

7th Open Forum for Technology Transfer and Innovation

under the auspices of the
Romanian Ministry of Education, Research and Youth

April 10, 2008
Chamber of Commerce, Bucharest

**NETWORKING AND LEARNING
AT LOCAL AND NATIONAL LEVEL:
bringing the concepts together**

Riccardo Cappellin
University of Rome "Tor Vergata"
cappellin@economia.uniroma2.it

1. Introduction

The economic development of regions depends on their competitiveness in an increasingly integrated global economy. Thus, the aims of an European innovation policy are to increase the overall productivity, to promote a greater competitiveness of exports toward non European countries and to facilitate a fast transition toward a modern knowledge economy.

The internationalization of markets and of production processes indicates that innovation and new knowledge are the key factors of international competitiveness for the European firms and regions. In the long term, the real factors of international competitiveness are neither taxes and corporate profits nor labour flexibility and labour costs, but rather productivity changes, innovation capabilities, knowledge and know-how. There are different factors of innovation, such as finance and entrepreneurship capabilities, but the role of knowledge, technological and organizational capabilities and know-how is becoming crucial.

Innovation is not only the key factor of competitiveness and success of the existing firms, but also the factor explaining the survival or crisis of firms or the factor leading to the creation of new firms. Knowledge and innovation lead to economic and employment growth, but also to international division of labour, agglomeration and exclusion phenomena. In fact, the major factor of growth disparities between countries is the gap in technology and knowledge.

Table 1 - Structure of OECD¹ manufacturing trade² by technology intensity (shares in total manufacturing trade)

	2000	2001	2002	2003	2004	2005
High technology	26,7	25,8	25,2	24,5	24,4	24,1
Medium-high technology	37,6	38,0	38,8	39,3	39,0	38,7
Medium-low technology	15,1	15,0	14,9	15,5	16,5	17,6
Low technology	20,1	20,7	20,9	20,7	19,6	19,0

Source: OECD, STAN Indicators Database, March 2005 (www.oecd.org/sti/stan/indicators/).

1. Excludes Luxembourg and Slovak Republic. 2. Average value of total OECD exports and imports of goods.

Table 2 - The competitiveness of the European economy in medium-tech industries

		European Union (25)			Japan			United States			China		
		exp	imp	exp-imp	Exp	Imp	exp-imp	exp	imp	exp-imp	exp	imp	exp-imp
Manufactures	2004	3053,7	2878,3	175,4	524,3	256,0	268,2	668,7	1133,9	-465,2	542,4	428,3	114,1
	2005	3240,3	3042,2	198,1	546,4	276,4	270,1	732,5	1239,3	-506,9	700,3	493,1	207,2
Machinery and transport equipment	2004	1556,1	1453,6	102,5	371,3	124,4	246,8	393,3	609,1	-215,8	268,3	252,8	15,4
	2005	1636,1	1509,8	126,3	381,3	132,4	248,9	433,7	663,4	-229,8	352,2	290,5	61,8

Source: World Trade Organisation Statistics: International Trade Statistics 2006 (http://www.wto.org/english/res_e/statis_e/its2006_e/its06_appendix_e.htm)

The relative importance of medium tech is confirmed also by their increasing share in the trade of OECD countries (56,3%) and by the fact that both the share of low technology and also of high technology products have decreased in the OECD trade after 2000, when the ICT bubble exploded.

In particular, exports in machinery and transport equipment of the European Union are 3,7 time the exports of United States and 4,6 time the exports of China. The trade balance of European Union in machinery and transport equipment is highly positive and still 2 time that of China, but lower than that of Japan. Thus, in order to maintain the competitiveness of the European Union, innovation policies should focus especially on medium tech sectors.

The European FP6 project: IKINET – International Knowledge and Innovation Networks (<http://www.ikinet.uniroma2.it/>) has aimed to increase the understanding of the **process of**

knowledge creation and innovation in medium technology sectors and to identify characteristics of innovation networks within **regional clusters** and barriers for their **enlargement at the European level**.

Medium technology sectors have achieved high success in industrial restructuring and play a key role in European competitiveness, as they represent the largest share of European industry **exports, value added, employment, human resources with tertiary education and also R&D investments**.

Table 3 - The share of sectors by technology intensity in the EU25

	Manufacturing	HT	MT	LT
1 Export	100	21,5	59,4	19,1
2 Value Added	100	19,5	47,8	32,7
3 Employment	100	5,8	53,3	40,9
4 Human Resources in STE	100	11,0	58,9	30,1
5 R&D	100	46,7	48,9	4,4

Sources: OECD SAN Indicators 2007, EU Key figures 2007. Eurostat data base, Science and Technology

The fast growth of emerging countries create important opportunities for the exports and growth of these sectors. However, medium tech sectors need to fast and regularly innovate and improve the quality of their products, in order to insure international competitiveness and to avoid the de-location of productions from the European regions and countries. Thus, clusters in medium tech industrial sectors should increasingly **base their international competitiveness on innovation and the capability to create new knowledge**. Medium tech sectors are characterized by many specialized small firms, but also large firms or medium size firms are important in these sectors. Medium tech sectors need not only to integrate knowledge from new high technology and scientific segments, but also to improve their internal competencies through a greater effort in enhancing interactive learning processes.

This contribution aims first to clarify the factors determining the **process of innovation** and of knowledge creation in medium technology sectors, with specific reference to the role of **tacit knowledge and creativity**, in the combination of different and complementary information, technologies and knowledge.

Then, it illustrates the evolution of the **cluster concept** from a predominantly material linkage and agglomeration based concept to the **concept of innovation networks**, enabling the governance of generation and diffusion of knowledge.

Third, it compares the traditional **linear approach** focusing on R&D investments and the more modern **systemic approach**, focusing on interactive learning process and the development of creative capabilities.

Fourth, it illustrates the approach of **Territorial Knowledge Management** as an operational framework in the organization of the knowledge relationships between the firms in three types of regional production system, characterized by the specialization in **medium technology, high technology and low technology sectors**.

Finally this contribution illustrates the characteristics of **competence centres as a new tool of innovation policy**, which can be adopted by many countries and may contribute to the evolution of the European industry toward the model of the knowledge economy.

2. The role of tacit knowledge and creativity in learning processes

Innovation is promoted by factors operating both on the supply side and on the demand side. Among the first are: the costs and the quality of labour, the use of new machinery embodying modern technology, the accessibility to qualified suppliers. Among the second are: the access to a specific market, the level of demand, the forms of competition, as also the existence of specific barriers to potential competitors, such as IPR, which insure a temporary rent.

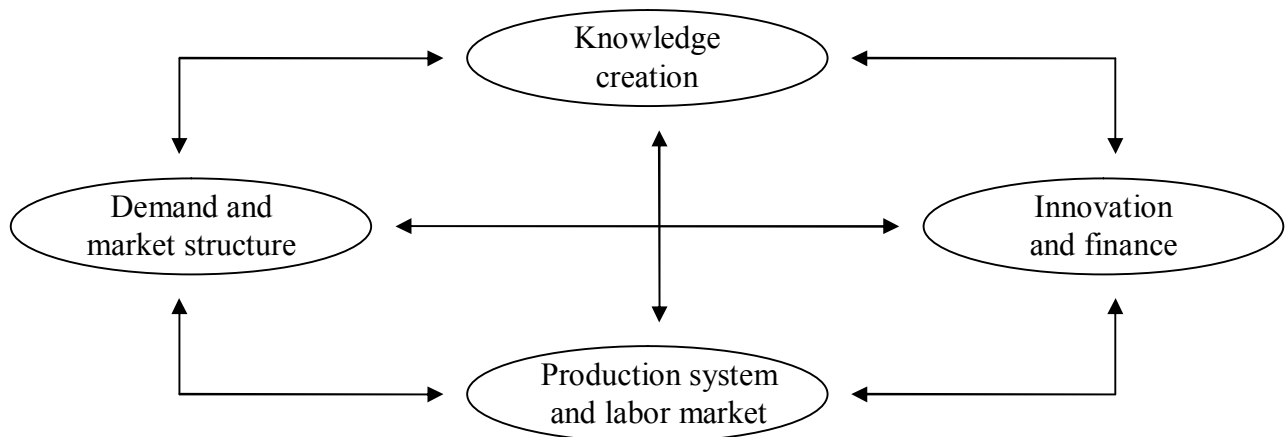


Figure 1: The relationship between knowledge creation and innovation

These complementary factors define the opportunities or the challenges in the external environment and they have to be complemented with the individual capabilities internal to the firm. In fact, the viability of a new process or product represents a necessary and not a sufficient condition. Innovation also requires the existence of subjective capabilities or of immaterial factors. These latter are represented by the capability of the firm and of the entrepreneur to elaborate an original long term project (i.e. a “business plan”) and a positive evaluation of the risk by the potential investors. Thus, internal knowledge and internal or external financial resources are two additional necessary conditions for the adoption of an innovation and they indicate the subjective capability/weakness existing in the firms in order to exploit external opportunities or to face external threats.

