Chapter 2
A View of SME Clusters and Networks in Europe

Abstract It is a matter of course that each country in the large European Union presents specific characters and individual features of its own industrial environment. However, a common peculiarity can be recognized, evidenced by two numbers: the percentage of SMEs in any national industrial system, always close to 90% of the total number of enterprises, and the percentage of personnel employed in SMEs, greater than 60% of the active population. What can also be widely recognized in almost all European countries are the recent crises, which have affected SMEs, and the attempt by SMEs to counteract their difficult position by searching for agreements and cooperation. One type of reciprocal support SMEs looked for in a crisis was contracts with larger enterprises: this gave rise to supply chains. But often the desire of SMEs was to have collaborative links with other SMEs, operating in the same industrial sector and mainly located in the same region: this resulted in the rise of networks and districts. In the last decade, the European Commission has started to promote studies devoted solely to supporting these types of clustering. Some countries have also launched programs to finance SME aggregations, defining agencies for pushing the establishment of new SMEs groups. This chapter offers an outline of a number of different national situations, concerning the rise and, sometimes, the fall of SME clusters and networks. Obviously, the scope of this chapter is not to give an exhaustive presentation of the European situation of SME aggregations: it aims to force the reader to recognize similarities, weakness and strength aspects, and to apply these to an analysis of the SME aggregations performance.

A. Villa, D. Antonelli, *A Road Map to the Development of European SME Networks,*

2.1 An Overview of SME Networks Across Europe

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In the European industrial system a network of small to mid-sized enterprises (SMEs) usually consists of individual firms, separate business units, project teams or groups of organizations, which are formally or informally connected in order to exploit synergies. Cooperation agreements can be temporarily stipulated, either over the short or long term: at the end of the cooperation agreement in the network, each SME will operate again independently.

Considering an individual SME, which is considering either to participate in a network or operate in a market of continuously growing competitiveness, the decisive difference, if the former option is adopted, refers to the condition of subordinating main individual plans to the network collective scope. This main characteristic of the networked organization justifies why networking advantages for SMEs come from reduction of transactions costs among the network components, as well as a more stable coverage of markets owing to reciprocal trust (Thomson 2003).

Networks cannot be reduced to either formal or informal connections of different units. The qualitative aspect of networks as "learning or knowledge communities" is one of the most effective competitive advantages in the long-run. This leads to the question if knowledge networks are more effective than institutions. Indeed networks are a kind of institution with habits, norms, rules and routines, but they have the ability to adapt themselves to changes faster than institutional organizations. Knowledge networks are mainly influenced by research and innovation activities which need flexible structures to overcome environmental dynamics. Then, networks of innovative firms, which co-operate in R&D processes – like product and process development activities – in a delimited area appear to be of particular importance in the European context.

From existing experiences, the organization of an industrial network through progressive grouping of some SMEs can occur according to some steps.

The first step of each network constitution/development process is the idea and impulse initialized by promoters, because of the need or lack of resources for reaching the foreseen benefits. The second step is the construction of the cooperation agreement and the networking rules (constitution phase). An important factor during this crucial step is the selection of the partners based on an intensive relationship management. The third step can be seen as the networking stabilization ("work in the network"), characterized by the assessment of the form of work, products, services, costs and risks (e.g. saving finance, reaching aims and identification, "actualizing" trust and reputation or developing products), such to have criteria and internal regulations in place for crises and conflicts. Further issues are the development of short- to long-term relationships, contracts, rights and open structures. Step four is defined by the evaluation of the set targets' realization and is supported by monitoring processes (Podolny 1998; Williams 2000).

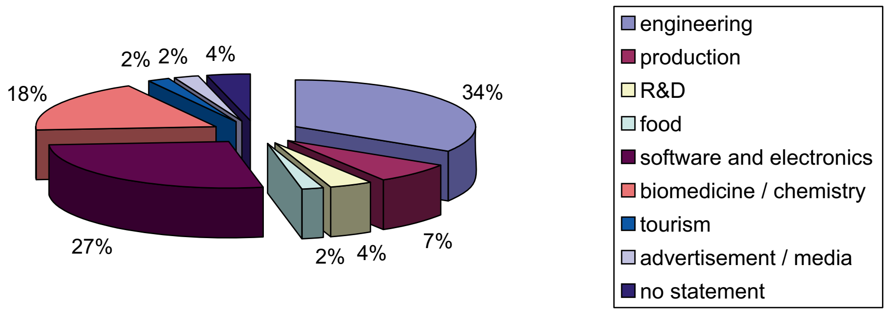

Fig. 2.1 European results concerning specialization

To have an overview of the experience of SME network organization in some European countries, the current situation of a number of clusters, concerning their success in terms of collaboration and main network attributes, was observed during the development of the CODESNET project. As seen from the CODESNET website (http://www.codesnet.polito.it) public data on more than 100 clusters from 11 different countries all over Europe have been collected and analysed. The sample includes mainly the engineering, software and electronic sectors, as well as some further clusters to complete the picture as shown in Fig. 2.1.

The data analysis, developed according to the CODESNET model of a SME network (as described in the Chap. 4), shows both unexpected as well as already detected results.

- Fifty-five percent of the clusters show a clear division of labour among the partners, thus making the coordination easier and more profitable.
- Only 35% of the assessed clusters can afford a dedicated supporting information and communication technology.
- There is no clear trend concerning the respective sales market, as well as no trend concerning the existence of a cluster-wide organization structure.
- Forty-seven percent of all assessed clusters apply conjoint marketing strategies and activities.
- Concerning the quantitative assessment, 46% show a high improvement potential and 51% can be found in the middle success category, whereas there is still potential to improve the collaboration or organization within the clusters.

There are different situations for geographical distributions of networks: on the one hand a network can be agglomerated in a relatively narrow area (rural district, county); on the other hand a network can consist of firms with a distribution over a whole nation or (but rarely) over Europe.

From public data, it is quite difficult to evaluate the financial situation of the clusters due both to the partial lack of relevant data and information, and to the effective difficulty in estimating the network economic data as opposed to that of the individual SMEs. This aspect, today, is an open problem and it has promoted specific analyses and studies, currently under development.

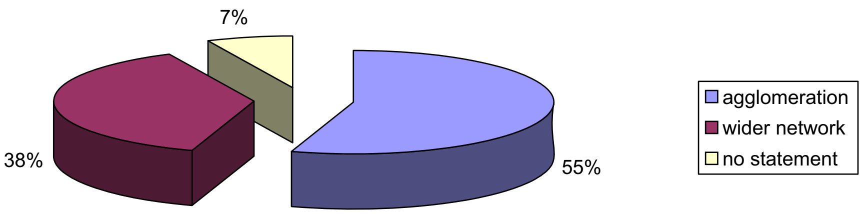

Fig. 2.2 European results concerning geographical distribution

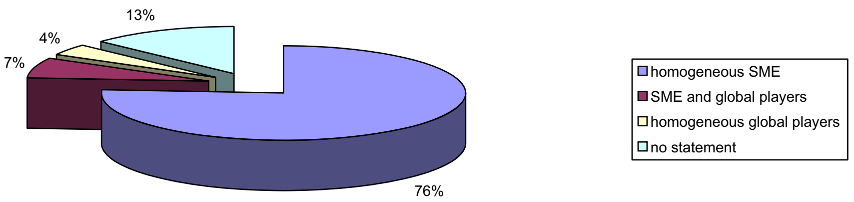

Fig. 2.3 European results concerning average firm dimensions

Referring to the set of collected SME networks during the CODESNET project, Fig. 2.2 shows that 55% of the evaluated clusters did not give any information about their sales rate. Accounting for the detected ones, the majority of SME clusters in Europe have sales between one million and one billion Euros.

To remark on the dominance of SME in European clusters, Fig. 2.3 offers an overview of the average firm dimensions. The majority of firms in the examined European clusters are SMEs (76%). The structure of the assessed clusters is mostly homogeneous concerning the firm size.

An overview of the most evident characteristics of SME networks and clusters in some European countries (where one or more institutions have been involved in the CODESNET project) is summarized in the following. A detailed description of the typical networks and clusters indeed requires a wider and wider presentation. However, the aim of this section is simply to outline the main features of the most diffused SME agglomerations: specific analyses will be reported on in the next parts of Chap. 2.

A study of mechanical engineering clusters in Germany shows that at least 227 agglomerated industrial areas exist with at least one mechanical engineering cluster. The 227 areas have about 542 specific clusters of special branches. Out of the identified 981 potential mechanical engineering clusters, only 55% can be considered a real cluster when applying the holistic definition. The highest concentration of mechanical engineering clusters can be found in the south of Germany as well as in the provinces of Thüringen and of Sachsen. Small specific agglomerations also exist in the south of the provinces of Nordrhein-Westfalen (area of Hamburg), as well as in the hinterland of Berlin. The results of the evaluation of German clusters collected by the CODESNET project show a medium sector diversification and identify the engineering sector as the most important in Germany. Concerning the distribution over a special region, no special trend was observed, since the networks and clusters are agglomerated and distributed nation- and European-wide to the same extent. The sales rate of the assessed German clusters ranges from 0.2 million to 36.7 billion €; the firm dimension in terms of employees from less than 20 up to over 10,000. In German clusters, a division of labour among the partners exists more often than not. Special Information and Communication Technology (ICT) is only applied by a minority, as well as only a minority established a cluster-wide organization structure. More German clusters are export-oriented rather than oriented towards the national German market (this situation goes hand in hand with the export orientation of the German mechanical engineering branch to which many clusters belong).

Concerning the SME networks in Italy, several "industrial districts" participated in the CODESNET evaluation. Compared to other nations, the clusters in Italy are diversified on the national level, but almost every one is specialized in a certain branch or niche. The allocation of nearly all clusters shows agglomeration and almost no European or national distribution. Sales reach from 1.1 million up to 6.5 billion €. Mainly SME with 15–200 employees are part of Italian clusters: only in one case the exception global player with over 10,000 was involved. In contrast to the German clusters, nearly all Italian clusters practice division of labour. As well as in Germany, almost all clusters in Italy do not use special ICT. The market orientation clearly indicates the national market as the main target. Trends, in either way, cannot be identified when concerning the organizational structure.

