Foggia region but whom are still very relevant: from a dynamical perspective the absence of external relations could cause the death of the system due to its small innovative capability (Bramanti and Senn, 1991).

The questionnaire, submitted with face-to-face interviews both to firms and institutions, was structured in two parts. The first part aimed at gathering general information on the characters of the firm or institution. The second part aimed to collect information on relations and, more precisely, on the existence or not of ties, its nature and, in the case of communicative relations, the kind of information exchanged. We classified the communicative interactions in three sub-groups: production system related; law system related; market system related.[5] A tie was established only if the existing connection was confirmed by both actors.

On the basis of this information, in order to understand the whole structure of the local organic sector, we studied the structural character of three different networks:

- the networking among local organic industrial firms;
- the local socio-institutional network supporting organic production;
- the interaction between the set of firms and the institutional system.

For each and every of these three networks a general interaction was established every time two actors where involved in trade relations, ownership relations (i.e. one firm owns entirely or partially another firm) and/or communicative relations. Moreover, we singled out the communicative relations from the general interactions. In particular a communicative relation was establishing every time there was an exchange of knowledge/information related to the law system, the market system and/or the

[3] With this technique, respondents were asked to name those firms with whom had relations without referring to a fixed list (Ferligoj and Hlebec, 1999). Hence, we included in the sample those firms which were mentioned as *link* by any firm originally included in the target sample.
[4] We are in the process of extending the analysis both to the universe of firms and institutions operating in the organic sector in the area of Foggia.
[5] Please refer to the appendix where the actual questionnaire used is supplied.

production system. This letter typology of communicative interaction was labelled 'knowledge interaction'.

It is important to mention that interviewed firms belongs to four different value chains: Olive oil production; Cereal, pasta and flour production; Fruit and vegetable production; Wine production. This fact might undermine the importance of knowledge flows directly related to the production system, however should not affect the importance of law system and market system related interactions as all firms belong to the organic sector and therefore operate in the same market and face the same law system.

4. RESULTS

Network descriptive measures as well as firms and institutions indices about general interactions and knowledge flows were analysed using the network analysis software toolkit UCINET 6.0 (Borgatti, Everett and Freeman, 1999).

4.1 Description of the networks

The analysis revealed the presence of a network[6] of 66 organic firms, linked by 56 undirected ties of different kinds (fig.1).

It is clear that the network is not a fully saturated one where all possible ties are actually present[7]. However, the network is cohesive enough, as it shows an inclusiveness of 97% (table 1). In such a structure, most of the actors can reach each other in one way or another.

Table 1 – Firms network indexes

Firms Network	Number of actors	Number of relations	Density	Inclusiveness
Network of interactions	66	56	2.6%	97%
Communicative network	66	37	1.7%	68%
Knowledge network	66	19	0.9%	38%

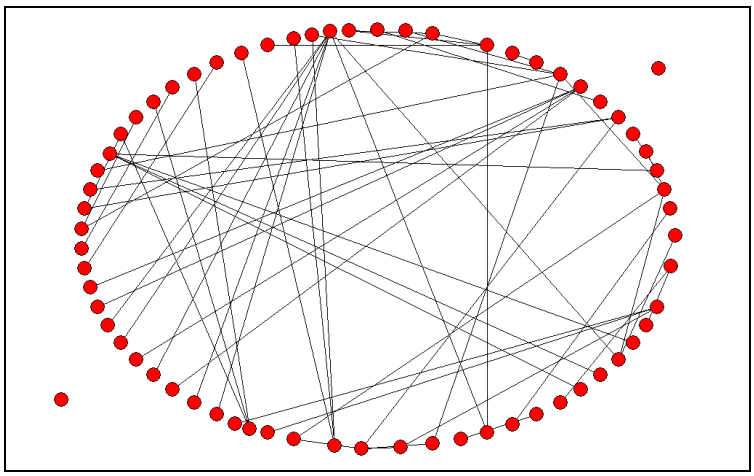
As we can note in figure 1, only two firms are completely disconnected from the network. As mentioned in the previous section the original network was built regardless

[6] The sociomatrix is a homogeneous and squared matrix of dimensions 66x66.
[7] As the number of possible relations among 66 nodes is much higher than 56, the graph shows a fairly small density.

of the nature of the ties from which it is made. This means that it contains all kinds of ties connecting local firms, whether it is a trade relation, an information exchange, or a longer-lasting cooperative relation. This network (called *network of interactions*, as it contains all relations identified) simply describes the relational structure connecting the 66 firms.

