

2nd Regional Development and Governance Symposium
25-26 October 2007

organized with the cooperation of
TEPAV, Aegean University, Aegean Region Chamber of Industry and
The Scientific and Technological Research Council of Turkey
Izmir, Turkey 25-26 October 2007

REGIONAL GOVERNANCE
OF KNOWLEDGE NETWORKS:
innovation models and policy strategies

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1. Introduction

The process of 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 (Abramowitz and David, 1996; Foray and Lundvall, 1996; OCDE, 1996; OECD, 1999; Foray, 2000; Chen and Dahlman, 2004).

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.

While innovation policies mainly focus on the development of high technologies and R&D investments, European industry is still characterized by medium technology industry, such as machinery, transport equipment and chemical products, which represent 59,4% of manufacturing exports and 53,3% of manufacturing employment, while the share of high tech industry is only 21,5% in the European exports and 5,8% in European employment.

Table 1
Structure of OECD¹ manufacturing trade² by technology intensity.
Share 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.

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.

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

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 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 especially 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 its internal competencies through a greater effort in interactive learning processes (Lundvall and Johnson, 1994) in order to increase its competitive knowledge advantage on the global markets and to develop new production fields.

This contribution aims first to clarify the factors determining the process of knowledge creation and innovation in medium technology sectors, by comparing 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.

Second, this contribution aims to compare three different forms of regulation of the relationships in the process of knowledge creation and innovation, such as the free market, the governance and the government model, focusing on the importance to promote an higher speed of change rather than on the static factors of competitiveness, such as a decrease of prices and the exploitation of economies of scale.

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 process of innovation and knowledge creation

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.

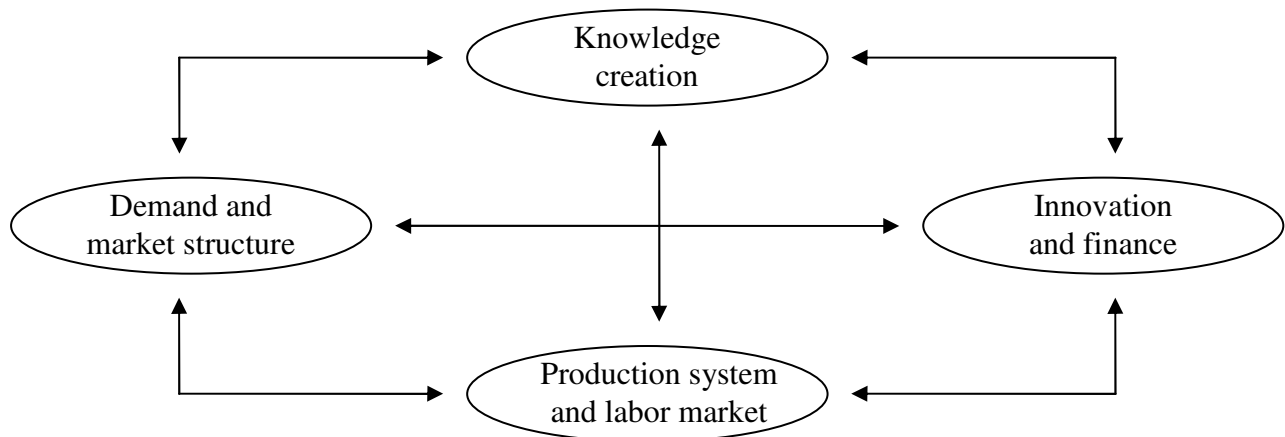


Figure 1: The relationship between knowledge creation and innovation

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.

In particular, the adoption of innovation requires a greater effort by the firms in the creation of knowledge. Firms should search, evaluate and adapt new technologies from external sources and develop them internally. That requires that firms invest in R&D and especially devote time and resources to the technical design of the new product or process and to the organization of innovation projects. 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.

The process of knowledge creation depends on the capability to originally combine different pieces of previous knowledge. That requires an high connectivity, which may be defined as a positive combination both of an high accessibility to different knowledge sources and of an adequate receptivity, in order to be capable to interpret and use them in an appropriate way.

Accessibility depends on geographical distance, but also to existence of other obstacles, which may increase the transaction costs between the firms or the regions. These latter may be related to the differences in the organizational structures or in the institutional framework (Audretsch and Feldman, 1996; Capello, 1999; Capello and Faggian, 2005; Karlsson and Johansson, 2007; Torre, 2003; Torre, 2008; Torre and Rallet, 2005; Torre and Rallet, 2006 ; Torre and Dupuy, 2006; Torre

and Gallaud, 2004; Zucker, Darby, Armstrong, 1998).