The clusters in Hungary, as assessed in the CODESNET analysis, are rather specialized in software and engineering services. The distribution varies from agglomerations in one county up to Europe-wide linkages. Although the clusters are rather specialized, a relatively high number of different fields of skill and knowledge are employed. Considering the firm size in terms of employees, the Hungarian clusters consist of rather small firms ranging from 5 to 50 persons. All clusters operate a distribution of labour. Due to the specification of software and immaterial services, no transportation means are needed and were therefore not indicated. A specific ICT does exist in any of the assessed clusters. Concerning the market orientation, the national market is more important than the export. Special organizational structures mostly do not exist, whereas the majority of Hungarian clusters are leading firms and have common marketing activities.

The clusters in Greece participating to the CODESNET evaluation are rather diversified on the national level, software and chemistry being the main sectors. The distribution of the respective networks is rather nation- and Europe-wide. Compared to other clusters in Europe, the partners of the Greek firms are rather small in terms of employees (ca. 8). Some of the analysed Greek clusters possess an organization structure with interesting characteristics, some other comprise leading firms and show conjoint marketing strategies.

Most of the Polish clusters are very specialized, on environmental technology and on advertisement and media. The distribution is rather in local agglomerations than nation- or Europe-wide. Two to three skill or knowledge fields are covered by the employees on average and the firm size varies from 1 to 2,000 employees. Division of labour as well as an applied organizational structure and conjoint marketing strategies exist in the most clusters. The market orientation leads rather into the direction of the national Polish market.

The French clusters vary in their diversification degree. On average several sectors are covered, whereas chemistry and engineering hold the main parts. Concerning the geographical distribution, the clusters are mostly agglomerated. Relatively homogeneous is the sales rate, from 250 to 600 million €, in contrast to the firm size which rages from 10 to 10,000 employees. Division of labour as well as special ICT for the respective cluster exist for the majority. In contrast to the existence of conjoint marketing strategies, which are mostly applied, a trend for the existence of an organizational structure is not recognizable. Furthermore the disposal orientation leads rather into the direction of the national market.

Concerning the United Kingdom, the CODESNET analysis has been focused on specialized clusters on aerospace and information technology. These clusters indicate nation- and Europe-wide linkages in their networks, instead of local agglomerations. The sales range from 60 million € up to 5.2 billion € per year while the number of employees in the cluster firms ranges from 20 up to tens of thousands. A clear division of labour and wide application of ICT have been realized. However, British clusters usually show a lack of organizational structures. Concerning the disposal market and the existence of larger leading firms in the clusters, no trend can be recognized by the available information. In contrast, a clear lack of conjoint marketing strategies and activities can be identified.

The clusters from Ireland analysed by CODESNET run across industry lines rather than being specialized. The geographical distribution of the respective firms is nation- and Europe-wide, mostly not agglomerated. Most important is the engineering sector (mechanical and electronic). Annual sales range from 6 to 400 million €, while the average firm dimension is around 10–25 employees. Almost all transportation means (trucks, ships and planes) are used by manufacturing clusters. Leading firms as well as conjoint marketing activities are lacking in the majority of the Irish clusters. In contrast to that, most of the clusters afford special ICT applications. A trend concerning the existence of an organizational structure is not recognizable and the disposal market is rather the national market than external ones.

Referring to the Swedish clusters available in the CODESNET catalogue, they are rather specialized, whereas they are diversified on the national level. Tourism and mechanical engineering build the balance point. All clusters are agglomerations and consist of homogeneous SME in terms of number of employees. Leading firms and conjoint marketing both exist in the majority of the clusters, whereas there is only one which owns an organizational structure. The national market is the favourite disposal market for the majority.

The Finnish clusters collected by CODESNET are relatively specialized, especially in software and Research and Development. They indicate an agglomerated distribution instead of wider network linkages. Despite the specialization, the clusters do not consist homogeneously of SME and none of them apply conjoint marketing activities or strategies. A trend concerning the disposal market is not recognizable as well as a trend concerning the existence of special ICT.

As mentioned before, the short list of comments above is merely a summary of considerations coming from an overview of the networks' catalogue collected by the CODESNET project. In principle, they can offer a concise description of the main issues, which can be seen in European countries where clusters and networks have a relevant presence in the respective industrial systems.

The following sections will address the main features and also weakness and strength aspects facing the SME networks in some countries. These aspects will highlight the most significant problems concerning network organization, their management and development, in the current dynamics of the European as well as worldwide markets.

2.2 Poles of Competitiveness in France

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In the context of a global economy characterized by increasingly severe competition, France launched in 2004 a new industrial policy to develop key competitive factors, among which of primary importance is certainly innovation.[1] This new policy induces and supports initiatives emerging from academic and economic actors throughout a region to develop dynamic networks which link firms, and research and educational institutions. This program is based on the creation of an official and financially supported designation called "poles de compétitivité". To date 71 competitiveness clusters have been created, including 17 which already have, or will have, a worldwide impact.

The aim of a competitiveness cluster is to concentrate at one location the talent incorporated within public and private research laboratories, teaching facilities and business enterprise expertise, in order to establish working relationships which should develop a cooperative environment and promote partnerships within innovative projects. Thus, the definition of a competitiveness cluster is based on the following key points:

- An association of companies, private and public research centres, and teaching institutions
- Collectively involved in a public/private partnership (requiring a common development strategy)
- Aimed at launching new projects resulting in innovative technological and organizational advances, increased economic efficiency and job creation
- In principle, enabling those players involved to become leaders in their field

[1] All information presented here on competitiveness clusters is based on public information, notably made available by the French Ministry for Economy Finance and Industry.

Four key elements for successful clusters have been identified:

- A common *development policy* consistent with the overall economic strategy of the territory
- *Close partnerships* among the various players linked to well-defined projects
- *Concentration* of highly marketable *technologies*
- *International visibility* based of a sufficient critical mass

The French government provided 500 million € annually from 2006 to 2008, in financial support, mainly to the industrial R&D sector, which is at the heart of the competitiveness clusters policy. This monetary aid applies to all the partners involved, regardless of size or origin, and therefore will enable external international players to become involved in these projects.

2.2.1 The French Context and Advantages Offered by Competitiveness Clusters

By the creation and support of competitiveness clusters, France launches a high-impact industrial policy, expected to augment innovation capabilities and establish competitive advantages. By regionally networking all the actors in the innovation process, the cluster policy is expected to bring new sources of value creation and develop employment within the regions. Indeed, even if France possesses lots of existing skills and talents – notably a high level of creativity – the coordination of these strengths clearly appears insufficient, especially for economic actors with similar activity domains distributed over a limited territory.

This economic development policy confirms the industrial sector as a key driver of the overall French economy: industry represents the main source of innovation (90% of R&D expenses) and competitive factor (80% of exports). The industrial sector plays the role of catalyst for the rest of the economy. However French industry is confronted with a twofold challenge linked to the evolution of the global economy:

- *Globalization of exchanges and production processes* which increases the levels of competitive pressures
- *Establishment of a knowledge-based economy*, where innovation, research, i.e. immaterial capital or collective intelligence, turns out to be one of the main vectors of economical development and competitiveness

To answer such challenges, the competitiveness clusters intend to build new coordination facilities based on the operational interconnectivity among territorial development, innovation and the industrial sector. Hence, the networking of industrial, scientific, and education actors over a well-defined territory will constitute:

- Faster and broader innovation (proximity among actors stimulates information sharing and competence flows; helps the emergence of highly innovative projects).
- Larger exposure: the concentration of participants in a limited territory offers a national and international visibility thus attracting more and better players.
- A counterbalance to economic outsourcing (competitiveness is directly linked to the implantation of enterprises within the territories, induced by the presence of pertinent competences and useful partners).

By highlighting innovation and the sharing of common savoir faire, such clusters will improve internationally the competitive attractiveness of the French territory, and will promote the regional specialization of French industry, as well as assist the emergence of new activities with significant international visibility. As a synthesis, the purposes of competitiveness clusters are:

- To align French creativity towards value creation
- To develop the French economy and competitiveness over the long term
- To concentrate highly technological activities in selected territories
- To heighten the economic attractiveness of French regions
- To improve employment and to limit outsourcing

2.2.2 Thematic and Geographical Distribution

The latest decisions of the French government have created a total of 71 competitiveness clusters (Fig. 2.4). These clusters concern emerging technological sectors such as nanotechnologies, biotechnologies or microelectronics, but also are involved in the more traditional industrial sectors. Among these 71 clusters, seven have the ambition/aspiration to become world-class leaders. Ten other clusters are slightly smaller, but aim to become also world-class leaders over time. The 51 remaining clusters have national and regional objectives, and among them 36 are applied to the industrial sector.

Different types of partners can apply to the financial support associated with the clusters, regardless of size or origin. This is especially important since it will allow international players to take part and profit from these projects. Welcoming outsiders is a significant part of diversifying the industrial and economic landscape within a region or in France overall. Moreover, this synergy also applies to the public sector, since the goal of these competitiveness clusters is to concentrate the efforts of the French government, national agencies and local authorities.

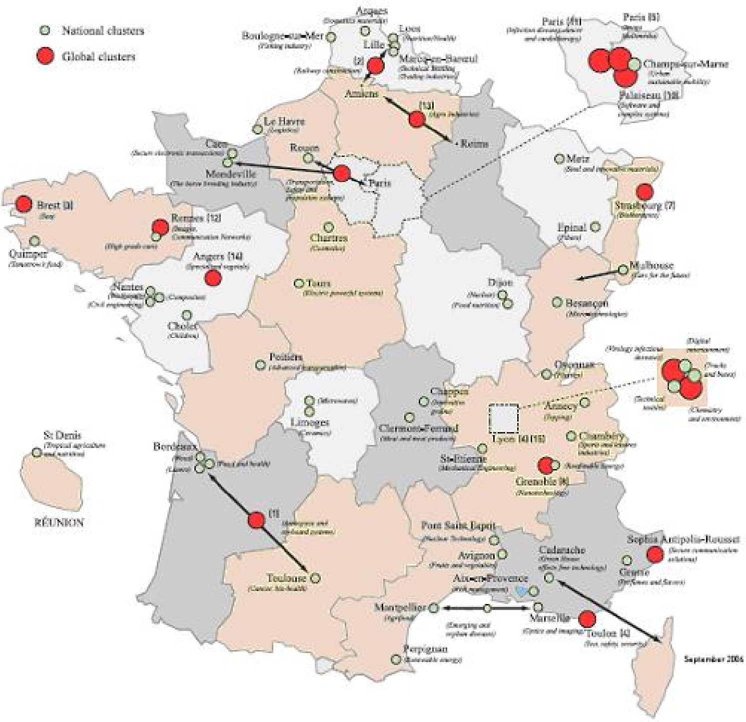

Fig. 2.4 Geographical distribution of clusters edited by the French Ministry for Economy Finance and Industry

2.2.3 Governance and Managerial Mechanisms

2.2.3.1 Governance Structure

The competitiveness clusters are managed in a project-oriented scheme. Clusters should become innovative sources of collective projects among enterprises, research centres, and training institutions.