As a following step, we focused our attention on the nature of ties and on the structure of the resulting networks. According to the multi-relational network theory, by distinguishing relations on the basis of their nature, it is possible to rebuild, with the same actors, new networks that are subsets of the whole network. For example, we can make a distinction between pure material relations from those that are also communicative.

Figure 1 – Firms environment: Network of interactions



As already mentioned, communicative relations are those through which firms exchange different kinds of knowledge/information (production system related, law system related, market system related) useful to their activity. The selection of these relations enabled us to identify another network that we called *communicative network* (fig. 2). This latter network is formed by a much lower number of undirected relations: 37 as opposed to 56. It results in a graph which is more disconnected, showing a higher number of isolated nodes (21 with respect to 2 of the former network) and, obviously a

much lower inclusiveness.[8] This suggests that only few of the firms interacting in the local organic sector are actually engaged in information and knowledge exchanges.

Figure 2 - Firms environment: Communicative Network

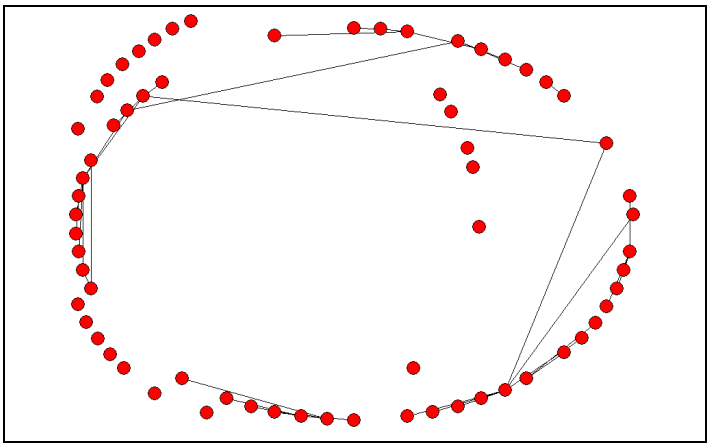
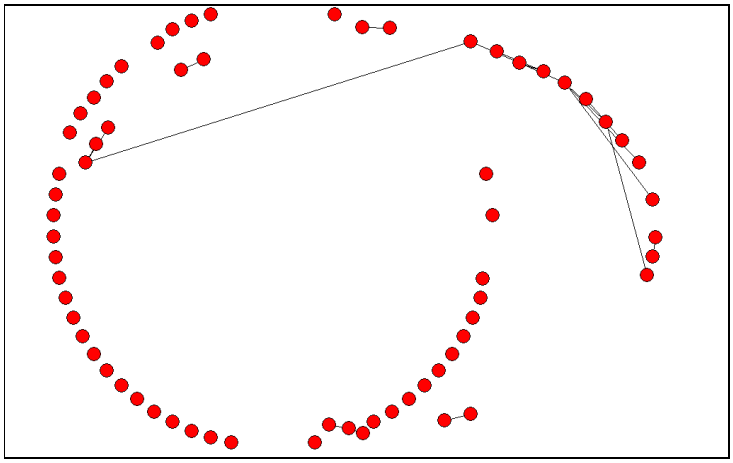


Figure 3 - Firms environment: Knowledge Network



This tendency is more accentuated if we make a further specification regarding the nature of the communicative relations. In fact, if we select among the communicative relations only those in which there is a real exchange of technical knowledge (information exchange that can affect directly the firm's productivity – i.e. what we called *production system related* knowledge), the network performance (that now we can call *knowledge network)* is heavily undermined (fig.3). In this case, the

[8] Which is, nonetheless, of 68%.

picture changes completely if compared to the *interactions network*: we have only 19 ties and 41 disconnected actors. Hence, the network is highly disconnected.

However, we should bear in mind that this last result is subject to the afore mentioned caveat that firms operating in different value chains might have little to exchange in terms of production related knowledge.

The analysis of the institutional network reveals the same tendency, although in a less heightened manner. As can be seen in table 2, the *network of interactions* among institutional actors, even if smaller than the firms' one,[9] shows a higher number of undirected ties (59) which in turn shows, on the whole, a higher cohesion (fig. 4a).