On the other hand, receptivity depends on the internal capabilities of the firms and of the regional economy considered, on the level of education or of previous experience and on the availability of specialized know-how. Thus, receptivity is linked to the capability to attract external qualified resources or also to retain these resources and to avoid that they move to other firms and regions.

Table 1: Connectivity as the result of accessibility and receptivity			
	High receptivity/capabilities		
Low accessibility	Emigration	Connectivity	High accessibility
	Lock-in	Conflict or dependence	
	Low receptivity/capabilities		

A positive combination of accessibility and receptivity is a prerequisite in order to achieve economic integration and synergy between firms and regions (table 1). On the contrary, the lack of both accessibility and receptivity leads to a situation of closure and stagnation, which may be defined as a “lock-in” effect.

Whether regions or firms are characterized by highly receptive or qualified human resources, but there is a low accessibility to other complementary capabilities, that situation is leading to emigration or “brain drain”. In the opposite case, a low receptivity by the human resources and an high exposure to external technology could lead firms and regions to a situation of technological dependence or even to a conflict situation between the external investments and the prevailing internal traditional culture.

Table 2: Creativity as the result of interactivity and combination			
	High combination of different competencies		
Low interaction	Discontinuous radical innovation	Creativity and continuous innovation	High interaction
	Lock-in	Incremental innovation	
	Low combination of different competencies		

A further element in the process of knowledge creation is creativity, or the capability to sustain the continuity of the process of knowledge creation. According to the model of interactive learning, creativity is tightly related to connectivity, as defined above. In fact, creativity implies both an high interaction between different actors, firms and regions, through intense and frequent meetings and exchanges of information and knowledge and also the original combination of different and complementary pieces of knowledge (table2). Without enough connectivity neither interaction nor combination would be possible and a low interaction with other local and external actors and the only use of the traditional know-how is leading to a situation of stagnation or a “lock-in” effect.

In particular, an high interaction, but only between actors which have very similar competencies, may only lead to marginal improvements or incremental innovations. While the opposite case of the combination of different complementary competencies, but of too low frequent interaction, could lead to no results or to discontinuous radical innovation.

A third characteristics of a process of innovation is that internal capabilities such as creativity should be combined with the stimulus of opportunities or challenges by the external environment (table 3). In fact, innovation is mainly driven by the need or aim to solve urgent problems, which may represent either a risk for the survival of a firm or a problem in order to secure the growth of the firm.

Table 3: Innovation requires external stimulus and creativity			
	High creativity		
Low external stimulus	Emigration	Innovation and competitiveness	High external stimulus
	Lock-in	Crisis and lack of competitiveness	
	Low creativity		

Opportunities or challenges may be represented by the evolution of the market demand, such as the opening of new markets or an increase of competition. Otherwise, the stimulus may be represented by the availability of new technologies, which compel to abandon less efficient traditional technologies or allow to produce new products and services, satisfying existing or new needs by final or intermediate users.

In particular, an high creative capability of the local human resources and entrepreneurs but the lack of market stimulus or the lack appropriate production technologies may lead to people to emigrate or firms to invest abroad. In the opposite case, the exposure to international market and the pressure by technological change may endanger the competitiveness and lead to a crisis of the firms and the local economy, whether local creative capabilities or knowledge are too low.

Innovation requires the combination of different competencies within a processes of collective learning, as firms are forced to cooperate in order to increase and diversify their knowledge base.

Innovation is not the result of the individual inventor or entrepreneur, but rather the result of a processes of collective learning and flexible forms of cooperation between many different private and public, regional and international actors, such as large firms, SMEs suppliers, knowledge intensive services, higher education and research institutions, financial intermediaries, public administration and many other partners such as professional association and media (Florida, 1995; Geenhuizen, and Nijkamp, 2006; Maillat, and Kebir, 1999; Morgan, 1997; Simmie, 2005; Vázquez Barquero, 1990; Vázquez Barquero, 2006).

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 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.

In particular, innovation processes in SMEs and in medium technology sectors has a gradual character and is driven by an intensive interaction between the suppliers and the customers. This process of interactive learning leads to the development of a “tacit” knowledge or a complex set of capabilities, which are localized or idiosyncratic and cannot easily be transferred (Cappellin, 2003, 2004; Cohendet and Steinmueller, 2000; Howells, 2002; Nonaka and Konno, 1998; Rizzello, 1999; Wink, 2003).