The focus on the process of knowledge creation rather than on the adoption of technologies explains the need to analyse the characteristics and factors of the process of knowledge creation in the case of intermediate technology sectors.

While most of the literature and policy debate on innovation focuses on high-tech sectors, the innovation process in medium-tech sectors has rather different characteristics and it is explained by different factors than in high-tech sectors.

Thus, differently from large firms and high tech sectors, innovation processes in the SMEs working in medium and low technology sectors do not depend on formal R&D, but on **tacit knowledge or on combinatorial capabilities and interactive learning processes** within networks of firms. Innovation has a **gradual character** and consists mainly in improvement of existing products, services and processes.

In particular, the process of **innovation in medium technology** sectors is driven by an **intensive interaction between the suppliers and the customers**, due to the **high specificity of the needs** of

the customers, which require solutions made by different complex combinations of **many specific components**.

SMEs systems are characterized by multiple incremental product and process innovation. It is often **difficult to distinguish the management of the process of daily production**, aimed to respond to the needs that result from the orders of the customers, **and the process of product development and innovation**. In particular, local production systems of SMEs are characterized by a **systemic process** within which different phases may be distinguished (Cappellin and Orsenigo 2000):

- **the phase of knowledge creation**, characterized by learning processes based on emulation and the close interaction of actors with different competencies,
- **the innovation phase**, characterized by a “problem solving” approach that makes expert use of a combination of different and complementary knowledge,
- **the production phase**, characterized by the joint work of various specialized suppliers.

SMEs develop **vertical flows of tacit knowledge within their respective “filiera” or value chain**. Moreover, they are increasingly **developing also horizontal linkages with different technologies and sectors**, which are crucial in order to promote structural changes and a **productive diversification of the cluster**, through the creation of new fields of production.

In a policy perspective, differently **from a linear approach**, which just promotes the **transfers of information and of modern technology** or provides customized expertise to individual firms, a **system approach focuses on promoting knowledge networks and cooperation** between the various local and external actors and on the **development of the internal capabilities** of these actors.

Tacit knowledge plays a key role in the process of innovation by SMEs in medium technology sectors, where innovation is based on the **capability to informally search for a solution to local problems together with other partners**. This process is different from the formal research activities in the high technology sectors.

Tacit knowledge is essential both in explaining the capabilities of an individual actor to think and to act and also in explaining his capabilities in the interaction with different actors. Tacit knowledge may refer both to the **internal capabilities**, which explain the process of how an individual actor behave, and also to the **relational capabilities**, which explain how he interacts with other actors and facilitate his tight integration with these actors.

A key dimension of tacit knowledge refers to **creativity**, since creativity is a form of tacit knowledge. **Creativity** is the result of a **process of selection and of association and simplification** (“pattern making”) that allow to **combine different and complementary information, technology and knowledge** borrowed from various sectors, disciplines and regions in the solution of a specific **problem**, which stimulates action and which usually requires the **joint contribution of various actors** interested to it.

Creativity requires the **combination of knowledge** in different fields and the **interaction between actors** having different competencies. The creative process is a fundamental component of a cognitive process, thorough which various set of knowledge are first searched, identified, understood, analysed for similarities and are finally brought together by adapting and extending their significance leading to the creation of a new set of knowledge (figure 2).

As the combination of various colours may lead to a different colour, creativity requires the combination of previous knowledge. **Openness**, connectivity, increased **accessibility** and

receptivity are key conditions for knowledge creation. New ideas always develop at the frontier of different established knowledge fields, which are extended into new directions.

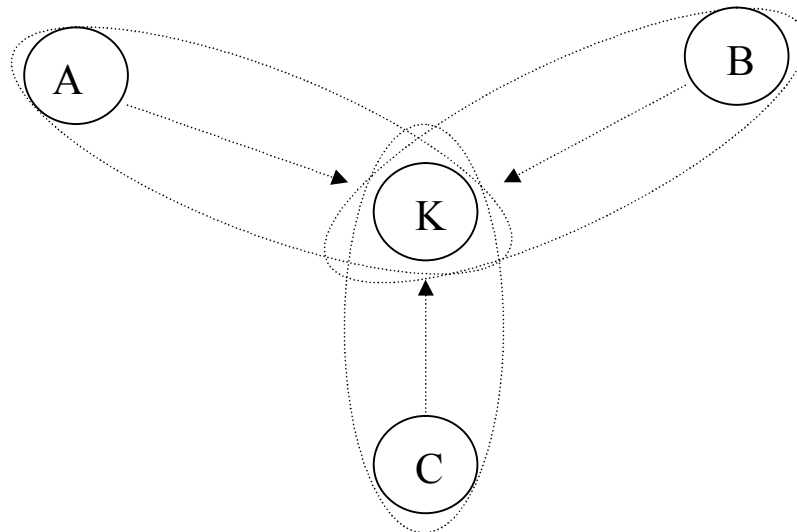


Figure 2: Creativity as combination of diverse accessible knowledge

Moreover, innovation is also made by breaking established links and by creating new links. This process is similar to the Schumpeter's process of "creative destruction". Both exploration and exploitation a component of the creativity process. Exploration is the search for diversity, while exploitation is the search for homogeneity and compatibility.

The model of figure 2 also indicates that three firms: A, B and C, which master three specific fields of knowledge do not need to merge or to geographically agglomerate, leading to the creation of a geographical cluster, in order create new knowledge, while they may only develop some forms of interaction by reducing the cognitive distance which has previously separated them. Thus, geographical concentration into a cluster can be substituted by a cognitive interaction within a network.

Policies aiming to promote creativity are different in the various sectors. Creativity in **high tech sectors requires large investments in R&D**, while in **medium technology sectors** creativity requires **networks and informal interaction**, leading to interactive learning between SMEs. However, creativity also requires a **sustained effort in innovation** by SMEs.

Creativity does not only consist in the adoption of specific product and process innovation, but also in the **design of medium term projects** having a collective nature **between the various SMEs** and large firms. In fact, regional innovation policies, rather than to aim to the **creation of new clusters**, should **promote large innovative common projects in the various clusters and regions**.

To enhance creativity requires to **facilitate the vertical relationships along the supply chain** between client and suppliers in a vertical perspective, but also **horizontally between different sectors** both locally and with external partners, such as **international research institutions and large international firms**.

The most appropriate characteristics of a **governance structure of the relationships aiming to promote creativity**, seem to be: a low level of formalization of the relationships, not too high specialization, a **network organization**, autonomy and responsibility, the trust that all workers can be capable to give a creative contribution to the firm, the measurement of results and rewards, self-

regulation and adjustment focusing on the exploitation of the actual results rather than on the strict respect of previously defined guidelines, the creation of various channels of communication between the units, firms, institutions and workers interested to the same area of production.

3. The changing nature of clusters and the role of proximity

At the present time the organization of production is experiencing a profound transformation process in which the hierarchic models give way to more flexible and decentralized forms of organization. This has produced multiple interpretations such as the industrial districts (Becattini, 1979), flexible specialization (Piore and Sabel, 1984), the new industrial spaces (Scott, 1988), industrial clusters (Porter, 1990), the knowledge economy (Cooke, 2002), the new economic geography (Krugman, 1990; Fujita et al., 2000), the theory of the innovative milieu (Aydalot, 1986; Maillat, 1995). Thus, a single unique interpretation as to how production is organized within the territory does not exist.