Table 2 – Institutions network indexes

Institutions Network	Number of actors	Number of relations	Density	Inclusiveness
Network of interactions	16	59	50.0%	94%
Communicative network	16	28	23.0%	81%
Knowledge network	16	15	12.5%	69%

Only one actor is isolated and the network density is of about 50%. However, also in this network, these indexes undergo a substantial reduction if we consider the way in which knowledge/information flows through it:

- in the *communicative network*, the number of ties decreases to 28 and the density is reduced to 23% (fig. 4b);
- in the *knowledge network*, the number of ties decreases to 15 and the network density to 12.5% (fig. 4c).

Figure 4 - The socio-institutional environment

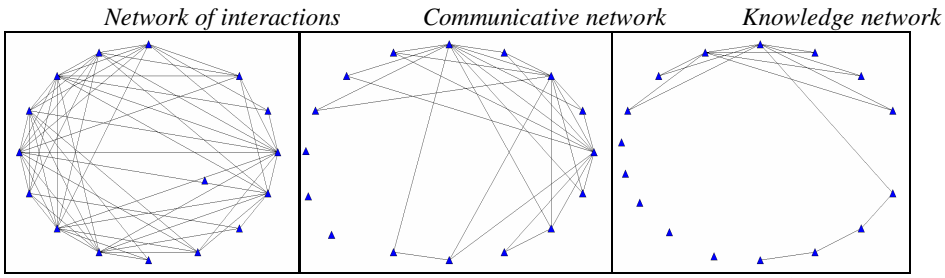


Figure 4a Figure 4b Figure 4c

[9] The sociomatrix is a homogeneous and squared matrix of dimensions 16x16.

The trend observed in the firms' system is confirmed also in the surrounding social environment: moving the focus of our analysis from multiple relations to merely communicative relations the network under investigation becomes highly disconnected. It is only reasonable to expect that further confirmation will come from the structural analysis of the network between firms and their surrounding institutional environment.

As to know fully how tacit knowledge flows within a region, we should know how it flows in the environment in which institutions and firms operate, because we couldn't think the activity of the former unconnected from the latter, we have turned our attention to the firms-institutions network until establish a complete system.

Therefore, in order to understand how information and knowledge flow from the institutions to the firms and how they circulate through the network, we have investigated the network created with the firms and the institutions sets. We obtained a dichotomous rectangular sociomatrix with dimensions 16×32[10], where the institutions are the senders while the firms the receivers of information and knowledge flows. The analysis showed the existence of a network in which 48 actors, linked by 106 directional ties of three different types, interact (table 3).

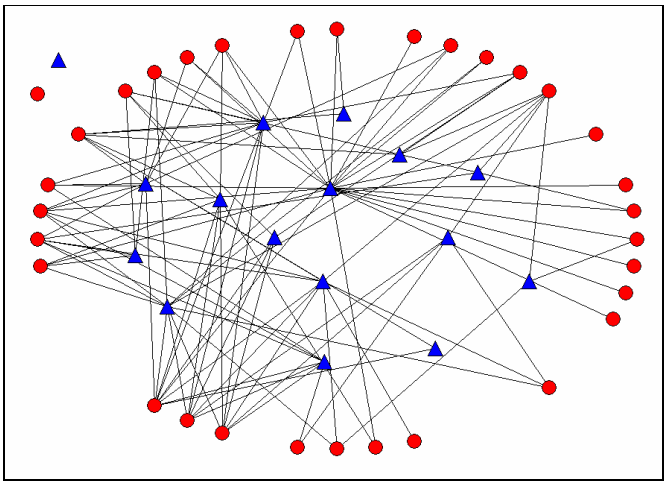
Table 3 – Institutions - Firms network indexes

Firms-Institutions Network	Number of actors	Number of relations	Density	Inclusiveness
Network of interactions	48	106	9.40%	96%
Communicative network	48	101	8.95%	92%
Knowledge network	48	28	2.48%	52%

For the three kinds of networks we can assert that there are directional relations from institutions to firms. The *network of interactions* (fig. 5)[11] is not fully saturated, but we observed a density (9.40%) higher than the one observed in the firms' network, although it was much lower than the institutions' one. However, the network shows an inclusiveness of 96%; as we can see in the graph, only two actors are isolated (one firm and one institution).

