Globalisation, changing consumer preferences, and a new legal and regulatory framework create substantial uncertainty for European agriculture. These are the circumstances under which policymakers must find strategies for developing food production systems in ways that benefit the whole of society, whilst minimising negative effects upon the environment. Government agencies and agricultural businesses have put considerable effort into organic agriculture as a way to promote not only farm financial success, but also to meet broader social concerns. Food system experts recognise the importance of knowledge and knowledge diffusion for successful agriculture, especially in uncertain times and for a newly forming industry.

Here we report findings from a case study of knowledge diffusion in the organic food sector in the province of Foggia, a developmentally backward area in Puglia, the ‘heel’ of the Italian boot area of southern Italy. The organic sector, with a legislative framework and policy environment that is becoming ever more complex, presents a challenge for organic farms and firms to keep pace with changes.

We also studied the role institutions play in diffusing knowledge to Poggia’s organic producers.

Having performed acceptably well in the provision of juridical and technical knowledge, institutions need to improve their provision of commercial information.
Historically, both governmental and non-governmental institutions have been an important part of Italy’s agriculture, and we wanted to see how those institutions aided organic producers. Our study identified crucial information needs and gaps. We suggest ways to shore up knowledge for the organic sector where knowledge is needed but not provided either within the production sector per se, or through institutions.

Background on organic food sector

Since the EU-wide legislation took effect at the beginning of the 1990s, organic agriculture has expanded rapidly. Among European states, Italy ranks among the highest for organically farmed areas and highest for number of organic farms, covering nearly 6 per cent – more than a million hectares – of Italy’s agricultural land (Dabbert et al., 2004). The impressive growth of the organic agro-food chain in Italy is the result of a convergence of circumstances: the numerous food scandals that have afflicted Europe, the search for technical and economic alternatives by farmers, waning farm profits, and the relatively abundant flow of government support channelled into the organic food chain. Private farm operators, agricultural associations, conventional farmers’ unions, and public authorities have always played and still play a major role in Foggia agriculture. The know-how embodied in such agencies is enormous and has especially helped small operators with negligible economic and political strength gain a foothold in organic agriculture.

Foggia (total agricultural area: 618,719 hectares – of which 25,817 hectares used organically) presents an interesting case study of knowledge diffusion processes and the search for technical and economic alternatives by farmers and public authorities. 

Box 1. Social network analysis

Social network analysis is a method that has its historical roots in the disciplines of sociology, social psychology and anthropology. It provides an explicit formal way of measuring network characteristics through the use of several indices. In addition to straightforward indices such as number of relations, density (the ratio of actually present ties to all possible connections) and inclusiveness (the percentage of actors connected to a network), there are several which involve the notion of centrality. Network centrality could be an important concept for agricultural development because it could reveal the resilience and vulnerabilities of food production networks, the likely dynamics of innovation within the network, and on an individual level it could reveal who are the most influential and powerful actors.

Degree centrality indicates the degree of connectivity of central agents. A high value of this index would indicate that there are central actors and that these are well connected. Closeness centrality is a measure of the average distance of central actors from any other actor in the network; this measure is grounded in the idea that an actor is central if it can quickly interact with all the others. Betweenness centrality is a measure of the power of agents located between others. A network with high betweenness centrality has one or a few very central actors lying on the shortest paths between other actors. More information on these indices can be found in, for example, Wasserman and Faust (1999) and Scott (2000).

Table 1. Firms network indexes

<table>
<thead>
<tr>
<th></th>
<th>Firms network</th>
<th>Firms-Institutions network</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of relations</td>
<td>Density</td>
</tr>
<tr>
<td>Network of interactions</td>
<td>56</td>
<td>2.6%</td>
</tr>
<tr>
<td>Communicative networks</td>
<td>37</td>
<td>1.7%</td>
</tr>
<tr>
<td>Technical knowledge network</td>
<td>19</td>
<td>0.9%</td>
</tr>
<tr>
<td>Law system knowledge network</td>
<td>2</td>
<td>0.1%</td>
</tr>
<tr>
<td>Market related knowledge network</td>
<td>35</td>
<td>0.6%</td>
</tr>
</tbody>
</table>

“Après leurs succès dans la production d’informations techniques et juridiques, les institutions ont besoin d’améliorer leur production d’informations commerciales.”
because a relatively large number of firms operate within a well-defined region, having established a small but growing industry dedicated to organic production with substantial institutional involvement (Sisto, 2003).