- Research and development (R&D) projects are the core activity for these clusters, and the main competitive factor.
- Non-R&D projects (training, infrastructure investments, IT investments, economic intelligence, international development, territorial development, etc.) constitute an indispensable supplement to ensure sustainable economic development and competitiveness.

Each cluster is to be represented and animated by a *coordination entity* with a specific legal structure, usually based on the status of an association. This governing body has to ensure a prominent management role to the industrial, academic and scientific actors, and a lower but clear representation for regional institutions. The coordination entity employs a permanent staff whose mission consists mainly in playing the role of the key facilitator in the emergence of innovation projects among the various actors concerned. National and regional governments both contribute to the funding of the clusters.

The principal mission of such a coordination entity consists in:

- Elaboration and deployment of the general strategy for the cluster
- Coordination and selection (with a designation) of research projects which can become candidates for public funding assigned to clusters
- National and international communication in the cluster
- Launching cooperation with other clusters in France and abroad
- Evaluation of projects

A mid-term program is defined to ensure the adequate supervision of the relations among the clusters, government, and territorial institutions.

2.2.3.2 Financial Mechanisms

An important financial incentive has been offered to guarantee the success of the competitiveness clusters. The national government has planned a budget of 1.5 billion € over three years, with three main forms of financial aid:

- First, a project-oriented budget is constituted with contributions from several complementary ministries (Industry, Equipment, Defence, Agriculture, Territorial Development and Competitiveness (DIACT)) and from regional development agencies (Agence Nationale de la Recherche, Agence de l'Innovation Industrielle, Agence OSEO for Innovation in SME). A major portion of this budget is directly destined for R&D and innovation research programs, which are at the heart of the clusters.
- Second, the company and the employees implicated in R&D programs validated by the clusters can take advantage of tax exemptions and reductions of social charges.
- In 2006, the French government created 3,000 positions in the research sector: the major part of these posts concern the scientific domain covered by the clusters.

This national budget gathered from several distinct sources has been centralized within a unified fund so as to simplify its administration. Supplemental funding will come from other territorial institutions, like the regional governments which also have a clear mission to provide support to competitiveness clusters. These institutions already supply substantial amounts in addition to the national budget.

2.2.3.3 Direct Help for R&D Projects

The use of this budget is submitted to a systematic selection process: R&D collaborative projects from all areas covered by the competitiveness clusters are analysed, then selected on the basis of equitable and transparent decision criteria. Calls for projects occur three times each year. The major selection criteria are:

- Concrete results in terms of value creation, economic activity, and employment
- Innovative technological content
- Development of new products and services with a market focus
- Consistency among the projects goals, the global strategy of these clusters, and the local strategies for companies

A custom governance structure has been defined to ensure the selection and supervision of the projects. A typology of projects was defined, with a specific agency in charge to supervise each of the four types of projects, as defined in Table 2.1.

Table 2.1 Typology of projects and the supervising agency

Project type	Supervisory institution	Selection procedure
Fundamental R&D project, where there is a technological gap, with long-term view on market deployment	Agence Nationale pour la Recherche (ANR)	– Periodic call for projects – Priority given to cluster projects
Industrial collaborative R&D projects with mid-term market impact (five years)	Ministry for Economy Finance and Industry	A ministry expert nominated for each cluster
Individual SME innovation projects	OSEO-ANVAR Agency	– Permanent call for projects – Priority given to cluster projects
Very ambitious and long-term innovation projects (budget > 10 millions euros)	Industrial Innovation Agency	Specific expertise to support the definition and management of such projects

2.2.3.4 Tax Exemption Opportunities

Tax exemption can only be applied by a company implanted in so-called R&D geographical areas linked to the clusters, and participating in one or several R&D projects. These exemptions concern both national and regional taxes. For the employees directly participating in the projects, social charge exemptions can be granted. The amount depends on the size of the company: 50% of exemption for SMEs, and 25% for remaining companies.

2.2.4 Case Study

ViaMéca is the French Rhônes-Alpes cluster in the field of the mechanical industry (http://www.viameca.fr). Industrial groups, SMEs, research centres and partners, all have plotted a common future with the objective of making the ViaMéca cluster a leader in the mechanical engineering sector with global visibility. ViaMéca intends to play the role of an accelerator by creating new relationships between the players in the mechanical engineering sector. By putting the development of the mechanical engineering industry at the heart of its strategy, ViaMéca is weaving a network of businesses with multiple, complementary skills. With only three years of existence, already 20% of the French mechanical engineering companies have come together under this designation.

2.2.4.1 Industrial Context and Purpose

In an international context of competition globalization, the manufacturing and mechanical industry has to shift towards a highly innovative mode of operating, while maintaining the current objectives of lean production and cost reduction. For such challenges, marketing and technological innovation require to be associated with an increased level of reactivity among all stake holders. Technological as well as organizational innovations will constitute a necessary support to implement profound transformations of production and design modes. The Digital and Intelligent Manufacturing Plant will become a reality, by integrating tools from both the world of machines and the realm of data acquisition/treatment. Mechatronic production lines provide a successful and excellent example of such integration, with intelligent sensors embedded at the heart of the manufacturing devices. The power of innovative manufacturing processes integrated with the ubiquity of information management will constitute one of the major competitive factors in the near future, supporting both product and organization innovations.

However such progress will only be possible if it is associated with complementary actions: significant increase in vocational training, consideration of new environmental and sustainable development factors, notably induced by new constraining French and international regulations.

ViaMéca competitiveness cluster puts the focus on the deployment of global integrated innovation and engineering (including product design, manufacturing innovation, life cycle management, etc.). This overall integrated innovation and engineering is considered as a weapon against the risk of regional industrial activities being outsourced. This new paradigm makes it possible to compete on the global market with new arguments, distinct from the old quality-cost-delay triangle, and based on novel differentiations of products and associated processes. By putting the focus on research and innovation, this general and integrated vision of the mechanical industry will also require conserving viable local manufacturing potential, to make possible the emergence and testing of prototypes and innovations.

Table 2.2 Key figures

9,000 Businesses
235,000 Employees (20% of the French workforce working in mechanical engineering)
2,500 Researchers
Over 1,000 engineers or research Masters awarded diplomas each year

The Rhone-Alpes region has key advantages for such an endeavour. With a high density of industrial companies, as well as research and education institutions, the region has already launched such innovation-oriented dynamics in recent years (see Table 2.2). The *raison d'être* of the cluster is to finish the complete alteration from a region characterized by old industrial techniques, to become an innovation catalyst, forging the new manufacturing industry of the twenty-first century.

2.2.4.2 The Actors of the Competitiveness Cluster

ViaMéca cluster is supported by an essential mass of industrial companies as well as research and educational institutions (Fig. 2.5). The development of regional competencies remains a major goal, based on an intensive strategy of networking. To put forth actor networks, technological platforms will be developed, aiming at coordinating actors and enhancing industrial transfer from research (the regional

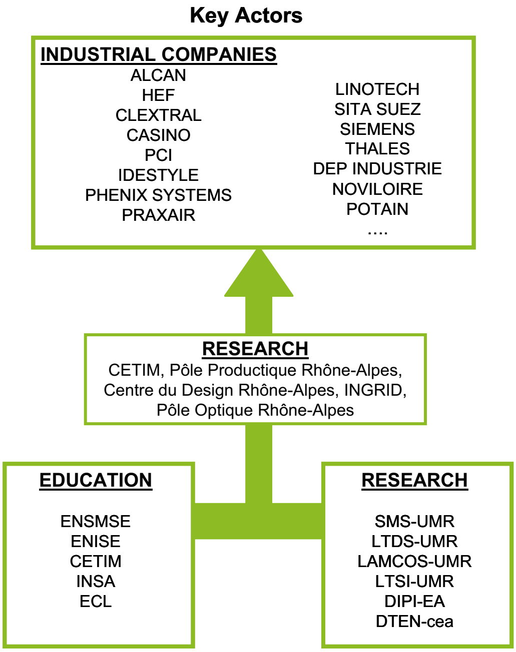

Fig. 2.5 Key participants of the ViaMéca competitiveness cluster

INGRID platform is a good example). The high density of the actors and the wide panel of technologies and processes in the region provide an excellent fertilizer for technological transfer.

Priorities have been given to three major technological domains: material sciences, advanced manufacturing processes, and design of products and sub-products.

These three fields are to be embedded within a global vision of integrated innovation, design and engineering.

In this region, more than 32% of industry works in the field of mechanics. There are 6,800 companies, with 550,000 employees (in 2003), which represents more than 20% of the whole industrial workforce. The mechanical area represents 16.8% of the added value of the regional industry with a turnover of 84.4 billion €. In the field of industrial equipment production, the Rhônes-Alpes region is ranked first nationally. This activity gathers 17.6% of the national employment in the same sector (57,640 employees) and produces 14% of the overall national product. The region has a second area of excellence with the metal finishing industry, which concentrates 16.7% of the overall national employment in this sector (55,180 employees).