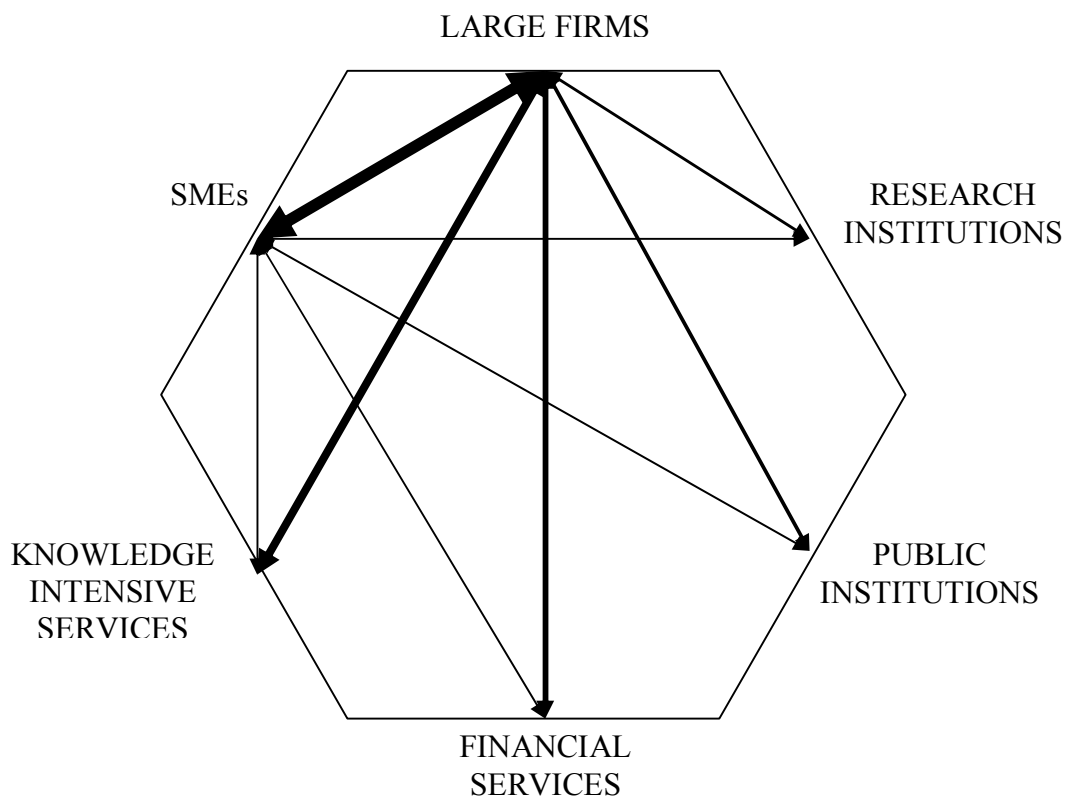


Figure 3: Information and knowledge links in a regional innovation system

The structure of a network can be illustrated by the relationships between various actors, which can be classified in **six groups: large industrial firms, industrial SMEs, business services, financial services, research institutions and public institutions**, as indicated in figure 3. These actors correspond to those considered in the empirical analysis of the IKINET project which has analysed six specific clusters in different European regions. The network relationships between these groups of actors have different intensity and they are mostly hierarchically organized around the large industrial firms. **Each group of actors is characterized by very tight internal relations** and it may represent a sub-network within the overall network.

In particular, the structure of a network is characterized by:

- **nodes**, which may be firms and other private and public actors,

- **links**, which connect directly or indirectly the various nodes,
- **flows**, which may be material or immaterial, such as product, services, financial, labour, power, information and knowledge flows,
- **distances**, which may be geographical but also technological, organizational, cultural, institutional and determines obstacles or transaction costs in the circulation of the flows,
- **infrastructures**, which may be material or immaterial, such as norms, institutions and social capital, and reduce the transaction costs, thus facilitating the circulation of the flows between the nodes.

The adoption of a network perspective allows to focus some new aspects of the process of technological change. In fact, in a network perspective, technological change may be interpreted as the result of the **continuous or gradual search by each node, of the most appropriate level and form of integration or co-operation with the other nodes or actors within the network.**

Networks represent the most effective form of organization to promote a fast speed of innovation. In a dynamic environment the creation of value and of new knowledge depends on the **combination** of the knowledge acquired from many other firms. The speed of innovation depends on the **interaction** between a plurality of actors.

Geographical proximity per se is not sufficient to generate knowledge between firms. The concept of geographical proximity should be integrate with that of cognitive proximity, which represents a key factor for the extension to the international level of the cooperative relations in the process of interactive learning between the various firms.

More generally, it is possible to combine the concept of **geographical proximity** with a broadly defined concept of **organized proximity**, which includes other dimension of proximity, such as cognitive, relational, cultural, social and institutional proximity.

In fact, regional production systems may have a rather different and evolving nature in the various regions and have transformed into **territorial networks** made by specialized and complementary firms.

First, **territorial networks** are different from the traditional clusters and industrial districts, specialized in a single sector, and are characterized by a **greater sectoral diversification**, a **greater integration of the various sectors** of the local economy and also by an **increasing internationalisation.**

A modern regional production system is not characterized by the **geographical concentration of many firms specialized in the same sector**, but rather by an **increasing diversity and complementarity of the various firms** and by the development of **external relationships with other regions and countries.**

While the models of the clusters and of the industrial districts were characterized by **the concepts of sectoral specialization and of geographical concentration**, the model of territorial networks is characterized by **the concept of integration, both between various sectors and between various regions.** Key concepts in the model of territorial networks are those of openness, connectivity, integration, synergy, cooperation.

Second, the model of territorial networks implies a **greater formalization of the relationships** between the firms, which were based on trust and personal links in the traditional geographical clusters and industrial districts.

Third, the cluster concept has evolved from a predominantly **material linkage and agglomeration based concept** to the concept of the **innovation network**, which represents **an institution that supports knowledge generation** and the sharing of knowledge. According to evolutionary and institutional economics, a specific character of **innovation networks** is the fact that they represent a **form of governance enabling the generation and diffusion of knowledge** between various local and external actors.

The IKINET project has highlighted that production clusters may be classified into **three types of networks**. Regional production systems most often have evolved from the form of a simple agglomeration of similar SMEs, such as in so called “ecological networks”, to the form of a community characterized by intense processes of interactive learning, such as in so called “identity networks”, and they may finally evolve to the form of “strategy networks”, characterized by an explicit governance of knowledge interactions between the various firms.

The similarities and differences of the concept of the innovation network with those of other related concept in the literature of regional economics are described in table 3.

Table 3: The characteristics of an innovation network				
Key Elements	Innovation network	Cluster	Industrial District	RIS
Firms	+	+	+	+
Geographical proximity	+	+	+	+
Material relationships	+	+	+	+
Technology relationships	+	-	-	+
Cognitive processes	+	-	-	-
Intermediate institutions	+	-	+	+
Intersectoral character	+	-	-	+
Interregional character	+	-	-	-
Evolution paths	+	-	-	+

Thus, all these concepts are based on the existence of various firms and of geographical proximity and material linkages. However, networks differs from all other concepts for the fact that they are characterized by the explicit consideration of cognitive processes and may have an interregional character.

Differently from clusters and industrial districts, networks consider the existence of cooperative relationships in the field of technology and may have an intersectoral character and an explicit dynamic nature, allowing evolution along specific paths.

Networks, differently from clusters, explicitly consider the role of intermediate or bridging institutions.

4. From a linear to a systemic approach in the analysis of innovation

The IKINET project has clarified that the perspective of the transition to the model of the knowledge economy implies a distinct change in the industrial development strategies and in the policy approach to the technological change.

The innovation process in medium tech sectors is different from the “linear” approach focusing on R&D expenditure and the rational process of optimization of individual firms. On the contrary, innovation can be interpreted according to a “systemic” approach. This approach focuses on the process of knowledge creation, on collective processes of interactive learning, on the iterative adaptation between the different partners and on an implicit process of automatic selection of the most competitive innovations.

Table 4: Why the process of innovation in SMEs and in medium technology sectors differs from that of large firms in high tech sectors

	Linear approach	Systemic approach
Key word	Technology	Knowledge
Stimulus	Cost competition, supply changes and new equipment	Market orientation, demand changes and user needs
Process	In house R&D and technology transfers	Interactive learning
Role of human resources	Labour substitution and receptivity to new technologies	Competencies of the actors, creativity and entrepreneurship
Competitiveness factor	Productivity increase and economies of scale	Continuous innovation, flexibility and fast change
Governance process	Rational optimization by individual firms and market competition	Connectivity, iterative adaptation and selection within innovation networks
Policies	Public finance to R&D and public market regulation	Multi-level governance, bridging institutions and public-private partnership

The emerging “knowledge clusters” are the result of the evolution from the traditional industrial “fordist” model, based on the exploitation of economies of scale external to the firms but internal to the cluster, to the model of the “knowledge economy” and are characterized by intense knowledge interactions between the various local actors (Asheim and Clark, 2001; Asheim, Coenen,

Moodysson and Vang, 2007; Bougrain and Haudeville, 2002; Braczyk, Cooke, Heidenreich, 1997; Cooke, Morgan, 1998; Lundvall, 1992; Nelson, 1993).

This new cluster based or network oriented approach implies a shift from a linear approach, which just promotes transfers of information and modern technology or provides customized expertise to individual firms, to a systemic approach (Lundvall, 1992, Antonelli, 2005) focused on promoting knowledge networks and cooperation between various local and external actors and on the development of their internal capabilities.