Investigating firms–firms networks

In Foggia, we conducted face-to-face meetings where we administered questionnaires to find the connections among a sample of 52 firms and 16 institutions. The sample of firms was later increased to 66 firms as we obtained further information. We used social network analysis (Box 1) to identify relationships that the participants themselves recognise, and to investigate how these links might determine opportunities or constraints for knowledge flows.

The first network, shown in Figure 1a, is called the network of interactions, as it contains all ties amongst the firms regardless of their nature (i.e., whether they are a trade relation, information exchange, or a longer-lasting co-operative relation) and excluding institutions. This network consists of 66 organic firms, linked by 56 non-directional ties. Not everybody has contacts with everyone else: the density of the network is rather low (Table 1, row 1, Firms' network section), but the network is cohesive. An inclusiveness of 97 per cent tells us that most of the actors can reach each other in one way or another. The two remaining firms are unconnected (Figure 1a) and may be unable to benefit from any interaction with other firms. The network does not include a very central actor, as indicated by a low degree index (not shown). The higher centralisation index (also not shown) indicates closeness, but it shows only a medium ability for the most central actors to reach other firms through direct ties.

As a further step, we used the same actors to build new networks, distinguishing among different types of interactions. The first of these new networks (which are subsets of the whole network of firms) we called the communicative network (Table 1, second row, and Figure 1b). It contained only those ties identified as communicative exchanges of knowledge.

This network is formed by a much smaller number of relations: 37 as opposed to 56. It results in a graph that is more disconnected, showing a higher number of isolated actors (21 compared to 2 in the former network) and, obviously a much lower inclusiveness. This suggests that only a few of the firms interacting in the local organic sector exchange information. The centralisation indices (not shown) for degree shows only a little improvement, while betweenness and closeness decrease showing a network without ‘key agents’.

We also divided communicative networks into three sub-categories: technical knowledge that can affect directly the firm’s productivity, organic production laws, and knowledge or information about markets and consumers.

We see from Table 1 (rows 5–5, Firms’ network section) that we have 19 ties and 41 disconnected actors for the technical network, 2 ties for the law network, and 13 ties for the market network. Hence, the law network is the smallest, being composed by only two dyads of firms, and the technical and market networks are both highly disconnected (as illustrated in Figures 2a–2c). Most of the knowledge flows among firms relates to technical knowledge.

Central single actors are most important in the market-related network. In Figure 2c we observe two star shaped sub-graphs, each dominated by one central firm. However, the technical and law system knowledge networks do not depend on central actors.

Investigating institutions–firms networks

Institutions gather information and knowledge from different sources: some produce knowledge by themselves (e.g., research institutes and research departments); others exchange information and knowledge among themselves and subsequently diffuse it to firms; and others diffuse codified knowledge obtained from legal and technical sources. Our institutions–firms networks consist of 32 firms and 16 institutions in which the institutions send and firms receive information.

In the network of interactions (Table 1, row 1) we observed a density (4.7 per cent) higher than the one observed in the firms’ network and an inclusiveness of 96 per cent. Only two actors (Figure 3a) are isolated (one firm and one institution). In the communicative network (Figure 3b) we have only a slightly smaller number of directional relations (101 as opposed to 106), which resulted in a graph that is still highly inclusive (92 per cent: only three firms and one institution are disconnected).