2.2.4.3 Coordination Mechanisms and Strategy

The strategic committee initially created to launch the project has been transformed into an administration council. It is in charge of defining the overall strategy for the cluster and supervising its activities. The administration council works with an operational office in charge of day-to-day administration. At a second level, the cluster has defined seven complementary commissions to oversee specific coordination missions over the broad region (R&D activities, educational issues, etc.). These commissions are notably in charge to launch and coordinate the calls for projects linked to the cluster strategy. The third level of governance is at the project level: each project, linking various industrial, education and research actors defines its own coordination mechanisms. The strategy of the ViaMéca cluster is mainly oriented on the following topics:

- Development of innovation by the completion of R&D projects associating research centres, technical centres and industrial businesses
- Integration of (organizational or technical) innovation in industrial businesses and development of skills via collective actions
- International exposure, by setting up technological partnerships abroad

This strategy must be implemented over a long-term horizon, through three main phases. The first strategic phase follows a key objective of acceleration of technological transfer: making the regional businesses aware of cliental expectations; strengthening SME response capabilities as regards to innovation, quality, cost and delivery time; creating clusters or groups of businesses by speciality, thus ensuring complementarities of means of response (studies, development work, installations); initiating and participating in R&D projects by connecting public and private research laboratories.

The second strategic step is oriented on improving the global visibility of the region. Thanks to ViaMéca, SMEs/SMIs have access to major European contractors. ViaMéca will embark on an international development strategy by approaching European poles and clusters, by being complementary in their areas of activity, by facilitating the access of businesses to European projects, and by participating in the Mécafuture Platform.

The last phase will finalize this international development by obtaining a world-class industrial and scientific reputation. In that perspective ViaMéca emphasizes three key issues: obtain an international leadership for breaking technological deadlocks concerning specific domains of excellence; increase by 20% the number of researchers working on the cluster orientations and scientific publications; augment significantly the number of industrial innovations (innovation projects, funding and patents).

2.3 Science Parks in Greece

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Science and technology are vital not only for the progress and the exploitation of knowledge, but also for the achievement of viable and balanced growth, stability and prosperity. Contribution of technology to economic growth and competitiveness is significant and is of great importance to innovation in any economy (Mowery and Rosenberg 1989). Science and technology parks (STEPAs) are essential means for transferring the scientific and technological knowledge from the research institutes and universities into enterprises. A STEPA is a mediator that contributes considerably to the regional growth, facilitating the creation of high-technology spin-off companies and disseminating innovative technological achievements to regional SMEs. For these reasons STEPAs all over the world are founded near universities and research Centres and are closely connected with them.

A science park is an organization focusing on the concentration of high-tech, science, or research-related businesses. Science park establishments host research-oriented SMEs and/or R&D sections of bigger enterprises. Science parks attract such firms because they provide various facilities. Their appeal comes from the neighbouring research and academic organizations and the offered infrastructures. Science and/or technology parks accommodate enterprises that produce commercial applications of high technology, exploit recent research results and use novel approaches in the sale and technical support of products and services (Chan and Lau 2005). Science and technology is based on the combination of research and innovation with the relative production and commerce.

Science parks' geographic proximity with research institutes, could be viewed as "the generation of new and valuable knowledge through human intervention" to the extent that an "innovative milieu", which generates constant innovation, is created and sustained (Hall 1994). It is proven that a science park incubator is recognized as an effective support mechanism for new entrepreneurial firms and its contribution is based on the framework of shared facilities such as offices, administrative staff and access to university research and external grant support from the government and other sources, such as venture capital (IASP 1998).

2.3.1 STEPA Characteristics

A STEPA is actually a complex economic and technological unit that aims at encouraging the growth and the implementation of high-technology and innovation production (Dettwiller et al. 2006). STEPAs provide services such as high-tech research installations, pilot laboratories, centre of innovation, centre of technology transfer, "incubators" for new firms, innovative techniques unit, etc. Most STEPAs today focus their activity on information technology (electronics and computers), telecommunications, biotechnology and new materials (IASP 1996).

The general characteristics of a STEPA are the following:

- Promotes and facilitates the transfer of research results from universities and research centres to the industry and more generally to the productive sector, increasing the economic growth
- Facilitates the creation and the viable growth of new innovative enterprises (incubator of enterprises)
- Constitutes a body of research and development for SMEs and new markets
- Provides the suitable environment where the knowledge-based enterprises can develop stable collaborations with concrete research and technology centres for reciprocal benefit

In economically developed countries, a STEPA establishment creates the environment and the conditions so that the whole region grows in new and different directions. In developing economies, the expectations and the role of STEPAs are "catalysts for growth". STEPAs facilitate the establishment of new high-technology companies and encourage the production of innovative products and services. Beyond the economic status of a country growth, STEPAs contribute effectively to the concretization of functional objectives that conform with the strategies of regional policy.

The total number of incubators for enterprises and science parks in Europe is roughly 900, which create roughly 40,000 new work places per year. The period of incubation (average period hosting an innovating company) is usually two to three years. Greece today allocates one incubator of enterprises per 106,000 SMEs. The corresponding number in Austria is one incubator per 3,000 companies (see Fig. 2.6). The minimum initial capital for starting a company in Greece is

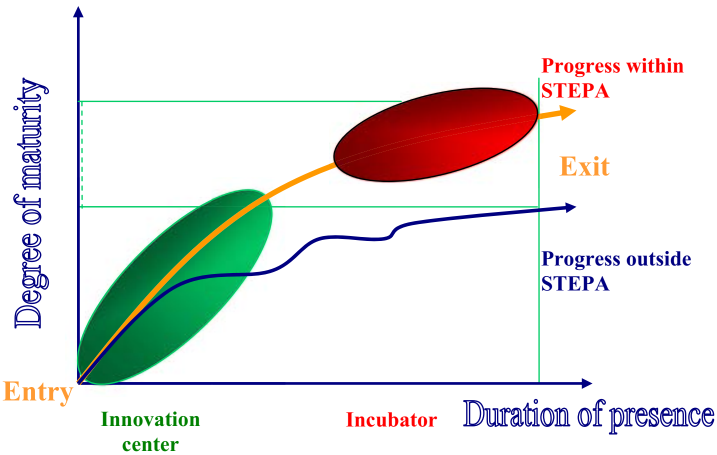

Fig. 2.6 The growth of a start-up company hosted in the innovation centre and then in the incubator of a science park

among the lowest in the European Union (0.017% of the GNP compared to the 0.036% of the European Community average).

The universities and the research institutes continuously propose and develop new technologies adopting innovative approaches. Even though a huge experience is accumulated and acquired, technological and innovative value remains as property, usually unexploited, by the researchers that worked in the particular programs. Moreover, there is not particular preparation of how the knowledge and all the innovative results will be disseminated to the enterprises. The difficulty in diffusing the research and technological results is more difficult than their usage for production.

In this direction, the role of STEPAs is essential. Their mission is mainly to bridge the gap between academic society (universities, research centres, etc.) and industry. In other words, the main role of STEPAs is their activation as "lighthouses of knowledge" for the diffusion of innovation and technology, so as the industry can directly use part of the enormous available scientific knowledge. Thus, they contribute effectively to the fast transformation of innovative results of research and technological development in successful enterprising undertakings.

2.3.2 Science Park Institution

In Europe, the institution of science parks is essential for the regional development and the general economic growth. One of the biggest science parks in Europe, and biggest in England, is Cambridge Science Park, which was founded by the Trinity College in 1970. It attracts relatively small local R&D enterprises directed to the new technologies. The presence of University of Cambridge, which has a great tradition in high-technology industry, supported the activities and the blooming of Cambridge Science Park. Many high-technology companies were founded in computer, information technology, telecommunications, software development, biotechnology, robotics, and the like. In 1970 it hosted 20 high-tech companies with roughly 1,500 workers. Until 1980, 360 companies were set up and 10,000 persons worked. Today, more than 1,700 high-tech enterprises with 40,000 workers have been developed globally (http://www.cambridgesciencepark.co.uk). Another best case science park in Europe is Lindholmen Science Park, in Göteborg. It was founded in 1995 in old shipyards, which had closed and 4,000 places of work were lost. Today, 10,000 people work in the Lindholmen Science Park. It hosts very important and well-known companies. The main activation areas are: mobile data communications, intelligent vehicles and transport systems and media (http://www.lindholmen.se/ext/index_en.php). In France, the most successful science park is Sofia Antipolis Science Park, which was founded in 1969. It includes 150 intermediate and big enterprises around the world. Main hosted companies are Dow Chemical, Digital Equipment, IBM, Cordis (US companies), as well as other Japanese, British, and Swiss companies. The Sofia Antipolis is the only park in Europe, which is not close to any university or technical university and in its early phase was supported by informal networks of partners that contracted initially a not-speculative company (http://www.sophia-antipolis.net). In Ireland, the Shannon Development was founded in 1959 and is situated in the area of University of Limerick supporting a network of science parks in the whole country (http://www.shannon-dev.ie).

2.3.3 Present Situation

The level of starting companies in Greece is among the lowest in the European Union. On the other hand, many universities, research centres and knowledge creation organisms are active in Greece, proposing new methods and approaches for products, services or processes but without being able to introduce their products to the market. Greece is mainly a rural area, where knowledge and technology productivity and new innovative creations need to be imported in the Greek market. For these reasons and in order to establish a communication channel between enterprises, universities and research institutes, the Greek government encouraged the inauguration of science parks.

The placement and distribution of science parks in Greece was done under the basis of the regional development advancement. Each Greek region presents different rates of growth, productivity, extroversion, unemployment and general social and economic status. In every region a science park was settled. The preparatory actions for the foundation of science parks in Greece dates back to 1988 and the first science park operated in 1989 in western Greece.

Western Greece was an industrial area, with local enterprises presenting huge rates of growth. In addition, the port of Patras, the capital of western Greece, was the gateway to European countries and to the West. In parallel, the University of Patras, the Technological Institute of Patras and other research institutions create knowledge and have many experienced researchers. Western Greece was blooming, until the 1980s, when all the huge industries closed, increasing unemployment and presenting negative growth rates. Consequently, the government decided to create a link between research bodies and enterprises, so that entrepreneurship and growth would be supported.

Patras Science Park S.A. (PSP) was established in 1989 as Patras Technological Park S.A. In 1992 it took its current name, while in 1998 it completed its premises at Platani, Patras. Its only shareholder, since 2001, is now the Greek State (under the supervision of the Ministry of Development and particularly GSRT).