According to this new approach (table 4), focus should shift from the aim to promote the adoption of modern technology to that of enhancing internal capabilities and knowledge. The stimulus to change and innovation within firms is not only determined by the pressure of competition, the need to increase productivity and reduce costs, or the opportunity created by the supply of modern technologies and to adopt modern equipments, but rather by the identification of new markets, the aim to adapt to changes in the demand and the opportunity to satisfy new users needs. While in the linear process of innovation the formal process of R&D investment plays a key role, according to the systemic approach to innovation, solutions are gradually discovered through a process of interactive learning involving many different actors also outside the R&D laboratories. The desired outcomes are not just the increase of productivity indicators, often interpreted as disjoint result, but rather the speed of a continuous process of innovation, where each change is the evolution of previous changes.

The IKINET project has emphasized that:

- **SMEs** also compete through **innovation**,
- **R&D** is not the main factor of innovation in **medium technology sectors**,
- **spontaneous clustering processes** are not always sufficient for competitiveness,

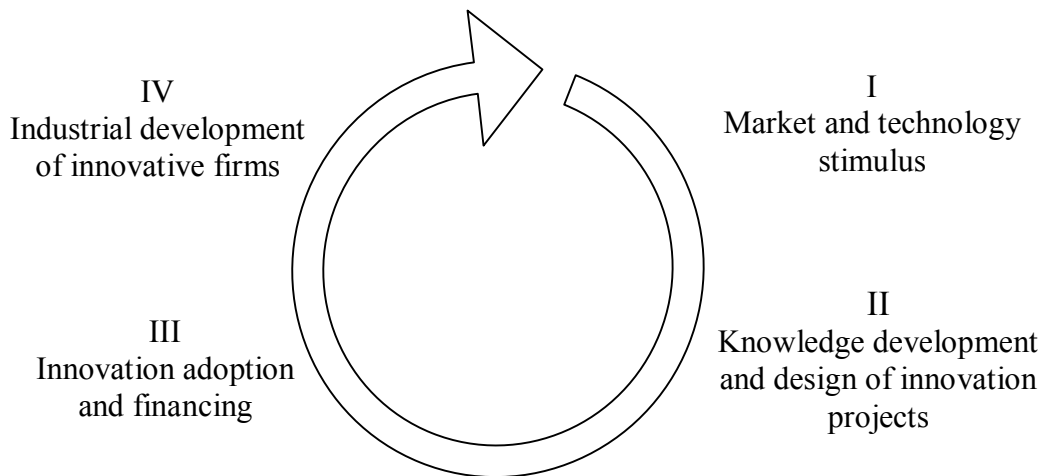


Figure 4: The fields of innovation policies

This new approach lead to identify a more complex set of domains for innovation policies, rather than the single financing of R&D, as indicated in figure 4. In fact, policies should first promote openness and receptivity of the firms to the stimulus coming from international competition, the creation of new market needs and from the availability of new technologies. Second, policies should also promote the creation of new knowledge suitable for solving the problems and promote the design of innovative projects by firms and groups of firms. Then, policies should promote the receptivity of the local actors in the adoption of innovation and the evaluation and financing of the innovation projects. Finally, policies should promote the coordination between the various firms,

their reciprocal adaptation and the integration of innovative firms in the international and local technology and production networks.

5. Territorial Knowledge Management and the drivers in knowledge creation

The limits of the traditional industrial clusters are underlined by the fact that the linkages between SMEs in the process of interactive learning within a cluster are often informal, rather chaotic and time-consuming. That highlights the need for an explicit effort to be devoted to the **organization of the knowledge networks** and the knowledge **interactions** with the specialized suppliers, with the clients, the knowledge intensive services, the research institutions, the public administration and other organizations localized in a given cluster and also with many other external actors.

“**Territorial Knowledge Management**” (TKM) is an operational framework which aims to **organize the cognitive relationships between the firms** in the process of innovation within a local network of cluster. TKM aims to facilitate the flows of tacit and codified knowledge, by enhancing **six factors or dimensions**: stimulus to innovate, accessibility, receptivity, local identity, creativity and governance capabilities. This approach is highly flexible and can be adapted to the various European clusters.

Territorial Knowledge Management aims to make more explicit and formal the organization of knowledge interactions, through which the firms and the actors in a traditional production system circulate the required information and competencies among them in a too implicit, complex and slow process.

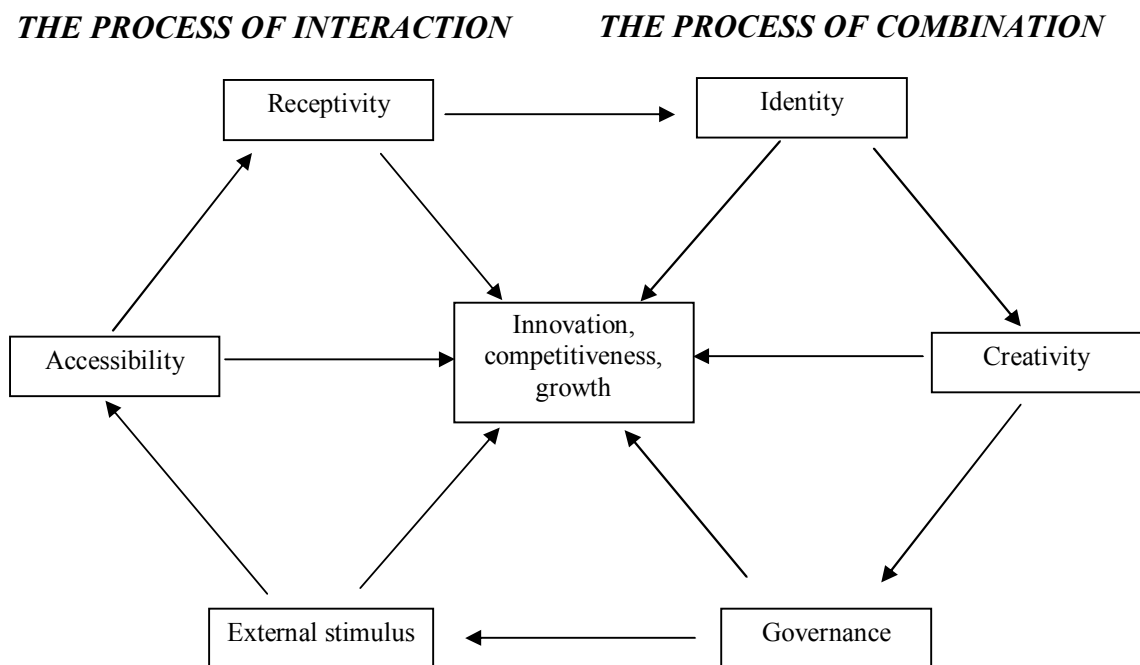


Figure 5: Territorial Knowledge Management as a framework for the governance of regional knowledge networks

The approach of Territorial Knowledge Management (TKM) is based on the concepts of cognitive economics, such as the concepts of networking and integration, interactive learning and knowledge creation. According to the approach of Territorial Knowledge Management (Cappellin , 2003b) there are six dimensions or drivers (figure5), which represent key necessary conditions for the

development of interactive learning processes within a network and the creation of new tacit and codified knowledge:

- external stimulus,
- accessibility,
- receptivity,
- identity,
- creativity,
- governance.

These six factors allow to **focus the various policy instruments for the governance of the learning networks** in a regional innovation system **on a limited number of dimensions**, which are tightly related to the factors of the processes of knowledge creation according to the literature in cognitive economics.

Table 5: Policy areas according to the Territorial Knowledge Management approach within selected knowledge and innovation networks

	Type of knowledge and innovation network		
Characteristics and factors	Ecological networks	Identity networks	Strategy networks
a) regions, sectors and firms	Peripheral regions Low tech sectors Traditional SMEs	Industrial clusters Medium-tech sectors Innovative SMEs	Urban areas High tech sectors Large enterprises
b) knowledge base	Symbolic/synthetic Knowledge	Synthetic/symbolic knowledge	Analytical/ synthetic knowledge
c) knowledge interaction	Knowledge spill-over	Interactive learning	K M and R&D joint projects
1. Innovation stimulus	Cost competition in the global market	Customer needs and high supply chain integration	Product innovation in specialized markets and technology push
2. Accessibility	Low international accessibility - low local accessibility	Low international accessibility - high local accessibility	High international accessibility - low local accessibility
3. Receptivity	Low qualification of human resources	Specialized skilled workers	High internal sectoral diversity
4. Identity	Fragmentation and external dependence	High local embeddedness and local identity	Low cognitive proximity and common identity
5. Creativity	Technology adoption	Networking and interactive learning	High investments in R&D
6. Governance	Public infrastructures and finance and deregulation	Multi-level governance at the regional level and bridging institutions	National industrial strategies and firms alliances in specific fields

The relationships between these dimensions of the knowledge creation and innovation process are indicated in figure 6. In particular, the external stimulus induced by the opportunities of the demand, the pressure of competition or the change in technologies determines a tension leading to

the search for a solution of the problems of the firms. This searching process is facilitated by an higher accessibility to potential complementary partners and it also requires an appropriate receptivity of these latter. The creation and strengthening of a common identity, made by common values and sense of belonging, is the prerequisite for the cooperation and the search for joint solutions. These latter are the result of creative capabilities and of the original combination of different and complementary pieces of knowledge through a process of interactive learning between various local actors. Finally, new ideas can be translated into economic innovations only through an appropriate organization and governance, which implies the commitment of appropriate resources and the integrations of the new ideas with complementary production capabilities.