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 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. In the traditional industrial model, technologies are basically a product, similar to the case of new equipment. That implies that firms have to invest in R&D, since these activities allow to generate new technologies. However, they may also directly buy the required technology in the market of technologies. Technology implies an increase of productivity, a decrease of labour inputs and a decrease of costs. Thus, technology directly solve the problem of the firm. On the contrary, resistance to the adoption of technologies by labour requires an effort to increase its receptivity. The ideal model is that of total automated plant or through outsourcing of a firm made by a single man. Thus technologies are similar to a bitter medicine, which has a direct cost for its production as also for the costs related to the downsizing and to the professional re-qualification of the labour force.

In the model of knowledge economy the aims of firm is not the adoption of modern technologies as rather the fast adoption of product and process innovation, in order to respond to the changed needs by the users of the product or service. Innovation is not a product, but rather a dynamic process and flexibility and speed of adoption are key factors of competitiveness. Innovation requires information, new knowledge and technical and organizational capabilities. These latter are the result of collective processes of interactive learning, where the key actor is the people, such as the entrepreneurs, skilled technicians and workers. Creativity is not the result of the individual inventors, but rather of a collective and continuous effort by a specific team or professional community. Entrepreneurship and governance, through public-private partnership, are required in

order to organize the joint effort of different actors and firms or regional clusters are necessarily a complex organization. The focus shift from the stimulate of competition between the local actors to that of promoting connectivity and iterative processes of reciprocal adaptation and of selection of the best productive combinations. Therefore, the labour force is not the object on which technology has an impact, but rather the actor which promotes innovation (Almeida and Kogut, 1999; Felix, 2006; Florida, 2002; Stambøl, 2005; Van Oort, Weterings, Verlinde, 2003). That leads to explain the need for investment on continuous education at all levels of the organization, and to promote the interaction between the various individuals, by investing in the creation of networks, clusters, intermediate institutions and “social capital”.

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). That calls for changes in cluster policies, similar to changes which are widely adopted in the rest of the European economy and industry.

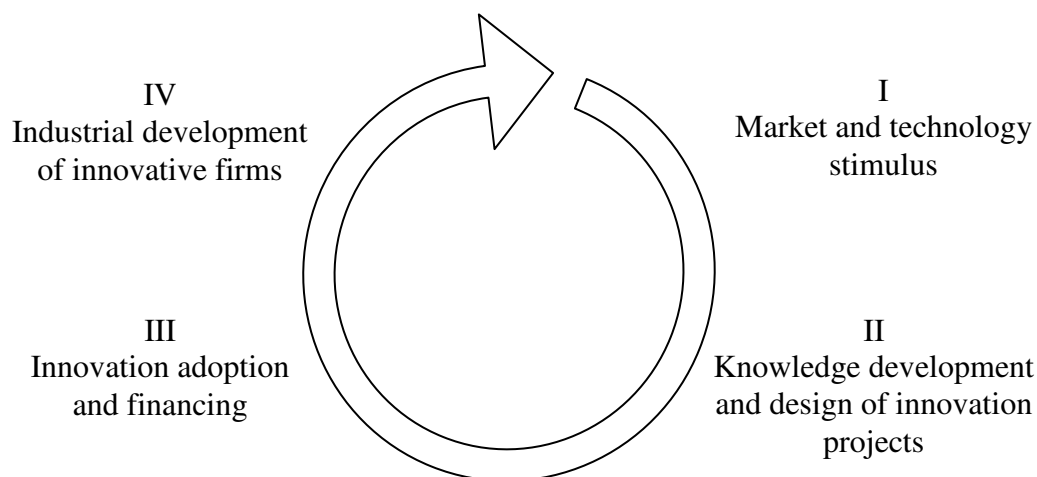


Figure 5: The fields of innovation policies

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 5. 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.

3. The model of networks and the approach of multi-level governance

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.

In a developed market economy, many economic relations are not regulated by the market competition between firms producing the same products. Neither they are regulated by the norms defined by the State or by the internal rules within a large company. In fact, many economic relations are regulated by negotiations, agreements and forms of partnerships between the firms working in different sectors and various economic stakeholders, characterized by different capabilities.

Thus, market competition, State norms or internal corporate organization and networks or multi-level governance represent three different and complementary forms of regulations of economic relations in a market economy. Innovation policies can adopt these different forms of regulations in order to promote international competitiveness of a modern industrial economy.