Patras Science Park is an organization of a particular structure, establishing mechanisms and services primarily targeted to promoting the creation, operation and growth of "innovative firms". PSP contributes to the creation, operation and development of spin-offs based on innovation, and promotes their activities. Patras Science Park supports the completion of innovative ideas, products, services and procedures as well as the exploitation of research and development results, it encourages the constructive collaboration of knowledge creation organizations (KCO) and research institutes with enterprises, it promotes the introduction of new organizational and administrative methods for enterprises, the acquisition and diffusion of new knowledge for enterprises or any kind of legal entity and the attraction and installation of entrepreneurial schemes in the Park's premises (http://www.psp.org.gr).

The second try for the establishment of such an organization took place in Athens, the capital of Greece (1992). In the wider region of Athens, two science parks have been established, each one serving different purposes. The first is Lefkippos Technology Park (LTP), on the premises of the National Centre of Scientific Research "DEMOKRITOS" (NCSR "D"). The initial aim of the NCSR "D" was the utilization of the advantages of nuclear energy for peaceful aims. The centre has eight institutes covering the scientific areas of nanoscience and nanotechnology, informatics and telecommunications, materials science, chemistry and biology to nuclear physics and nuclear technology and radiopharmaceuticals (http://www.demokritos.gr). The objectives of LTP are to promote and diffuse scientific and technological work and achievements, to commercialize R&D results, to offer specialized services to the private and public sectors, and to contribute to the development – through technological innovation – of the knowledge-based society. The incubator of LTP hosts companies activating in the fields of biotechnology, informatics, materials, energy and services.

In the same period with LTP, another science park emerged in a city near Athens, Lavrio, under different terms, the Lavrion Technological and Cultural Park (LTCP). It was founded by the National Technical University of Athens, with the collaboration of local institutions, the people of Lavrion and the support of the Greek State and the European Union. The history of the area started in 1876, when "The Companie Francaise des Mines de Laurion" developed the mines of Lavrion. Lavrion was the first city in the newly created state of Greece to come across a great economic, industrial and cultural development. In 1989, the differentiation of employment in Europe had a harsh effect on Lavrion leading to the closing down of all industries one after the other. The intervention of the Greek state to save the mines was not capable of avoiding the catastrophe. After more than a century the mines were shut down forever leaving a whole city without employment. In 1992, the Greek government, in a movement of encouraging local development in Lavrio, bought the whole area of the old industry and handed it over to the National Technical University of Athens with the aim of creating a new pole of attraction in high technology and culture. The foundation of the Lavrion technological culture created and functioned soon after its restoration (http://www.lavrioferenceculturalpark.gr).

One year later, in 1993, another science park emerged in southern Greece in Crete. The Science and Technology Park of Crete (STEP-C) and the Managing Company of STEP-C (EDAP SA) were established in 1993 in Crete. The idea for a technology park in southern Greece, especially in Crete, dates back to 1988, when it was first designed by key individuals in the Foundation for Research and Technology-Hellas (FORTH), one of the most respectable research institutes in the country.

STEP-C aims to provide to the significant research activities of FORTH with a reliable interface to the business world and to have a significant role for the development of the region. Another purpose is to support company members of the STEP-C to exploit any novel technology opportunities offered by the research institutes and to become key vehicles in the technology transfer process. Its main purposes are the exploitation of inquiring results and the creation of a pole of growth in the region, besides the poles of the primary sector and tourism, the support of installation and growth of new enterprises of high technology and the creation of a "Centre of Learning" for executives of enterprises. The various services the STEP-C covers the needs of the enterprises, not only those hosted in its incubator but also the companies situated in the wider region. Those services are academic, technological, entrepreneurial, financial, legal, and informative (http://www.stepc.gr).

Thessaloniki Technology Park (TTP) was established in April 1995, by the Chemical Process Engineering Research Institute (CPERI). Its purpose was the greater exchange of ideas, people and facilities between universities and industry, especially those in northern Greece. The TTP building infrastructure has a total surface of 7,500 m^2, including the Centre for Research and Technology Hellas (CE.R.T.H.)/CPERI research laboratories/pilot plans, an incubator building and an administration/conference centre and library/scientific information. The incubator is available to enterprises and to individuals who want to convert an innovative idea to an enterprising success. Incubator services include accountant, secretarial support, connection with Internet and ISDN, e-mail, searches of collaborations and support on attendance in European and national programs E&A. (http://www.thestep.gr).

In the Region of Epirus, the Scientific and Technological Park of Epirus (STEP-EPIRUS) was founded in 1999 from the University of Ioannina and the General Secretary of the Region of Epirus. The main purpose of STEP-EPIRUS is the diffusion of the know-how that is produced in the academic community and the research centres aiming at creating a new pole of development for Epirus. It serves as an *incubator* for new enterprises among the four prefectures of the Region of Epirus. The enterprises hosted on the premises of STEP-EPIRUS develop high-technology products and services. In parallel, STEP-EPIRUS offers to the hosted enterprises consultant services, and is a mediator to academic and research institutions, collaborations with other enterprises, administrative and secretarial support (http://www.step-epirus.gr).

The incentives for the second science park to be settled in central Greece were given by the private sector in the Region of Thessaly, in Volos. The Technology Park of Thessaly (TE.PA.THE.) was established in December 2001 by the Metallurgical Industrial Research and Technology Centre S.A. (MIRTEC) and 38 other shareholders, mainly agencies and companies of the region of Thessaly. TEPATHE is a new model of collaboration including industrial, academic, research and government organizations, and was established in order to lead the knowledge-based information society of the twenty-first century in the Region of Thessaly. Its main objectives are the acceleration of the establishment of new dynamic high-technology companies, the encouragement of the improvement of existing companies with the introduction of new technologies, and the support of local and regional development.

The Technology Park of Thessaly promotes activities that contribute to the increased competitiveness of the Thessalian Industry. This is achieved by participation in many European and National Regional Development programmes. In TEPATHE, the Technology Transfer Unit contributes to the transfer of research and other activities products of research institutes and universities to the regional industry. The Technology Park of Thessaly has as a short-term development strategy to start out as an incubator for small firms originating from regional higher education institutes, research centres and the local community in the Region of Thessaly. In addition, the contribution of TEPATHE in the development of the Region of Thessaly is of great importance (http://www.tepathe.gr).

According to the frame presented above, there is a differentiation among the objectives and the legal framework of science parks in Greece. Their aims, the institutions of their administration and collaboration (universities, local councils, private organizations, etc.) appear to be adapting depending on the particular characteristics of the region of installation of each science park. However, an institution that could meet the needs of all the science parks in Greece, promote the exchange of information of technology and extend considerably the market of companies that support and engrave common results, is the Hellenic Science and Technology Parks Association (HESTEPA), founded in July 2006.

HESTEPA aims at growing narrower collaborations between existing but also future Greek organizations. In particular, its goals are:

- The facilitation of communication between its members
- The formulation of proposals for the appointment and promotion of national policy with regard to the institution of science and technology parks

- The promotion of the role of science and technology parks in the local and regional growth
- The creation of networks of collaboration with other institutions and particularly with the enterprises that are hosted in science and technology parks as well as with institutions of enterprises
- The intensification of mechanisms of diffusion of technology with the collaboration of science and technology parks, including academic institutions, government-owned institutions and enterprises
- The participation in international organizations with relevant goals
- The attendance in national or international committees, councils, conferences, reports, etc., related to the aims of HESTEPA
- The organization, attendance and concretization of programs of training and education
- The collection, organization and diffusion of information relative to the interests of its members
- The organization of meetings, congresses and the publication of special forms that promote the objectives of its members
- The provision to other organizations of services in subjects that are related with the objectives of its members
- The attendance in programs and actions that support the objectives of its members

Although science and technology parks (STEPAs) in Greece have been extendedly promoted, their status needs to be further developed. Some general directions concern with the exploitation of HESTEPA, so that new synergies will be created. In addition, the Greek universities and research centres, and especially their liaison offices, should be advanced and gradually linked with the Greek science parks (Bezitzoglou 2006). Also, all Greek STEPAs should be supervised by the same governmental organization, so that strong bonds will be developed between the two parties. The new role of science parks may be to cater to the development of the social capital necessary for enabling and facilitating entrepreneurship in networks (Hansson et al. 2005). However, since Greece does not belong to the core technological countries of Europe (Bakouros et al. 2002), above all and the most important is the development of a strategic plan for innovation, which will provide the financial and legal framework and the general terms for successful incubator services and support for enterprises in Greece.

2.4 Outsourcing Networks in Ireland

C. Heavey, P. Liston and P. J. Byrne – University of Limerick

Ireland experienced a disproportional level of foreign direct investment in the 1990s resulting in the manufacturing sector being dominated by large multinational companies. These multi-nationals were attracted to Ireland by a combination of the competitive corporation tax system introduced by the Irish government in the 1980s, relatively low labour rates (although this has steadily increased since then) and the emergence of Ireland as a knowledge economy. Consequently, Irish SMEs typically participate in virtual networks through outsourcing contracts with these multi-national companies, or as they are sometimes termed OEMs (original equipment manufacturers). These OEM-lead outsourcing networks are a defining characteristic of modern Irish manufacturing.

Outsourcing networks (or virtual networks) typically link highly innovative but de-verticalized lead firms (OEMs) with sets of highly functional suppliers who provide a wide range of production-related services (Sturgeon 2000). These networks are highly flexible systems characterized by fluid relationships with short-term contracts between participants within the network. Such networks are now a characteristic of our business nation and can be found extensively across the Irish landscape. These networks are of extreme importance to the emergence, survival and growth prospects of many of our indigenous SMEs. In recent times the impact of our knowledge economy has surpassed the competitive edge we once enjoyed with respect to our low labour rates. SMEs have had to adapt to these changing conditions. In the past SMEs competed through the provision of low cost manufacturing to support OEMs, they now compete through superior supply (network) management for these OEMs. So in summary, indigenous SMEs, working with these OEMs have moved through an evolutionary phase from low-cost manufacturers to their present day position of knowledge-based network managers.

Section 2.4.1 reports on a field study carried out in current practices in outsourcing with particular focus on the role of networks of SMEs. This study found that the formation of Irish outsourcing networks is typically instigated and aided by what is known as the RFx process (where RFx is the collective term for *request for information*, *request for proposal* and *request for quotation*). This RFx process and its implications for the responding companies are discussed in Sect. 2.4.2. Sections 2.4.3, 2.4.4, and 2.4.5 then describe three different network structures based on case study examples of indigenous Irish companies. These case studies highlight the varying levels of interaction and forms of governance that exist in Irish manufacturing networks today.