In these first two networks the centralisation indices (not shown) indicate that the institutions, and not the firms, are the central agents. A comparison of Figure 3b with Figure 3d tells us that institutions play a substantial role for the Foggian organic food network in diffusing knowledge and information.
Figure 1. Network firms–firms
Figure 1a. Network of interactions

Figure 1b. Communication network

Figure 2. Knowledge network firms–firms
Figure 2a. Technical knowledge network

Figure 2b. Law system knowledge network

Figure 2c. Market related knowledge network

Figure 3. Network institutions–firms
Figure 3a. Network of interactions

Figure 3b. Communication network

Figure 4. Knowledge network institutions–firms. Dots denote firms, triangles institutions.
Figure 4a. Technical knowledge network

Figure 4b. Law system knowledge network

Figure 4c. Market related knowledge network
We also divided knowledge networks for institutions–firms into three subtypes (Table 1, rows 3–5, Firms–Institutions network section). For technical knowledge the density drops to 1.2 per cent and the inclusiveness to 52 per cent (35 firms and 8 institutions are disconnected). Similarly, for the law system network there are twenty-two isolated actors (14 firms and 8 institutions). However, for the market-related knowledge network density (0.9 per cent) and inclusiveness significantly decrease (20 firms and 10 institutions).

Whilst these sub-networks (shown in Figures 4a–4c) appear small and disconnected, it is important to point out that the institutions play a substantial role in improving knowledge diffusion among firms. Compared to the earlier knowledge networks (shown in Figures 2a–2c) the institutions–firms networks are much larger, particularly in the provision of law-system related knowledge, but also technical knowledge.

The organic institutions–firms network is dominated by two key institutions: the most important certification agency (ICEA) and the Agricultural Regional Counsellor (IPA), the institution that ‘makes rules’ on organic production in the region. Finally, the Business Consortium (CCIAA) plays, for a subset of firms, a central role in diffusing market-related knowledge.

Further analysis of knowledge flows and role of institutions

The questionnaire included a section to gauge knowledge needs, availability, and institutional support for organic producers (Table 2). Responses show that while farmers require both general agricultural knowledge (of farming methods and practices) and technical knowledge (of products and productive processes), it is not difficult to acquire, and few feel that more institutional support is needed to upgrade knowledge in these key areas.

The picture changes when we consider commercial and legal knowledge. Nearly 72 per cent of those interviewed consider commercial knowledge important in order to work in the sector, almost half of them consider this kind of knowledge difficult to acquire, and identify the need for further institutional support. Just over 40 per cent of respondents consider juridical knowledge important, nearly 22 per cent find it difficult to access, and 37 per cent want more institutional support in this area.

Better knowledge diffusion, a few suggestions

Despite a cohesive ‘network of interactions’ among organic producers, knowledge–based exchanges among firms are fairly marginal. Foggia’s organic producers are not taking full advantage of social networks, perhaps due to negative attitudes about cooperation.

Our study shows that this communication void is partially filled by active local institutions. In fact, in our case study, Firms–Institutions networks are much more dense and effective in diffusing knowledge. Specifically, we show that institutions are more effective in diffusing juridical and technical knowledge (sector specialists such as agronomists, colleagues and organic farmers provide most technical support). Local institutions are less effective in providing commercial/market information.

Overall, the know–how embedded in local institutions represents a key asset for the organic sector mainly
composed of small operators needing substantial production assistance. However, having performed acceptably well in the provision of juridical and technical knowledge, institutions need to improve their provision of commercial information. Such information is important but difficult to acquire. Entrepreneurs, however able to produce organic food, face difficulties identifying market niches and subsequently redefining marketing strategies. These difficulties might be addressed by new regional marketing officials and/or added information activities by in-place commercial institutions.

Although Poggia represents a specific case study, some knowledge diffusion issues and recommendations can likely be shared by similar groups of organic producers: small-scale and mainly family-based farms dependent on public incentive payments, those facing fast changing consumer preferences, and those confronting a complex regulatory environment. Such similarities call for institutions to facilitate the creation, interpretation, and sharing of knowledge.

Summary page is included overleaf.

Box 2. Some illustrative cases of institutional exchange

**Case 1** – An interviewed firm located in Stornara and involved in food processing (fruit and vegetables) stated that when it started organic production it faced a labelling problem. A change in the law created uncertainty about the kind of information to be provided on the labels of organic food and the correct way of writing this information. To solve this problem the owner of the firm conferred with the certification agency to interpret the new law and advise the firm on how to prepare the labels.