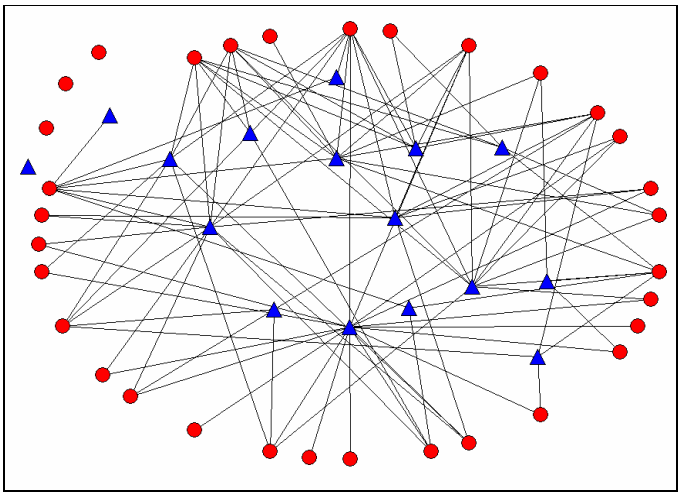
[10] We go back to the original firm sample size, dropping those firms added through the *free recall* approach. This is necessary because we did not collect information on linkages among institutions and this later introduced group of firms.
[11] We used circles for firms and triangles for institutions.

Figure 5 – Institution/Firms environment: Network of interactions



In the *communicative network* (figure 6) we have a slightly smaller number of directional relations: 101 as opposed to 106. It resulted in a graph which is still highly connected (there are only three firms and one institution disconnected) and highly inclusive (92%). Overall the communicative network performance is rather satisfactory; it indeed emerges that institutions play a determinant role in boosting communication and promoting information diffusion among firms operating in the organic food sector.

Figure 6 – Institution/Firms environment: Communicative network



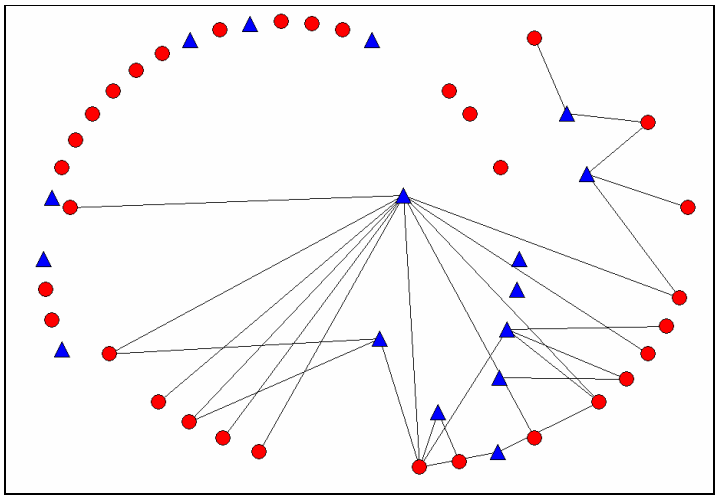
Comparing the number of ties observable in figure 6 with those earlier observed in the firms' communicative network (figure 2) we can maintain that if on the one hand the percentage of firms involved in communications interactions is rather low, on the

other hand the number of institutions involved in communication interactions with organic firms is indeed high. This finding would suggest that institutions are actually an asset for the Foggian organic food network.

If we consider the third network, the *knowledge* one, the density drops to 2.48% and the inclusiveness to 52%. As we would expect, the graph is now much more disconnected, as the number of isolated actors increases to twenty (12 firms and 8 institutions) (fig. 7).

However small and unconnected the network looks now, it is still possible to point out how few institutions play a substantial role in diffusing knowledge among a group of firms. It would be interesting to investigate thoroughly the nature of these knowledge interactions. At present we are in the process of extending our research by submitting supplementary questionnaires. This further investigation will allow us to gather more information and address this question.

Figure 7 – Institution/Firms environment: Knowledge network



5. CONCLUSIONS

The case examined in this paper leads us to draw two important conclusions. First, that in the Foggia organic food sector, notwithstanding the existence of a rather cohesive network, knowledge and information flows among firms remain a fairly marginalised occurrence. This finding is confirmed when looking specifically at

knowledge flows (i.e. production system related interactions) as well as when looking more generally at communicative interaction. As discussed earlier the poor performance of *knowledge networks* could be impute to the fact that the set of firms considered in this investigation belong to different value chains. However, this caveat should not hold for the overall *communicative network* where the exchange of knowledge/information directly related to the production system is considered jointly with the exchange of knowledge/information related to the market structure and/ore the law system. In light of this first conclusion we can maintain that the existence of a cohesive network is not by itself a sufficient condition for positive externalities associated with knowledge exchange in the surrounding environment.