2.4.1 Electronics Manufacturing Field Study

This study focused on the electronics sector as it is the largest manufacturing industry in Ireland with over 30,000 people involved in a wide range of sub-sectors including computer systems and sub-systems, peripherals and media, electronic components, data communication equipment, control and test systems and consumer electronics (Shannon Development 2007). The supply chains involved with producing electronic goods invariably contain many echelons with various com-

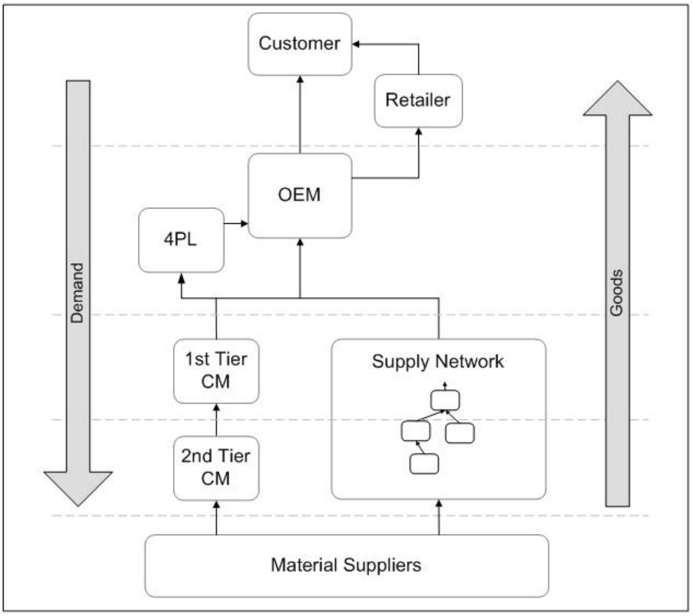

Fig. 2.7 Relative company positioning in typical supply chain networks

panies playing different roles in the production process (due primarily to repeated outsourcing activity), as depicted in Fig. 2.7.

In order to gain a balanced understanding of current outsourcing practice, field study participants were selected from across the supply chain spectrum (the supply chain roles of the participants are listed in Table 2.3). In all, seven different organizations are included in this field study evaluation, varying in size from a network coordinator with only four direct employees to a large multi-national OEM with over 50,000 employees. One of the organizations included in the field study is an association of over 40 individual companies and is best described as a virtual breeding environment (VBE). A VBE is defined by Afsarmanesh and Camarinha-Matos (2005) as "an association of organizations (members) and their related supporting institutions, adhering to a base long-term cooperation, agreement, and adoption of common operating principles and infrastructure, with the main goal of increasing their preparedness towards collaboration in potential virtual organizations". Such a virtual organization (VO) (also referred to as a virtual enterprise (VE)) is defined as "a temporary alliance of enterprises that come together to share their skills, core competencies, and resources in order to better respond to business opportunities, and whose cooperation is supported by computer networks" (Camarinha-Matos 2001).

During the course of the field study it became apparent that it was not only the case of the VBE which resulted in the formation of VOs. It was noted that in most cases the companies did not undertake the outsourced business in its entirety but instead formed an alliance with other companies which they relied upon for

Table 2.3 Field study participant details

Field study participant	Supply chain role	Company's main area of business	Number of employees in company (approx.)	Number of RFQs processed in a week (approx.)
Participant one	2nd Tier CM	Low volume assembly and manufacturing	130	5
Participant two	1st Tier CM	Electronics manufacturing	50	6–12
Participant three	1st Tier CM	Electronics manufacturing	600 (Irish facility)	8
Participant four	4PL	Warehousing, kitting and supply chain management	400	5–10
Participant five	Supply network coordinator	Supply chain management	4	4–5
Participant six	Supply network	Manufacturing related services	46 Independent companies	Still in initial stages of business development
Participant seven	OEM	Electronics manufacturing	>50,000 (globally)	n/a

materials and services. This leads to the proposition that there exists a VO continuum which spans various levels of complexity and integration in the involved networks.

Based on the field research, three different VO structures from this continuum are outlined in Sects. 2.4.3, 2.4.4 and 2.4.5. Each of these descriptions is supported by an Irish example from the study which typifies the type of network concerned. First, to give the context in which these supply networks are formed, the RFx process is described in Sect. 2.4.2.

2.4.2 Network Creation: The RFx Process

This section presents the RFx process which is encompassed in many different terms in both industry and literature (e.g. supplier sourcing, contract costing, supplier selection, partner search and selection, and tendering). The RFx process is of significance as it instigates the creation of VOs in order to meet the requirements of an RFQ. Having made the decision to outsource a business process the company (be they OEM or contract manufacturer (CM)) will first of all identify a broad selection of potentially suited contractors. This group of potential contractors is then reduced in size by subjecting it to a number of iterative supplier analysis steps (see Fig. 2.8).

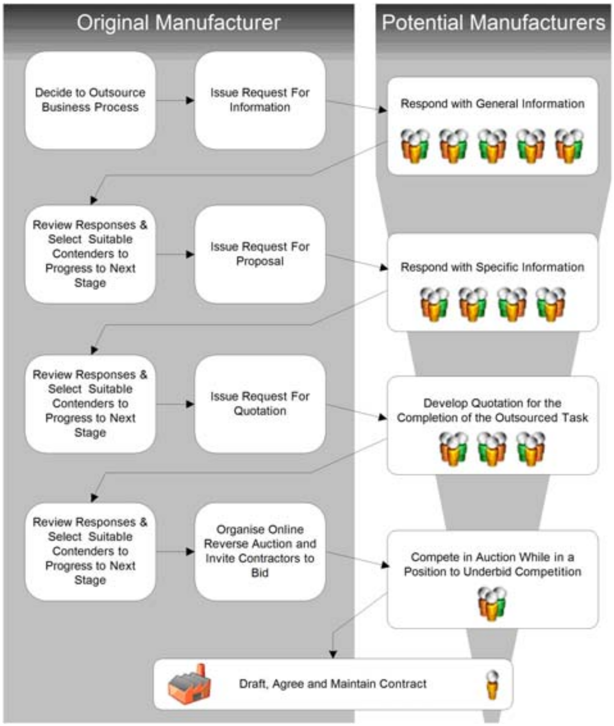

Fig. 2.8 The RFx process

This description is typical of the outsourcing decision process when the company outsourcing the business (described here as the buyer) is unfamiliar with many of the potential suppliers' capabilities. However, depending on the extent of the buyer's knowledge of the suppliers in review, they may choose to forego some of the steps identified here.

Once the potentially suitable contractors have been identified, the buyer issues what is known as a request for information (RFI) to each company in the selection. This request is to simply elicit general information about the companies and their competencies. Responses to an RFI are not binding on the respondent and are used more to eliminate non-relevant and non-responding contractors rather than select between vying service providers. Once the relevant contractors have been identified they each receive a request for proposal (RFP), which outlines the business process to be outsourced and requires a plan from the contractor detailing the system they propose to put in place in order to undertake this business process. The contractors are not required to provide cost information at this point in the process as future contenders are selected on the basis of the performance and capability they purport to offer. The contractors who have been successful in these first two steps of the process are now presented with a request for quotation (RFQ). This RFQ document contains a precise description of the work to be completed and outlines all other customer requirements and contractual agreements. Responses to an RFQ are required to include detailed descriptions of how the task will be undertaken, with a clear breakdown of the pricing scheme.

The successful contractor is often chosen at this stage but in recent years reverse auctions have been increasingly used as a further selection step. These auctions begin with an invitation being sent to the top performing contractors in the RFQ process. These invitations direct the recipient to log into an online website at a specified time where they are required to underbid (hence the phrase “reverse auction”) each other in an attempt to win the contract.

The suppliers must prepare their bid before the auction opens. The buyer can watch over the process, analyse the bid data and interact with the suppliers by phone, message board or e-mail. The suppliers see only the “lowest” bid and have to beat it to win the auction. This “lowest” bid is based on criteria set by the buyer, and can contain multiple attributes. When the auction has finished, the preferred supplier(s) (optionally the winner of the reverse auction) is selected and awarded the contract, pending agreement by both parties. After the contract has been prepared, drawn up, negotiated and agreed upon, a contract management process begins where the contract is managed throughout the contract’s lifecycle until termination of the contract.

This process supports the selection of business partners and thereby the creation and extension of supply networks. However it can also pose difficulties for networks, particularly in cases where an existing network of companies strives to collectively respond to an RFQ. The difficulties for these networks primarily relate to the short timeframes in which they must gather the required information from individual members and form a united solution for the buyer. The management structure of the network can also be a major factor when decisions have to be made quickly during a reverse auction; three different structures are discussed in the following sections.

2.4.3 Case 1: Contract Manufacturer

A contract manufacturer (CM) can be defined as follows (Bridgefield 2006): “A third party that performs one or more production operations for a manufacturer who will market the final item under their own name. They often charge on a per-piece or per-lot basis for the labour required for their services while using components or materials supplied and owned by the final item manufacturer.” Contract manufacturers can be further categorized depending on their positioning within a supply chain. The terms *first tier*, *second tier*, etc., are used to denote these positions. When responding to an RFQ, a CM will very often be required to develop a supply network of component and assembly suppliers. While the CM may not develop formalized associations with such companies, they have to form a close enough relationship to ensure they have a secure supply of material. This is particu-

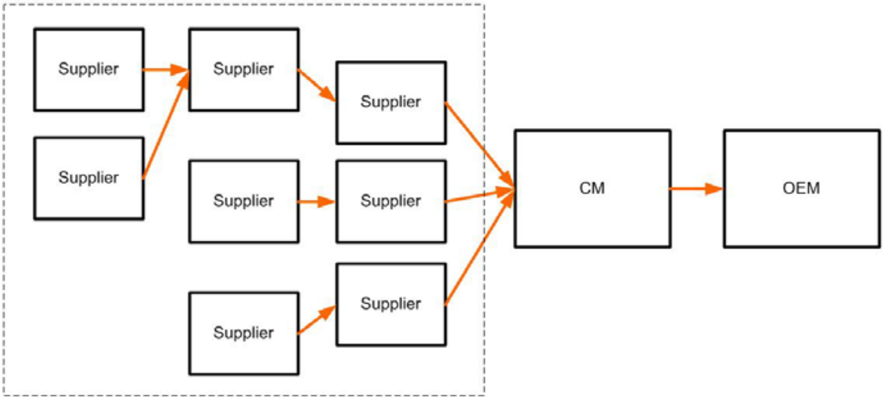

Fig. 2.9 CM supply network scenario

larly true in situations concerning specialized commodities that are not widely available on the open market or those for which the CM is the supplier's sole customer.