The approach of TKM may be applied to the steering of knowledge networks in different technical domains, in different professional communities, in different production sector, as the nodes of these networks may be different actors, such as firms, workers, consumers or institutions and it may be instrumental to clarify the policy challenges in the three types of territorial networks indicated above (table5).

6. The innovation process in medium tech sectors

Major factors of weakness of clusters specialized in **medium tech sectors** are: 1) a low international accessibility, 2) the lack of creativity and the need of promoting product innovation rather than only process innovation, 3) the need for formal instruments of governance of the knowledge relations aiming to a more formal cooperation between the firms.

Innovation policies in the modern **industrial clusters** specialized in **medium technology sectors** should take into account the nature of their knowledge base mainly made by **synthetic and symbolic knowledge**, and the form of their knowledge interaction, characterized by **interactive learning processes**.

External stimulus. Medium-tech sectors are characterized by tight user-producer relationships. SMEs aim to **respond to customer needs** or are driven by the requirement of the client in **highly integrated supply chains**. Innovation is the result of the adaptation to the local demand and it aims to solve specific problems. In fact, the mismatch between plans and actual results pushes to generate new knowledge. Firms are lead to innovation by the aim to exploit new opportunities or by the fear of closure, as the result of the selection mechanism prevailing in highly competitive markets. Policies, should promote **competitiveness based on product innovation** rather than only on costs advantages.

Accessibility. SMEs in medium-tech sectors are strongly **embedded in their territory**, which integrates cognitive, economic and social relationships among themselves. They participate to innovation networks, which have a local dimension and the international linkages are weak. Policies should enhance the still **low international accessibility** of SMEs and their integration into international knowledge and innovation networks, while maintaining an high local accessibility. The international **openness is high in commercial and production perspective, but still low in the case of technology cooperation**.

Receptivity. The high specialization of firms in medium-tech sectors leads to **high level of tacit knowledge**. Thus the openness to external relationships is enhanced by the existence of rare internal specific capabilities suitable to be combined with external knowledge and by relational competencies in the development of cooperation with other actors. Firms are characterized by an **high flexibility** in their internal organization and in the relationships with external actors. The high specialization of **internal human capabilities** determine an **high absorptive capacity** of SMEs in their specific field of specialization, but limit the capability of cooperation with other different

sectors. SMEs should invest more in “exploration” into new fields and aim to **extend their common specialized know-how**.

Identity. SMEs in a sectoral cluster **share common aims, mental models, as also trust and loyalty**. Interactive learning processes lead to the development of individual knowledge and also collective knowledge. The sense of local identity and collaborative attitudes are enhanced by the creation of various **intermediate institutions**, such as industry associations or specialized services or just common agreed routines, which are part of the “**social capital**” of the regional economy. The high common identity of the **local community** and the **regional embeddedness of firms** are a point of strength, but may favour conservative solutions and lead to a **lock-in** effect, whether the individual actors are not allowed to have more autonomy as indicated by the network model. The international extension of knowledge networks of SMEs call for the **identification of common objectives and projects with external partners**, while maintaining a strong local identity.

Creativity. Medium-tech sectors are characterized by **informal process of interactive learning**, rather than formal R&D. Innovation in SMEs requires an higher capability to select and originally combine internal competencies with external and scattered competencies, through **networking** and interactive learning for **solving new specific problems**.

Governance. The increasing **focus on knowledge creation** rather than on investments and public subsidies leads innovation policy for medium-tech sectors to focus on **new instruments**. These may be designed in order to enhance the **six drivers indicated above**. The dimensions of accessibility, identity and creativity seem particularly crucial for clusters of SMEs in medium-tech sectors. SMEs requires supporting infrastructures, such as intermediate institutions, and linkages should be systemic in order to **reduce the institutional distance**. Policy making should be based on **multi-level governance** rather than on policy-making based on traditional planning or on the free market approach and aim to the creation and strengthening of **bridging institutions**, such as competence centres, based on the agreement between the various local actors on a **joint long term development strategy**.

7. The innovation process in high tech sectors

Clusters specialized in **high tech sectors** indicate different key problems, such as: 1) a low local embeddedness of large firms, 2) the problems in combining R&D activities or analytical knowledge and symbolic knowledge, which are science and technology driven, with creativity, which is driven by the users needs and the demand, 3) the need to avoid a too high concentration in large firms and to promote spin offs and participation also by SMEs and the other social partners in strategic decision making.

Innovation policies in the **central urban areas** should take into account the nature of their knowledge base, made by **analytical and synthetic knowledge**, and the form of the knowledge interaction, characterized by knowledge flows coordinated by **knowledge management** and by **R&D joint projects**. Knowledge networks in these areas are characterized by the **links between large firms and the research institutions** and by the professional **networks within the knowledge intensive business services**.

External stimulus. The stimulus to innovation derives from the new opportunities created by the **recent advances in science and technology** at the **world level**, the increasing international competition and the need for firms to identify **very specific fields of application** for these technologies. In fact, the international enlargement of the market has led to look for a very narrow specialization in specific market niches, spread at the world level.

However, **new markets** may also emerge **in the large urban areas** of the most developed countries as these areas are the **incubator of innovation** and the place where the increasing **knowledgeable local citizens** express **new needs and opportunities for new products and services**.

Accessibility. The international accessibility of the urban areas specialised in high tech sectors is rather favourable, being them the **nodes of international transport networks**. However, the large dimension, increasing congestions and high diversity of these areas lead to **divides, exclusion and increases social disparities and cognitive distances** between the various very specialized social groups and production activities. Thus, policies should promote a greater accessibility between these groups and activities, by creating soft infrastructures, performing the role of **bridge between the different segments** of the local economy and society.

Receptivity. On the contrary, the receptivity to innovation in the urban areas specialised in high tech sectors is rather high, not only because the **high education level of local labour force**, related to the fact that **knowledge workers** concentrate in the urban areas, but also because of the high internal diversity and high specialization of the various local activities, facilitating the **access to the most diversified external sources of knowledge**.

Identity. Urban areas specialised in high tech sectors are characterized by the existence of **well developed associations, communities and organized groups** in the most different economic and professional fields. Thus sectoral identities are strong. On the contrary, the high diversity of local actors and the high internal congestion increase the cognitive distance among them and lead to **segmentation** and to a rather **weak place identity**, thus lowering the commitment by the local actors to the development of the local area. Local policies should therefore reinforce the local identity and strengthen common values and aims, for example through the organization of **major international events** or the building of **symbolic architectures**.

Creativity. Creativity in urban areas specialised in high tech sectors is mainly based on the high developed **formal R&D activities**, both in the large firms and in research institutions. However, the **local market** plays an increasing **importance** for the development of highly qualified and complex new products and services, which may later become a part of the local export base. That indicates the need to better integrate **symbolic (creativity base) knowledge**, with analytical and synthetic knowledge, which are the traditional strength of the urban areas, in order to increase the brand value of the new productions. Thus, policies should be capable to promote new knowledge through **interactive learning processes** both within very specialized professional communities of interest and between fields, which are highly different but may be complementary in solving these new emerging problems.

Governance. The international openness and role of urban areas specialised in high tech sectors leads to the need of a **tighter integration of local initiatives with national and European programs**. Usually, governance of knowledge networks in urban areas and high tech sectors is characterized by the **design of well coordinated projects in rather specific fields**. The various sectors and professional groups are characterized by **high level of self-government and tight internal connectivity**. On the contrary, the high internal diversity of urban areas and their congestion level indicates the need to improve the **connectivity between the different economic activities and professional communities** through the development of **bridging institutions**. Universities, large research institutions and competence centres may have an increasing role in promoting these links. Moreover, the development of new productions and the fast transformation of the local economy and society within cities also leads to the importance of accompanying these changes with **new projects in physical planning** aiming at the renewal of specific areas.

8. The innovation process in low tech sectors

Clusters specialized in **low tech sectors** are characterized by various weakness, such as: 1) a too low international accessibility, 2) the lack of receptivity and of qualified skills, 3) the lack of identity and fragmentation in decision making.