Governance is the challenge of steering and positioning complex policy networks at international, national, and local level through complex organizations and forms of horizontal and vertical negotiation.

Governance is a model of regulation of the relationships between the firms and the actors belonging to a network, based on interdependent adjustments decided on the base of negotiation procedures. It differs both from the atomistic behaviours funded on the individual interest and competition, such as in the free market model, and also from the changes enforced by a centralized authority, such as in the government model.

Governance is about the adoption of organizational arrangements or different mechanisms of regulation, in order to manage the knowledge relationships between the various actors, which participate to the process of knowledge creation and innovation.

There is a large variety of modes of governance of the knowledge relations. They range from coordinated transactions and constructed interactions to quasi-hierarchies (Antonelli 2005). For example, the following organizations represent different governance modes:

- large “networks of excellence” between research institutions and research groups,
- international and interregional agencies,
- large multinational companies and financial groups cross-participations between firms,
- joint projects between national and foreign firms for new productions and new technologies,
- committees, norms and technical standards between the firms of the same sector,
- vertical sectoral clusters of firms in the same supply chain,
- local networks, communities or industrial districts,
- forms of public-private partnership,
- poles of competitiveness and centres of competence.

Both large and small firm can not easily introduce innovation alone. Innovation as also knowledge creation is not the result of an individual firm or of a single person, but of the interaction between various economic actors or stakeholders, such as the people within the individual firm or the relationships between the various firms.

In particular, innovation is not only adopted by the single firms under the pressure of cost competition. On the contrary, the most important innovation are those which lead to the creation of new sectors or of new firms in the local economy. Clearly, these changes are the outcome of the joint activity of various actors and not of an individual entrepreneur.

Since interactive learning is the key process in knowledge creation and the access to tacit knowledge is crucial in SMEs and medium-tech sectors, networks (Figure 2) are an appropriate

form of organization, which facilitates the interaction and the flows of information and knowledge. Within networks nodes and links are constrained by the existence of spatial distance.

As indicated above, innovation requires a process of interactive learning, where both high connectivity, which is the result of accessibility and receptivity of different actors, and an high creativity, which is the result of the interaction between actors and the combination of complementary pieces of knowledge, are crucial.