**Case 2** – Another sole proprietorship firm located in San Giovanni Rotondo faced serious problems related to the production of organic olive oil. Apparently, the olives had an unusual colour due to the presence of some kind of parasite that couldn’t be eliminated with the usual pesticides (as they would have done in a non-organic olive oil production). The owners of the firm were reluctant to dispose of all the olives collected in that year and decided to contact the certification agency’s expert (an agronomist) who provided all the relevant information to solve the problem without using chemical pesticides.

Table 2. Different types of knowledge in organic production

<table>
<thead>
<tr>
<th>What kinds of knowledge/skills are required in order to work in the sector?</th>
<th>Which kinds of knowledge are difficult to acquire?</th>
<th>Which areas require further institutional support?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Knowledge (knowledge of farming methods and products)</td>
<td>78.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Technical (products and productive processes)</td>
<td>93.8%</td>
<td>25.6%</td>
</tr>
<tr>
<td>Commercial (market structure, outlets, marketing)</td>
<td>71.9%</td>
<td>43.8%</td>
</tr>
<tr>
<td>Juridical (regulatory norms, administrative measures, etc.)</td>
<td>40.6%</td>
<td>21.9%</td>
</tr>
<tr>
<td>Managerial (management techniques)</td>
<td>25.0%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Technological (ICT, etc)</td>
<td>28.1%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Organisational (organisational models)</td>
<td>25.0%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Other</td>
<td>5.1%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Further Reading

Recent uncertainty throughout the food system has put pressure on European farmers, now facing economic globalization, changing consumer preferences, and a new legal and regulatory framework. Under these new circumstances, policy-makers must identify new strategies for developing food production systems in ways that benefit the whole of society, whilst minimising negative effects upon the environment. In this regard, the organic food sector, characterised by an ever more complex legislative framework and policy environment, presents an opportunity and a challenge for policy-makers as well as for farms and firms. This article reports findings from a case study of knowledge diffusion in the organic sector in the province of Foggia, a developmentally backward area in Southern Italy. Our study shows that despite a cohesive ‘network of interactions’ among organic producers, exchanges of knowledge are fairly marginal. This communication void is partially filled by local institutions that are shown to be effective in diffusing juridical and technical knowledge but less effective in providing commercial/market information. Further institutional efforts are required to cover these knowledge gaps. The study draws attention to some policy issues that can be shared by groups of organic producers elsewhere with characteristics similar to the Foggian case study; similarities that call for institutions to facilitate the creation, interpretation, and sharing of knowledge.

Les incertitudes récentes du système agroalimentaire ont mis la pression sur les agriculteurs européens, confrontés à la mondialisation, aux changements de goût des consommateurs, et à un nouveau cadre légal et réglementaire. Dans ce contexte, les autorités politiques se doivent d’identifier de nouvelles stratégies pour que le système agroalimentaire se développe de manière à être bénéfique pour l’ensemble de la société tout en minimisant les effets négatifs sur l’environnement. De ce point de vue, les produits “bio” caractérisés par un cadre législatif et un environnement politique encore plus complexe que les autres, constituent tant pour les politiques que pour les firmes et les exploitations une opportunité et un défi à relever. L’article rend compte d’une étude de cas sur la diffusion du savoir dans le secteur bio de la province de Foggia, une région plutôt arriérée de l’Italie du sud. L’étude en question montre que, en dépit de l’existence d’interactions en réseau entre les producteurs, les échanges de connaissances restent assez faibles. Ce vide dans la communication est partiellement comblé par les institutions locales, qui se révèlent efficaces dans la diffusion d’informations techniques et juridiques, tandis qu’elles sont beaucoup moins aptes à produire de l’information sur les marchés. Des efforts supplémentaires en matière institutionnelle sont donc nécessaires pour couvrir ces manques dans la communication. L’étude attire l’attention sur les questions susceptibles d’intéresser d’autres groupes de producteurs bio dans la définition de leur politique, lorsqu’ils se trouvent dans des situations similaire à celle de Foggia. Ceci appelle à la création d’institutions pour faciliter la génération, l’interprétation, et le partage des connaissances.