Innovation policies in the **less developed peripheral areas specialised in low tech sectors** should take into account the nature of their knowledge base, mainly made by symbolic or creativity based knowledge and sometime by synthetic or engineering based knowledge, and the form of the **knowledge interaction** in these regions, characterized by **automatic knowledge spill-over based on geographical proximity**.

External stimulus. The pressure of **international competition** on costs is inducing to adopt process innovation. However, the competitiveness of local productions should increasingly less based on lower labour costs and more on **product innovation and on higher quality products**. That requires to improve the quality of human resources, productivity levels and to focus on innovation.

The **low potential of the local market** should lead to look for the development of productions addressed to the international markets, according to the **export led strategy, which has been** traditionally followed by all successful industrial clusters. That requires an **higher specialization of local productions** and an higher integration into **interregional and international supply chains**.

Accessibility. The development or improvement of **international transport and communication infrastructures** is clearly a prerequisite for an export led growth strategy. However, less developed regions are often characterized by **fragmentation and isolation** of the individual economic activities and that leads to the need to improve **internal communications**.

Receptivity. The level of **general education** in the **less developed peripheral areas** is often rather high, while there is a **lack of specialized workers** with high professional experience. Traditional production know-how should be oriented to more **specialized fields**. However, the receptivity to innovation is not only limited by the technical capabilities of the labour force, but also by a **traditional organizational culture**. Firms should aims explicitly to a long term **growth strategy** requiring a **wider vision and larger investments**, rather than to insure the comfort of a smaller dimension and to exploit rents in a local market, as it often occurs in small family owned SMES.

Identity. Peripheral and less developed areas are often characterized by **fragmentation, internal conflicts and low level of consensus** on common values and on a **long term development strategy**. That weakens the potential to promote a more clear role in external relations and often leads to a situation of closure or of **external dependence**.

Creativity. Innovation is often limited to **product differentiation and incremental innovations, as the result of** symbolic knowledge. On the other hand, policies often focus on promoting **technology transfers** and to the adoption of modern production technologies, which represent forms of synthetic knowledge, in the traditional low tech sectors of activity. A complementary strategy could be to focus on product innovation, to enhance creativity and to increase the effort by the individual firms, in the design of business plans aiming to the **reconversion to new productions and new markets, and between the local firms, aimed at the development of new and more complex production fields**.

Governance. Less developed regions are often characterized by the weakness of the public administrative structures and by the need for a wider adoption of **innovation in the public sector**.

Regional development policies have focused on the building of infrastructures and the provision of financial incentives to the firms, rather than on **promoting innovation**. The aim to **create artificial clusters** has often led to failure, due to a too low effort in promoting the key factors indicated above, such as: international accessibility, local identity and creativity.

Public funds should only complement the **mobilization of private investments** and successful clusters seems to require the participation of **large and often external firms and forms of interregional cooperation** between the local public institutions.

Intermediate institutions should promote a **better connectivity and specialization of the local firms**, a stronger local identity and a change in local culture favouring **specialization, outsourcing** to other local firms and subcontracting from major external firms. In fact, the creation of local knowledge networks is tightly complementary to a strengthening of other networks, such **subcontracting networks** and **labour mobility networks**.

The focus on “analytical knowledge”, rather than on “synthetic knowledge”, has led to create **centres of RD excellence** supported by public funds and **separated from the rest of the regional economy**. Regional development agencies and other public centres rather than aiming to provide technological services to the individual firms in traditional productions could have a more strategic role whether they would support the **design of major projects** aiming to the **reconversion** of the local economy and promoting the **cooperation** between the various local firms.

9. The network approach to innovation policy

The **emerging “knowledge clusters”** are the result of the evolution from the **traditional industrial or “fordist” model**, based on the exploitation of economies of scale external to the firms but internal to an industrial cluster, to **the model of the “knowledge economy”** where **regional innovation systems and innovation networks** are characterized by intense knowledge interactions between the various local actors. That calls for **changes in cluster policies**, similar to changes which are widely adopted in the rest of the European economy and industry.

The changing economic and technological scenario is calling for **a new strategy in cluster policies**, aiming to reorient existing clusters. Cluster policies should be based on the identification of the different evolution profiles of individual clusters and of their specific strengths and weaknesses and on the design of explicit strategies for the individual clusters.

The “**Cluster Memorandum**” of the European Commission has emphasized that:

- clusters have positive effects on the competitiveness of firms,
- clusters most often emerge as the result of a bottom up process and they can not be completely planned exogenously from public institutions,
- cluster initiatives are nationally differentiated and European coordination should be highly flexible and focus on strategic initiatives.

The changing economic and technological scenario is calling for a new strategy in cluster policies, aiming to reorient existing clusters. Cluster policies should be based on the identification of the different evolution profiles of individual clusters and of their specific strengths and weaknesses and on the design of explicit strategies for the individual clusters.

While in traditional clusters policy should aims to increase the **factors of cohesion of the local community** by exploiting economies of scale as a key factor of competitiveness, modern network

approach to “knowledge clusters” calls for policies aiming to promote innovation through **greater flexibility** of the innovation networks and the design of **an explicit innovation strategy**.

In **particular**, the challenge of increasing international competition calls for **large projects realized within national thematic networks** and building on the existing strengths and innovative capacities of the various regions. The problem is not the creation of **new geographical clusters**, but rather to promote **new strategic projects in the existing clusters and regions**.

Medium size firms have developed vertical flows of tacit knowledge in their respective supply chain, but they need to be supported in order to **develop horizontal linkages** between different technologies and sectors, by participating to regional “**centres of competence**” focused on **new fields of production**, which may be related to traditional specializations in the various regions, with the participation of firms and research institutions having complementary competencies.

The approach of learning networks underlines that **time is a key dimension of innovation**. The competitiveness of firms and regional innovation systems is increasingly less determined by low production costs or also by a higher quality of the products or services and it requires **a faster speed of the process of change** with respect to the competing firms and regions. Well structured production and innovation networks allow a **greater flexibility**, to accelerate the policy making process and to decrease the decision and implementation times, by reducing transaction and **adjustment** costs.

The speed of information flows and of decision making processes and a **faster adoption of innovation** is tightly related to the **stability of the organizational forms** and it depends on the existence of a well developed institutional system.

A **policy for the knowledge economy** based on the approach of “governance” or “dynamic coordination” implies the use of **different policy instruments** with respect to those usually adopted in **traditional innovation policies**, such as:

- public R&D
- public subsidied to private R&D
- public demand of innovative products and services
- IPR in order to insure a monopoly power to innovators

The knowledge networks indicates **new instruments of innovation policies** which aim to:

- create new **nodes** in the knowledge networks, such as the enhancement of innovative spin-offs from firms, the recognition of universities as a new actor in innovation networks, the promotion of diversity and attraction of new actors,
- create missing **links** by defining new procedures in the relationships between the local actors.
- promote **international links** in order to avoid regional closure and lock-in effects,
- invest in **human resources**, education and life long learning, in order to increase receptivity to new knowledge,
- promote alignment and **identity building** by defining joint long term projects and a joint strategy.
- accommodate the **switching costs or adjustment costs** implied by major changes in order to increase the flexibility of sectoral clusters and SMEs and accelerate the time of changes.
- design and adopt new regulations, which may defend weak and dispersed interests and determine the conditions in order to **aggregate scattered needs and demand** and to create new markets for innovative products and services.

The multiplication of players and layers of negotiation – international, national, and local – demands a different model of government, called “multilevel governance”, based on organisational

structures of interaction and partnership. In particular, Research, Technology, Development and Innovation Policy (RTDI) is a field of concurrent legislation between various levels of government, and tighter vertical cooperation should be complemented with an increasing specialization according to the subsidiarity principle.

10. The characteristics of the “competence centres” policy

Competence centres are new instruments of innovation policy, which are suitable for the SMEs in medium tech **sectors** and may be adopted in countries where they do not exist. The IKINET project (http://www.ikinet.uniroma2.it/Policy_Forum.htm) may help in illustrating the different dimensions of the process of knowledge creation at the local level and in providing **guidelines for defining the strategy of competence centres**.

National and regional **competence centres** are designed to stimulate cooperation in research and technological development **in strategic important production fields** between companies, academia, the public sector and other organisations involved in promoting innovation, overcoming the gap between **pre-competitive technological research and practical industrial application**.