Many of the RFQs examined during the field study required the CM to develop one of these informal networks. One example concerned an OEM that had decided to outsource all of its packaging activities. To bid for this work, the CM was required to develop and cost a solution where it would be responsible for managing all material, procurement, warehousing, inventory, IT, logistics and quality activities. This work involved relatively straightforward processing on the part of the CM (i.e. packaging and labelling of goods). The key consideration for the CM was therefore ensuring that all the necessary packaging materials were available at all times as any delay in the shipping of goods would incur severe financial penalties from the OEM. To achieve this, the supply network as illustrated in Fig. 2.9 was developed.

The CM in this case had six weeks to respond to the RFQ. In this time they had to secure suppliers for moulded plastic cartons, assorted corrugated cardboard boxes, and various labels; agree stock holding levels at each supplier; and design contingency plans for critical materials. Costs for providing this service had to be calculated based on supplier quotes, estimated expediting costs, CM labour rates and overheads. The final decision on the contract winner in this example was based on the result of a reverse auction.

2.4.4 Case 2: Supplier Sourcing Company

A supplier sourcing company is an organization that selects suitable organizations on the open-market to fulfil the needs of an OEM. During the field study it was noted that many of the companies operating in this role in Ireland were former manufacturers that changed business focus. These companies use their manufacturing experience to their advantage by distinguishing potential processing problems

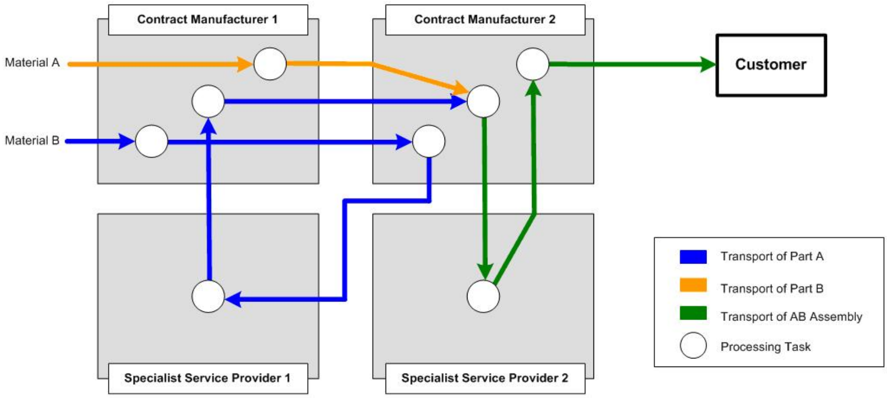

Fig. 2.10 Process steps for component supplied by a supplier sourcing company

and using their industrial contacts to source service providers with the expertise required. The supplier sourcing companies then take on responsibility for managing the flow of material between these independent companies and on to the customer.

One common reason why a supply network is needed in these circumstances is that there simply may not be a single company with all the technological capabilities required. A second reason is that, even when one company is capable of completing all tasks, there may be other companies who can complete specific tasks more efficiently and/or more economically.

Participant five from the field study is a typical example of a supplier sourcing company. Figure 2.10 illustrates a supply network designed by this company to supply a highly specialized product to a multi-national OEM. Four different companies based in two different countries are involved in the manufacturing process; therefore, significant transportation of the components is required. This necessity to use foreign specialist partners poses a greater problem for Irish companies than their mainland Europe counterparts as any cross-border collaboration requires either sea or air transportation. Note from Fig. 2.10 that product components visit both Company 1 and Company 2 at three different times during the production process, thereby further increasing logistical and scheduling problems for the network manager.

2.4.5 Case 3: Virtual Breeding Environment Supply Network

The third identified supply network structure is typified by *participant six*. This network is an open alliance of companies in the Shannon region of Ireland that was established in January 1999 and is best described as a regional VBE.

The network was originally established to generate more business opportunities for the member companies through joint marketing initiatives such as exhibitions, tradeshows, and advertising. However in addition to this *participant six* is now

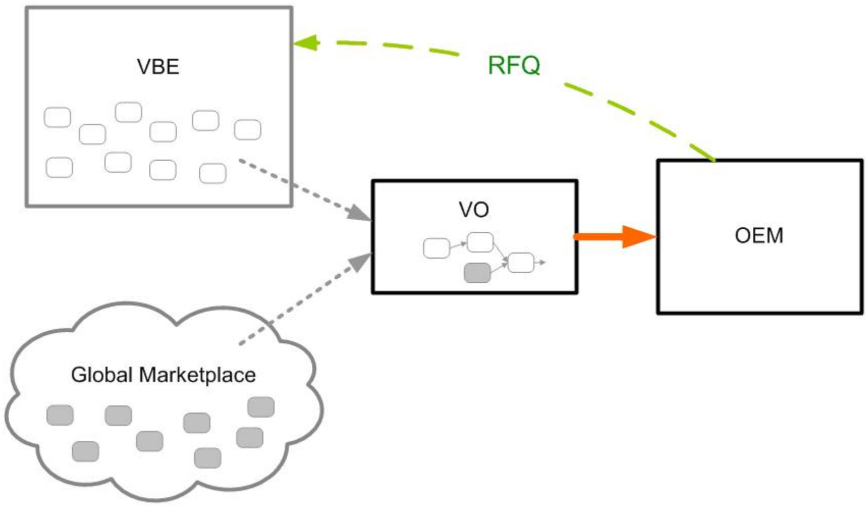

Fig. 2.11 VBE supply network scenario

aiming to increase the capability of the network members to collaborate when responding to RFQs so that they may rival larger competitors. An overview of the creation and operation of the network is illustrated in Fig. 2.11. When an RFQ is sent by an OEM to the VBE (this may be directly to the governing board of the VBE or to one of the individual members who in turn brings the business opportunity to the attention of the entire VBE), a network member is elected as VO developer and thereby made responsible for creation, formation and management of the network. The RFQs handled by *Participant six* are typically multi-faceted, requiring the VBE to consider the design, manufacture and product lifecycle management of a family of products. The VO developer must align each required task with a suitably skilled network member which, as illustrated in Fig. 2.11, may require the participation of companies from outside the VBE.

With the experience of operating in this manner, *participant six* has identified many barriers that impede the development of VO networks, particularly those with a high number of required members. The most significant constraint is reported to be the shortage of explicit supply network design tools and methodologies for developing, costing and selling a VO supply network solution to the customer.

2.4.6 Summary

Recent changes in global economics have lead to the transformation of business practice for many Irish SMEs. Where companies were once able to operate independently and rely on low labour rates for competitiveness, they now rely on collaboration and quality of service to ensure their continued operation. This has promoted the development of formal and informal outsourcing networks which span both across the island of Ireland and into many other countries; three different network structure examples have been outlined here. As SMEs begin to either participate in or manage these networks they require new collaboration support systems; it is important that these requirements are addressed in order to secure the future of Irish manufacturing SMEs.

2.5 Industrial Districts in Italy

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Industrial districts are established as an important asset of the Italian production system: the numbers of active companies, employees and exported products make them an important part of the national economy. Italian industrial districts are generally recognized as a valid organizational model, studied both on a national and international level, which makes member companies and districts as a whole capable of competing on international markets.

The international interest in SME clusters has been fuelled particularly by the experience of what has come to be called the Third Italy. The concept of the Third Italy started to be used in the late 1970s. At that time, it became apparent that while little economic progress was in sight in the poor south (Second Italy), the traditionally rich northwest (First Italy) was facing a deep crisis. In contrast, the northeast and centre of Italy showed fast growth, which attracted the attention of social scientists. In a number of sectors where small firms predominated, groups of firms clustered together in specific regions seemed to be able to grow rapidly, develop niches in export markets and offer new employment opportunities.

According to economical analysts "the growth of the northeast and centre of Italy pushed the scholars to analyse the economic and social fabric of the region, and its agglomeration of firms clustered in specific geographic zones, and operating in specific industrial sectors. These clusters were able to establish strong positions in world markets in a number of traditional product categories, including shoes, furniture, tiles, musical instruments, etc. Progress seemed promoted by the capacity of the clusters to innovate in terms of production processes as well as product qualities" (Callegati and Grandi 2005).

2.5.1 Basic Features and Figures of Industrial Districts

The Italian law no. 317, 5th October 1991, which rules state support for innovation and development of SMEs, defines industrial districts as: "geographical areas characterized by a high concentration of Small and Medium Enterprises, with peculiar reference to the enterprises' connection with locally resident population and productive specialization of the assembly of SMEs as a whole". Furthermore, it states that (Districts') Consortia for Industrial Development are to be considered public economic bodies. It then legitimates the regions to financially support innovative projects that involve many enterprises, according to specific contracts that are to be stipulated between the regional governments and the consortia. Priorities for financial intervention are decided by the regions.

The reference *Guide to Italian Districts* published by Unioncamere identified 100 existing districts in the country, gathering some 89,000 enterprises, which in turn employ almost a million workers (see Table 2.4).

From this common starting point, Italian regions have operated in differing ways, thus creating an inhomogeneous national landscape with regards to industrial districts' spreading and importance. The following regions, Piemonte (29 districts), Lombardia (16 districts) and Veneto (29 districts), gather alone more than 50% of all Italian districts (figures refer to 2004). Other regions, such as for instance Emilia Romagna, have preferred not to recognise districts as institutional entities until recent years, even though they carried out specific support actions for the nationally important local "clusterings". Friuli Venezia Giulia's regional government recognized four different districts with a regional law of 1999 and defined some specific support programs that will be analysed more in depth in the following paragraph.

Both the national and regional laws adopt a definition that recalls only two of the various characteristics on which the scholarly definition of "industrial district" is based. The points recalled in both laws are (1) a territorially restricted area and (2) a specific product or sector.