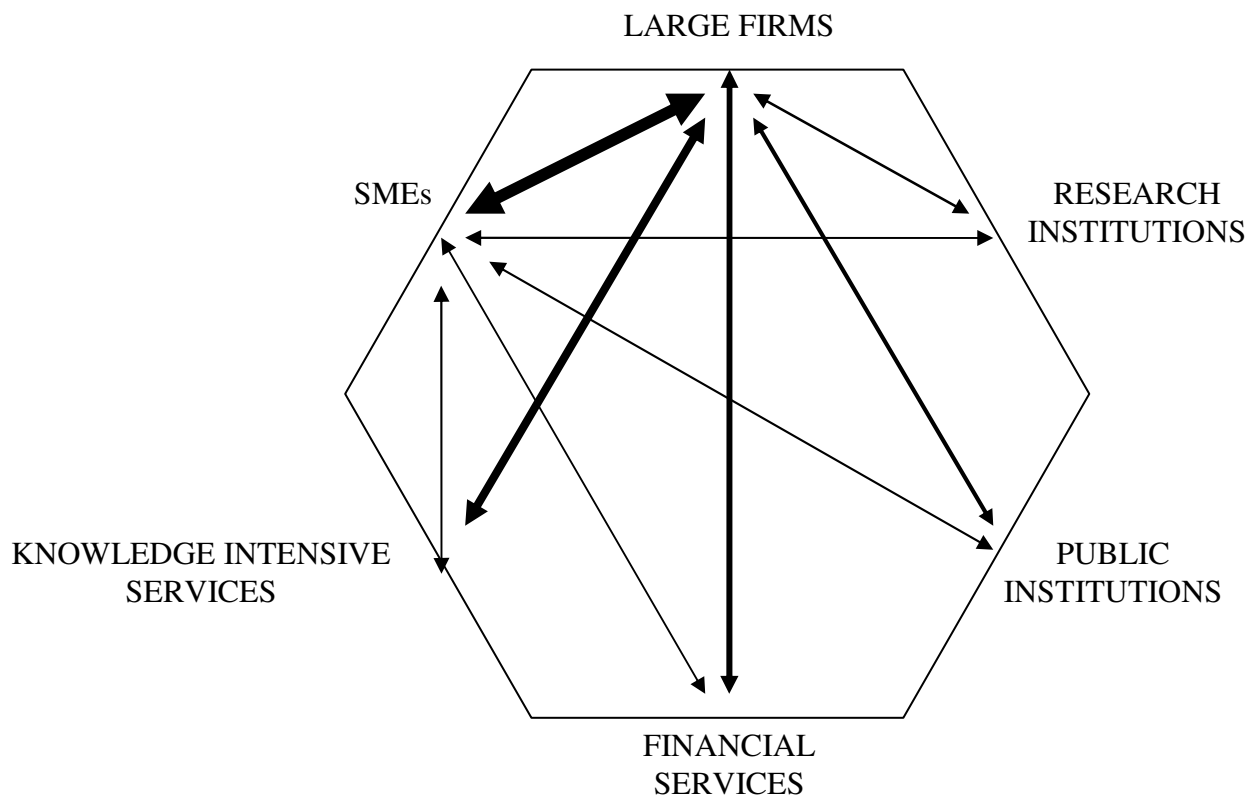


Figure 2 - Information and knowledge links in a regional innovation system

Knowledge network are continuously evolving (Cappellin, 2002, 2003, 2004, 2005; Cappellin and Orsenigo, 2006; Geenhuizen, 2007 and 2007/8; Holland, 2002; Karlsson, 1997; Karlsson and Johansson, 2006; Karlsson and Andersson, 2007; Karlsson and Ejeremo, 2006; Powell, 1990; Steiner, 1998; von Tunzelmann, 1998; Wink, 2007 and 2008). Knowledge creation implies the change in the links between the various nodes of a knowledge network and the change in the intensity of the flows between the nodes, which are linked between themselves.

Knowledge networks are characterized by an high flexibility. This process of change is similar to Schumpeter’s process of “creative destruction” and it is based on the integration of new nodes and the exclusion of others, in order to integrate specific complementary competencies. In particular, knowledge and innovation networks are characterized by a evolutionary process leading both to a greater integration and to a greater specialization of the individual nodes. Thus, the internal form and the borders of the knowledge networks continuously change.

The model of knowledge and innovation networks is tightly related to the governance approach. The systemic character of innovation networks requires a dynamic coordination between the firms, based on a gradual and cumulative process of interactive learning. Thus, innovation policies and the

choice of how to regulate the relationships between the various firms and economic actors have a key impact in determining the efficiency of an innovation network.

Within the firms, the governance of the innovation processes is related to decisions on integration and outsourcing of specific activities in the individual companies, as also to acquisitions of new firms, to sale of internal activities, to the creation of alliances with other firms. These governance decisions do not usually depend on the public authorities, but on the investment projects by the large corporations, the banks and the private equity funds.

On the other hand, governance at the collective level can promote a change of the connections within a regional or sectoral innovation network by allowing the participation of new actors to decision making processes, by empowering the individual actors and assigning them specific responsibilities and by increasing and organizing the human and financial resources needed for the innovation process.

The model of networks and of multi-level governance is different both from the free market model and also from the traditional top-down planning approach.

Different forms of regulation of economic relationships are characterized by a different level of integration, ranging from the liberal “free market” approach, which implies atomistic or autonomous decisions by the individual firms and the role of the “invisible hand” of the market, to the hierarchy model, where the relationships between the actors are very tight and have to comply to the indications of a superior power, which may be the State or a large integrated company. Networks of firms, which are highly specialized in specific production phases represent an intermediate case, which is based on a principle of negotiation and cooperation.