As a second important result we found that institutions play a significant role in each kind of network considered. For instance, the role played by supporting institutions in fostering the diffusion of information related to production system, law system and market system is quite relevant. This makes the firms-institutions communicative network highly dense (especially if compared with the firms' communicative network). Also the firms-institutions knowledge network is denser and more inclusive when compared with the firms' network: as far as knowledge flows are concerned, one can immediately see that few institutions play a key role in the network configuration. Indeed, this finding, although preliminary, suggest that formal institutions play a major role in promoting organic food production. The social capital embodied in such institutions seems to represents a key asset in this sector mainly composed by small operators which require substantial assistance in the production activity.

This research marks a first step on a bigger, and wider in scope, project which aims at a better understanding of the stylised facts observed through this study. As a suggestion for further research we are concerned with identifying the obstacles to the generation of positive "knowledge" externalities and reflecting upon the general characteristics that make one industrial area differ from the other. We also aim at better understanding the role played by supporting institutions in promoting organic food production. In order to do so we shall undertake further analysis of the Foggia case as well as comparative studies in other geographical areas.

References

Bala, V. and S. Goyal (1995): "A Theory of Learning with Heterogeneous Agents", *International Economic Review*, 36(2): 303-323.

Bala, V. and S. Goyal (1998): "Learning from Neighbours", *Review of Economic Studies*, 65: 595-621.

Bartlett, C. A., Doz, Y. and Hedlund, G. (1990): *Managing the Global Firm*, Routledge: London.

Becattini, G. (1979): "Dal 'settore industriale' al 'distretto industriale'. Alcune considerazioni sull'unità d'indagine dell'economia industriale", *L'Industria*, 1.

Becattini, G. (1987): "L'unità d'indagine", in Becattini, G. (ed.), *Mercato e forze locali: il distretto industriale*, Il Mulino, Bologna.

Becattini, G. (1990): "The Marshallian Industrial District as a Socio-economic Concept, in Pyke, F., Becattini G. and Sengenbergen W. (eds.), *Industrial District and Inter Firms Cooperation in Italy*, Genova: International Institute for Labour Studies.

Borgatti S. P., M. G. Everett and L. C. Freeman (1999): *UCINET 6.0. Version 1.00*, Natick: Analytic Technologies.

Bramanti, A. and L. Senn, (1991): "Innovation, firm and milieu: a dynamic and cyclic approach', in Camagni, R. (ed.), *Innovation Networks: Spatial Perspectives*, Belhaven Press, pp 89-104.

Camagni, R. (1991): "Introduction: from the local 'milieu' to innovation through cooperation networks", in Camagni, R. (ed.), *Innovation networks: spatial perspectives*, Belhaven Press, London.

Ellison G. and D. Fudenberg (1993): "Rules of Thumb of Social Learning", *The Journal of Political Economy*, 101(4): 612-43.

Ellison G. and D. Fudenberg (1995): "Word-of-Mouth Communication and Social Learning", *Quarterly Journal of Economics*, 110(1): 93-125.

European Commission (1999): *Evaluating socio-economic programmes: Principal evaluation techniques and tools*, MEANS Collection, Volume 3, Office for official publication of the European Communities, Luxembourg.

Ferligoj, A. and V. Hlebec, (1999): *Evaluation of social network measurement instruments, Social Networks*, n. 21, Elsevier, North Holland.

Garofoli, G. (2003): *Imprese e territorio*, (ed.), il Mulino, Bologna.

Groenewegen, P. (1995): *A Soaring Eagle: Alfred Marshall 1842-1924*, Aldershot: Edward Elgar.

Hodgson, G. (1993): *The Economics of Institutions*, Edward Elgar, Cheltenham.

Howells, J. R. L. (2002): "Tacit Knowledge, Innovation and Economic Geography", *Urban Studies*, 39 (5–6): 871–884.

Jovanovic, B. and R. Rob (1989): "The growth and diffusion of Knowledge", *Review of Economic Studies*, 56(198-9): 569-82.