The idea of the cluster policies and competence centres in various European countries is based on the following **characteristics of competence centres**:

- are part of a **national or regional network** created by a national or regional public program, which has defined a competitive mechanism for the selection of the various proposals of competence centres and an national or regional agency for the steering of the overall network of competence centres,
- have a **regional focus** but act on an **international scale**,
- concentrate on a specific **thematic production field**,
- are capable of **generating innovations** with a particularly high value-added potential,
- cover many links in the value chain and **connect multiple sectors of industry** and scientific disciplines,
- establish an outstanding communication and **co-operation platform** by promoting **public-private partnership** and existing networks between large and small firms and other regional actors, in close cooperation with universities and research, educational and vocational centres,
- aim to implement a **common strategy** of innovation and economic development for a specific **territorial cluster** or **regional innovation system**,
- represent **an innovative and operational mode of “governance”** or a “soft infrastructure”, that aims to develop synergies around **specific collective innovation projects** oriented toward one or more **well focused markets**,
- allow to reach a critical mass, in order to develop **international visibility** in an industrial and/or technological perspective and to increase the attractiveness of a cluster with respect to international competitors.

Examples of national programmes on clusters policy/competence centres/ poles de compétitivité/centres of expertise are the following:

France: www.competitivite.gouv.fr/

Finland: www.oske.net/in_english/programme/objectives/ and www.tekes.fi/eng/

Austria: www.ffg.at and www.ffg.at/content.php?cid=341

Competence **centres are different from research “Centres of Excellence”**, which mostly belong to larger research institutions and focus on well defined fields of advanced pre-competitive research, often in tight cooperation of specific industries, with the aim to raise the quality of

research and to improve its international visibility and reputation. Competence **centres** should aim to promote **innovative industrial projects**.

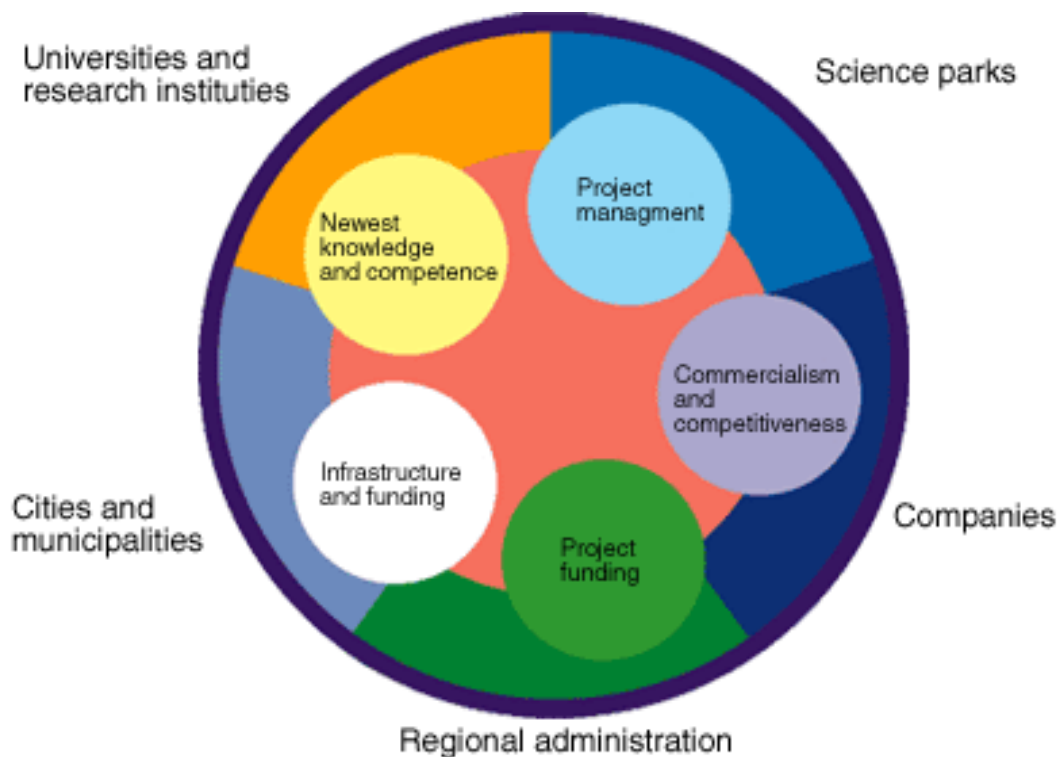


Figure 6: Main partners within a “Competence Centre” at the regional level

“Centres of Competence” are different from the traditional “Technological Centres”, which have been created by local and regional institutions and aim to provide rather routine technological and business services to individual SMEs within territorial clusters, as Centres of Competence aim to the **design and management of large joint projects with several firms** and other partners for the development of new innovative productions for the **industrial diversification of a cluster**.

Competence centres differently from the **traditional technological centres** should not focus on the supply of **specialized business or technological services** to the firms in the local clusters, but rather focus on the **management of large strategic projects**, which may promote the creation of new modern activities and a sectoral diversification of the cluster.

Competence centres may be **organized as a public-private-partnership**, where the regional government acts as a **coordinator** together with a consortium of private actors or the regional business promotion agency acting as **supporting and managing institution**.

Regional policy should identify **regional fields of competence** and target **relevant areas of new technology**. The following three fields of competence can be identified as candidate for cluster policies according to their respective stage of development: a) **developed fields of competence** well connected with the current specializations of the regional economy, b) **developing fields**, where strength in the supply by research institutions does not correspond to the actual demand by the regional firms, c) **emerging fields** in an early stage of research undertaken, which are in need of policy support for future development.

The selection of the sectors can be guided by the acknowledgement that the factors of competitiveness of the European economy with respect to the many and large emerging economies are related to:

- the high diversification of industrial productions within the various industrial clusters allowing the creation of new productions as combination of traditional specializations,
- the emergence of new needs, which often have a collective nature, by consumers and citizens and the creation of new markets,
- a high qualified labour force.

Competence centres should carry out an exploration activity leading to the design many large and small projects, to the identification of emerging needs in existing and new markets and the creation of coalitions **of regional and also international partners** needed to solve the problems. They should not represent only ad hoc organizations created in order to manage specific large projects, previously approved by national institutions.

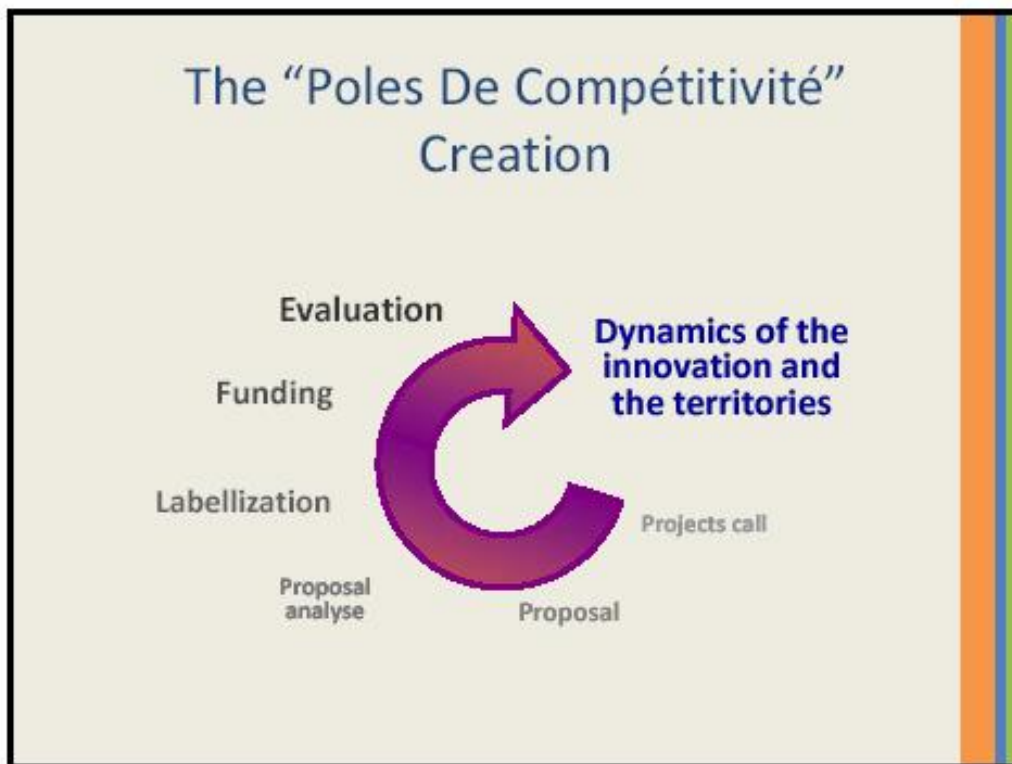


Figure 7: The stages in the creation of a competence centre

Competence centres are crucial in order to reduce the **“switching costs” to innovation** and to accelerate the speed of the process of adoption of innovation, thus avoiding the **risk of a lock-in effect** in territorial clusters and promoting an horizontal and vertical diversification of the traditional productions in these clusters.