A more exhaustive analysis of the concept of "districts" (and "clusters") goes beyond the idea of locally defined areas of productive specialization (Becattini 2003).

The fundamental configuration of an industrial district, on a deeper level, implies that the production process is not integrated on a vertical basis but instead is based

Table 2.4 Italian industrial districts (adapted from Club dei Distretti Industriali e Unioncamere, Guida ai Distretti Industriali Italiani, Roma, 2003)

Sector	Number	Companies	Employees
Food and agriculture	8	4,072	59,317
Textile: apparel	19	24,175	225,413
Shoes	14	10,889	105,744
Mechanical	7	7,041	92,742
House appliances	13	14,548	129,300
Non-metallic minerals	14	7,128	57,305
Other sectors	25	21,010	326,331
Total	100	88,863	996,160

on work distribution between different companies which are inter-related within a single *supply chain*. The specialization that defines the territory, according to the legal definitions, applies to the end products (shoes, chairs, glasses, tiles, etc.) but it implies a further spectrum of process-specific specializations. Companies forming a district (cluster) are not only geographically close to each other but are necessarily inter-dependant and cannot be considered as completely autonomous entities.

Vertical cooperation often coexists along with intense horizontal competition between the districts' actors. Furthermore, not only direct production connections are active within a district: local institutions, industry and trade associations, banks, research and educational structures can be considered among the prime actors in the building and operation of a district.

Industrial districts in Italy emerged as a rather "spontaneous" way of organizing production for competitiveness but the role of local institutions played a not marginal role by means of relevant social regulation and public services for the enterprises.

Over time districts have been varying the range of products, both enlarging the products' spectrum within the original specialization field (e.g. from wooden chairs only, to metal and plastic chairs as well) or even trespassing the borders with neighbouring fields. *Product mix* enlargement derives from two opposite business strategies whose interaction produces a common trend for the district as a whole: product range expansions for some companies and product specialization for others, usually smaller ones.

The birth of new specialization has been parallel to the evolution of the inter-sectorial configuration that sees local companies broadening their expertise to the production of district-relevant machinery, materials and connected technologies.
Following this evolutionary scheme the districts, even though retaining their original nature, grow into more complex aggregations that correspond to Michael Porter's definition of *geographical clusters* (Porter 1998a):

"Clusters encompass an array of linked industries and other entities important to competition. They include, for example, suppliers of specialized inputs such as components, machinery, and services, and providers of specialized infrastructure. Clusters also often extend downstream to channels and customers and laterally to manufacturers of complementary products and to companies in industries related by skills, technologies, or common inputs. Finally, many clusters include governmental and other institutions – such as universities, standard-setting agencies, think tanks, vocational training providers, and trade associations – that provide specialized training, education, information, research, and technical support."

Districts have traditionally operated as closed systems, with a dense network of internal connections but a rather limited number of external interactions and have mostly relied upon the capability of generating internally the required human, financial and knowledge resources. Partly due to the evolution of the district model itself and mostly due to the unavoidable change factor of globalization, this traditional closed model is, although, undergoing a deep crisis and districts are confronted with the need for major changes. According to the cited *Guide to Italian Industrial Districts* it is predictable that industrial districts will not be able to face “big armies (multi-national companies)” without transforming themselves into “pocket multi-national companies” and acquiring a cosmopolitan dimension (Club dei Distretti Industriali e Unioncamere 2003).

De-localization of the production and distribution processes, development of strategic relationships with extra-district suppliers (especially with regards to services such as technological innovation, design, marketing and financial services): these are the factors that have characterized the last few years for most of the Italian districts.

The internationalization of the districts opens up new challenges and problems. Districts are faced with the task of changing from closed local systems to specialized international cluster networks, while at the same time retaining the characteristics that made districts successful in the first place and meanwhile avoiding loss of competitiveness in a an increasingly rough global market.

Knowledge-intensive business services (KIBS), such as the examples mentioned above, are becoming increasingly needed in all production fields and even more so for industrial districts that need to grow their contacts and connections to international networks.

The CODESNET project highlighted some of these challenges and provided some case studies of innovative high-tech and knowledge-intensive clusters that are growing on a European level and having their origin in Friuli Venezia Giulia.

2.5.1.1 A Remark Concerning Terminology

The term “industrial clusters”, rather than “industrial districts” or “*milieu innovateur*”, spread in the 1990s, a result of Porter’s work, *Competitive Advantage* (Porter 1985) and his further publications. According to Porter’s definition “Clusters are a geographically proximate group of interconnected companies and associated institutions in a particular field linked by commonalities and complementarities. Clusters encompass an array of linked industries and other entities important to competition … including governmental and other institutions – such as universities, standard setting agencies, think tanks, vocational training providers and trade associations” (Porter 1998b).

For the purposes of this chapter we will stick to the different terminologies currently in use, often using both the term “cluster” and “district” in a very similar meaning.

2.5.2 SMEs Clusters and Institutional Support: the FVG Case Study

Friuli Venezia Giulia (FVG), Veneto and Trentino Alto-Adige, are the regions where the “Italian northeast” economic model first emerged in the 1970s and further evolved becoming highly successful and studied on a national and international basis. The main characteristics of the model are a capillary presence of enterprises on the geographical area, a dynamic productive structure highly inclined towards export and innovation, a balanced mixture of craftsman businesses, SMEs and a certain number of larger companies (actors).

Among the main peculiarities of the northeast there is the presence of industrial districts, areas where a large number of companies operating in different production are gathered and whose production is actively integrated.

In the region Friuli Venezia Giulia four of such districts exist and have for many years been well-consolidated. They are the Chair district around Manzano, the Furniture district in the Pordenone area (Brugnera), the Knife district in Maniago and a Quality Food district, especially focused on specialized ham production, in San Daniele[2] (a detailed description of their main characteristics can be found on the CODESNET website, as shown in Chap. 5).

Next to these established districts, new and innovative associations and clusters are emerging, tied to new technologies and advanced services: ICT, nanobiotechnologies, naval mechanical. In all these knowledge-intensive fields Friuli Venezia Giulia aims at better exploiting the region's quite distinctive position, both from a geographical point of view (its location in the centre of the new enlarged Europe) and from the perspective of number and quality of the territory's human capital, when compared to the other Italian regions.

A high level of educational resources (see statistics on the number of R&D employees per inhabitants as well as figures about number of scientific publication and their impact factor; see Fig. 2.12) contributes to helping the economical dynamism of the region, and investments in research and innovation are ever more needed because of the challenges and crisis following the increased scale and velocity of global competition and the emergence of competitors on the international market.

Relevant attention has been attributed by the institutions to supporting growth and activity of SME clusters and industrial districts. In the Regional Law no. 27, 11th November 1999, the region formally recognized industrial districts as "contexts of economic and occupational development and seat for promotion and coordination of local initiatives of industrial politics (…) to the purpose of reinforcing competitiveness of the productive system, the efficacy of the existing tools for industrial politics and of defining and activating new policies and guidelines". The same law defines the composition of a governing District Committee (Consortium), financed on a mixed public-private basis, which should include local authorities' representatives, representatives of the Industrial and Craftsman Associations and labour representatives. For the aims of supporting the activity of the districts, the District Committee produces a three-year development program plan, which is the basis for financial negotiation with the regional government.

[2] Respectively named Distretto della Sedia (PROMOSEDIA), Distretto del Mobile Livenza (DML), Consorzio Coltellinai Maniago, Distretto alimentare di San Daniele.

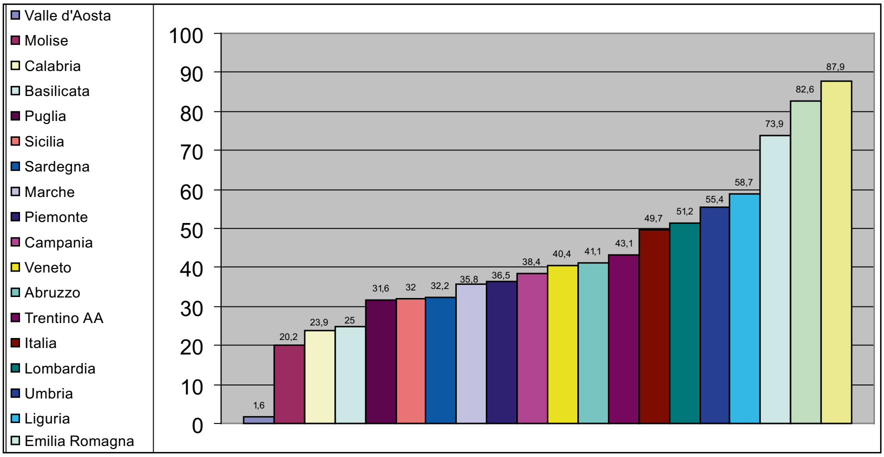

Fig. 2.12 Number of scientific publications per 100,000 inhabitants, Italy 2005 (adapted from IRES-FVG on data from ISI Web Science and ISTAT)

In more recent years the regional government, partly as an answer to new threats to the traditional economy of the territory and its traditional markets, has further expanded the set of institutional tools for supporting SMEs and SME clusters.

Recognizing the importance of innovation and research for regional enterprises as means of development and of maintaining a competitive advantage over global competitors, the regional government has resorted to some focused intervention for building or supporting the structuring of a certain number of new high-tech clusters. At the same time, it planned and executed some specific action to help existing clusters renew their competencies and push investments on innovation and knowledge-based development. Another Regional Law, no. 4 of 4th March 2005, "Interventions for support and competitive development of SMEs" ensures regional financial support to companies proposing well-structured plans for dimensional and competitive growth.

The institutional support activities helped shape the new cluster for home and living technology ("FVG Abitare" district), the one for biomolecular medicine in Trieste and to redesign the cluster of naval/electromechanical industry in Monfalcone. The region also sketched specific strategy plans for development of ICT and biotech/biomedicine fields, in both cases including points to support new cluster-like concentration of competencies and entrepreneurship.

Finally, and promisingly for the future, thanks to the enlargement of the European Union and thanks to the growth of the emergent countries in Southeast Asia, Friuli Venezia Giulia finds itself again in a central position. Its strategic position has stimulated a strong thrust towards innovation and know-how transfer from laboratories to enterprises.

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