Loasby, B.J. (1992): "Market co-ordination", in Caldwell, B.J. and Boehm, S., (eds.), *Austrian economics: Tension and new directions*, Boston: Kluwer Academic Publishers.

Lomi A. (1991): *Reti organizzative Teoria, Tecnica e Applicazioni*, il Mulino, Bologna.

Lundvall, B.-Å. (1992): *National Systems of Innovation*, (ed.), Pinter Publishers, London.

Maggioni, M.A. (1994): "Metodologie reticolari per l'analisi della dinamica industriale e delle politiche regionali", in G. Garofoli - R. Mazzoni, (eds.), *Sistemi produttivi locali: struttura e trasformazione*, Franco Angeli, Milano.

Marshall, A. (1890): *Principles of Economics*, Macmillan, London.

Maskel, P. (2003): "Creazione e diffusione di conoscenze nel 'cluster' di imprese: implicazioni per lo sviluppo regionele", in Garofoli, G. (ed.), *Imprese e territorio*, il Mulino, Bologna.

McDonald F. and F. Belussi (2003): "Industrial Districts: a State of the Art Review", *Project West-East ID "Industrial Districts' Re-Location Process: Identifying Policies in the Perspective of European Union Enlargement"*, Contract no. HPSE-CT2001-00098.

Mitchell, J.C. (1969): "The concept and Use of Social Network", in Mitchell J.C. (ed.), *Social Networks in Urban Situations*, Manchester University Press, Manchester.

Morone, P. and Taylor, R. (2004a): "Small World Dynamics and the Process of Knowledge Diffusion. The Case of the Metropolitan Area of Greater Santiago De Chile", *Journal of Artificial Societies and Social Simulation*, 7:1

Morone P. and R. Taylor (2004b): "Knowledge Diffusion Dynamics of Face-to-Face Interactions", *Journal of Evolutionary Economics*, 14: 327–351.

Nelson, R. R. (1987): "The Role of Knowledge in R&D Efficiency", *Quarterly Journal of Economics*, 97: 453-470.

Nooteboom, B. (1999): "Innovation, learning and industrial organization", *Cambridge Journal of Economics*, 23: 127-150.

Polanyi, M. (1962): *Personal Knowledge*, Routledge: London.

Polanyi, M. (1962): *The Tacit Dimension*, Routledge: London.

Porter, M. (1990): *The Competitive Advantage of Nations*, MacMillan, London.

Rullani, E. (2002): "Il distretto industriale come sistema adattivo complesso", in A. Quadrio Curzio and M. Fortis (eds.), *Complessità e distretti industriali*, Collana della fondazione Edison, Il Mulino, Bologna.

Sisto, R. (2003): "Il sistema istituzionale a supporto delle produzioni agricole biologiche nella provincia di Foggia: un'analisi reticolare", *Rivista di Economia Agraria*, n. 2.

Slicher van Bath, B. H. (1963): *The Agrarian History of Europe, a.d. 500-1850*, London: Arnold.

Viesti, G. (1992): "Crisi ed evoluzione dei distretti industriali", in F. Onida, G. Viesti and A. M. Falzoni (eds.), *I distretti industriali: crisi o evoluzione?*, E.G.E.A. S.p.A., Milano.

You J. and I. F. Wilkinson (1994): "Competition and cooperation: Toward understanding industrial districts", *Review of Political Economy*, 6,3, 259-278.

von Hippel E. (1988): *The Sources of Innovation*, Oxford University Press, New York.

Wasserman S. and Faust K. (1994): *Social Network Analysis. Methods and Applications*, Cambridge University Press.

Wilson, R. J. and J. J. Watkins (1990): *Graphs: An Introductory Approach*, Wiley, New York

Watts, D. and S. Strogatz (1998): "Collective Dynamics of Small-World Networks", *Nature*, 393: 440-442.

ANNEX: QUESTIONNAIRE USED TO COLLECT THE DATA

Date of interview: _____

1. General information

Business name or Institution name

_____

Address_____

_____

Telephone_____ fax _____e-mail

_____

Manager_____

_____

2. Kind of activity

_____

_____

3. Existing Relations

Roster of Firms or Institutions	Existence of relation Yes/No	Relation's Nature				Kind of information exchanged (if there is a communicative relation)			indicate the source or the target
		trade related	firm property related	in-between 1 and 2	communicative	production system related	law system related	market system related	