Knowledge **clusters are no longer organized along the boundaries of sectors**, as the knowledge and technology can be used in **different product segments**. The diversity of final products even raise incentives for cooperation, as direct rivalry between the partners can be excluded. Consequently, any support of knowledge clusters **should not be concentrated on single sectors but on broad platforms**.

Therefore, **the IKINET project** highlights that regional and national policies for competence centres should:

- promote the **development** of existing or **emerging clusters**,

- promote **new strategic projects in the existing clusters and regions**, rather than the creation of **new geographical clusters**,
- respond to the **emerging needs of the user side, identify and aggregate new demand, explore new markets** and aim to create new “lead markets” for the regional productions,
- **promote the use of the knowledge accumulated** within the cluster, the **circulation of tacit knowledge and the development of new competencies through the process of interactive learning** between the local actors,
- **create new activities or “strategic spin-offs”**, which can lead to a production diversification of the regional economy into new sectors of application, by investing in projects close to commercialization to **avoid path-dependencies and lock-in effects**,
- promote the **design and adoption of large strategic projects** of innovation requiring the coordination and cooperation of multiple partners,
- raise new **funding through public-private partnership** and involve **modern financial intermediaries in strategic industrial projects**, as the problem is the abundance of funding and the lack of profitable projects.
- build new formal and informal institutions, infrastructures, norms, rules and routines for the **“governance” of the knowledge and innovation networks** and promote the **participation of new partners** in innovation networks, such as KIBS and universities,
- represent a **bridging institution and promote contacts** between **SMEs and large international firms** on one hand and, on the other hand, the **research institutions**, thus promoting a greater effort on innovation and a mid term development strategy,
- promote **international links** and enhance a greater international integration and competitiveness in an increasingly **complex and connected world**.

11. The European dimension and the internationalization of competence centres

Clusters may contribute to the evolution of the European industry toward a knowledge economy. In particular, the transition to the knowledge economy of the European economy is not only demanding large international investments in new strategic industrial sectors or “structural reforms”, but also the creation of new “knowledge clusters”, due to the localized nature of the processes of knowledge creation. Thus, **a cluster approach is also needed in the European policy for the knowledge economy.**

The **international extension of knowledge networks** of SMEs call for the identification of common objectives and projects with external partners, while maintaining a strong local identity. It is necessary to find ways in order to combine regional public assistance with firm **collaboration in projects that go beyond their own territory**. Competence centres may represent **a stimulus to the international openness** and competitiveness of the regional clusters.

The process of internationalization is **a gradual learning process** and it requires a new mental model by the firms. Moreover the internationalization process has **a selective character** and a key role is played by **“gateways” or “bridging” institutions**. Thus, competence centres may create that **institutional framework made by trust, reciprocal commitment and well designed governance**, which allow the firms of distant regions to **exchange of tacit knowledge** and to participate joint projects.

A complex interaction is needed between **regional policies and national or European innovation policies**. Various new sectors (such as aerospace, environment, energy, finance, major international infrastructures, etc.) seem to require **an higher national or European coordination** and the initiatives to be taken at the regional level should be stimulated and orientated within the framework of national and also European networks.

However, the **national governments** may take various important initiatives, such as to:

- address the problems in the implementation phase of the competence centres,
- develop some systemic linkages between the various competence centres at the national and European level,
- promote international learning and benchmarking, share the tool box and compare the management models,
- allow an easier exchange of knowledge and their combination in the generation of new organizational and institutional solutions and the creation of a consensus on a new common model of action,
- identify success factors and evaluation criteria,
- design new public-private funding solutions,
- define concrete set of proposals and possibly strategic projects based on the cooperation of various competence centres,
- launch programmes for the creation of networks of competence centres in regions, which do not have them.

As firms are increasingly integrated in international production networks, **also competence centres have to build international networks**. The creation of **European networks of “competence centres”** would **increase their specialization** with respect to those of other regions at the international level and **widen the knowledge base of existing clusters**.

Regional, **national** and European institutions are required in order to promote **international forms of cooperation between SMEs**, both at the regional and national level. In fact, the development of international relations requires **a more stable framework and specific bridging institutions**, rather than the market mechanisms and private forms of bottom-up international cooperation may be capable to provide.

The role of the European Union changes in this context. Direct R&D and capital subsidies actually can only hardly reach SMEs in medium-technology sectors, as the SMEs miss necessary formal R&D and strategic resources to cope with EU preconditions. Instead, EU policy should focus on:

- support of competence centres as intermediaries for SMEs by initiating contests on strategic lead projects on a regional and interregional level
- contests for lead projects integrating medium-technology industries with high technology services and extending industrial value chains
- linkages between regional competence centres by standardisation of information, qualification levels and courses, technological norms and support of umbrella organisations
- strategic regulation to strengthen European technical (safety and environmental) standards in the global market
- subsidisation of public-private funding of competence centres in lagging regions spanning boundaries between these regions and leading agglomerations

References

(preliminary draft)

Cappellin, R. (1983), Productivity growth and technological change in a regional perspective, Giornale degli Economisti e Annali di Economia, March.

Cappellin, R. (1988), Transaction costs and urban agglomeration, Revue d'Economie Regionale et Urbaine, n. 2.

Cappellin, R. (1989), The diffusion of producer services in the urban system, Revue d'Economie Regionale et Urbaine, n. 4.

Cappellin, R. (2000), Urban agglomeration and regional development policies in an enlarged Europe, in Bröcker J. and Herrmann H., eds, Spatial Change and Interregional Flows in the Integrating Europe - Essays in Honour of Karin Peschel, Physica-Verlag, Heidelberg.
(<http://www.economia.uniroma2.it/dei/professori/cappellin/articles/PESCHE~1.PDF>)

Cappellin, R. (2003), Territorial knowledge management: towards a metrics of the cognitive dimension of agglomeration economies, International Journal of Technology Management, Vol. X, n. X.
(<http://www.economia.uniroma2.it/dei/professori/cappellin/articles/TERRITO2.PDF>)

Cappellin, R. (2003), Networks and Technological Change in Regional Clusters in Bröcker, J., Dohse, D. and Soltwedel, R. eds., Innovation Clusters and Interregional Competition, Springer Verlag, Heidelberg.
([http://www.economia.uniroma2.it/nuovo/didattica/MaterialeDidattico/307/Cappellin_R_\(2003\)_Networks_and_Technological_Change_in_Regional_Clusters_in_Bröcker_J._Dohse_.pdf](http://www.economia.uniroma2.it/nuovo/didattica/MaterialeDidattico/307/Cappellin_R_(2003)_Networks_and_Technological_Change_in_Regional_Clusters_in_Bröcker_J._Dohse_.pdf))

Cappellin, R. (2004), "International knowledge and innovation networks for European integration, cohesion and enlargement", International Social Science Journal, UNESCO, Volume 56 Issue 180, page 207-225.

Cappellin, R. (2007), Learning, Spatial Changes, and Regional and Urban Policies: The Territorial Dimension of the Knowledge Economy, American Behavioral Scientist, Volume 50, Number 7, pp. 897-921.
([http://www.economia.uniroma2.it/nuovo/didattica/MaterialeDidattico/307/Cappellin_R_\(2007\)_Learning_Spatial_Changes_and_Regional_and_Urban_Policies_The_Territorial_Di.pdf](http://www.economia.uniroma2.it/nuovo/didattica/MaterialeDidattico/307/Cappellin_R_(2007)_Learning_Spatial_Changes_and_Regional_and_Urban_Policies_The_Territorial_Di.pdf))

Cappellin, R. and Orsenigo, L. (2006), Regional learning networks in medium tech sectors and European integration, paper presented at the Special Session on: "International Knowledge and Innovation Networks", of the 46th European Congress of the Regional Science Association, Volos, Greece, August 30 – September 3, 2006.
(http://ikinet.uniroma2.it/WP2_Papers_final.htm)

Cappellin, R. (2007), Regional governance in the knowledge economy: policy strategies and policy making models, paper presented at the Special Session on: "The Governance of Knowledge Networks", of the 47th European Congress of the Regional Science Association, Paris, August 29 - September 2, 2007.
(http://ikinet.uniroma2.it/WP2_Papers_final.htm)

Cappellin, R., Knowledge creation in regional networks and the policies of "competence centres, contribution presented at the Policy Forum of the IKINET project on: "Regional competence centres and European knowledge and innovation networks", Rome, 19th - 20th September 2007.
(http://www.ikinet.uniroma2.it/Presentations/Cappellin_KS.pdf)

IKINET project, Policy conclusions of the Policy Forum - preliminary draft for discussion: September 19, 2007, presented at the Policy Forum of the IKINET project on: "Regional competence centres and European knowledge and innovation networks", Rome, 19th - 20th September 2007.
(<http://www.ikinet.uniroma2.it/Policy%20indications.pdf>)