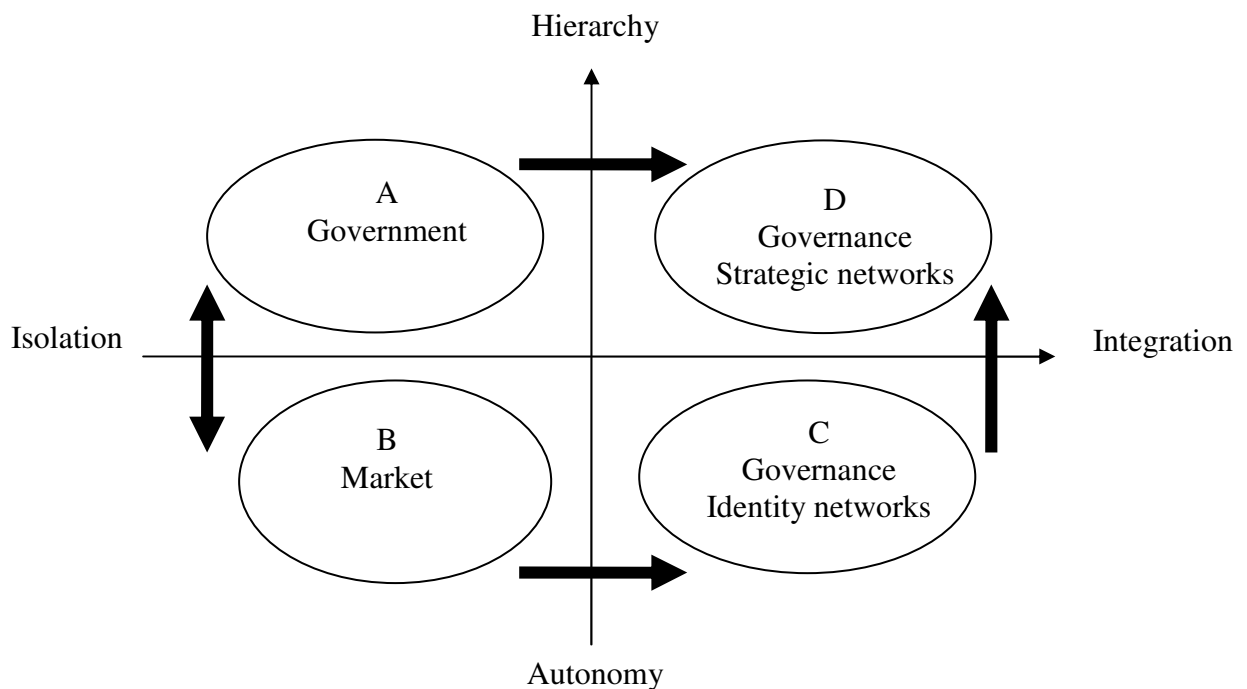


Figure 3: Four policy-making models

The hierarchical model is based on the principle of authority and it explains the regulation of economic relationships by the State and also within a large individual firms.

The free market model is based on the principle of autonomy and it advocates that the best policy is no policy and that public intervention is leading to distort the efficient allocation of resources automatically insured by the market.

The distinction between governance model and the opposite models of state organization (“government”) and perfect competition (“free market”) can be interpreted on the base of their respective position in two major dimensions: ‘hierarchy versus autonomy’ and ‘isolation versus integration’ (figure 3). The first dimension measures the power of the central authorities versus the freedom of the various firms and individuals. The second dimension indicates that the governance model is characterized by an higher level of explicit economic interdependence and it implies the sharing of common values and a sense of belonging.

Both the model of government and of free market imply the absolute isolation of each individual: either in front of the law defined and enforced by the State or within the market, as firms are prices takers in a perfect competitive market and no external economies exist.

Both the hierarchical model and the competitive model are static and based on the assumption that demand and technology can be easily foreseen, while the network model is more suitable to the actual dynamic environment, which requires flexibility and a fast adaptability to unanticipated changes both in the demand and in technology. These changes imply the need for an high autonomy and also an high integration of the various actors.

In fact, various recent changes, such as:

- the recent evolution in technology,
- the increasing complexity of the factors determining the innovation processes,
- the need to integrate complementary technologies,
- the changes in the industrial organization of firms,
- the increasing international competition,
- the increasing international interdependence of the actors and the firms,

seem to indicate the need and a trend toward a greater autonomy, which implies a shift from an hierarchical model to the free market model. At the same time, there is also a greater need for a change from individual actions to integration of the various actors, and that leads to a wider adoption of the governance model.

On the one hand, innovation breaks the order of the hierarchy, and on the other hand it requires an high cooperation, which is not allowed by the individualism and conflicts characterizing a free market.

Both the network model and the free market model are based on the principle of autonomy. However, the aspiration for a greater autonomy does not contradict the need for a greater integration, which in fact is based on the freedom of interacting with various actors and of making many different combinations of complementary competencies.

The difference between the free market and the governance model is explained by the fact that the free market model advocates more market competition and wage and labour flexibility, while the network and governance model focuses on the need for a greater connectivity or integration between the various economic actors and for a faster pace of the processes of innovation.

Moreover, a too intense free or unregulated market competition is leading to mergers, acquisitions, consolidation, increasing disparities, concentration, collusion, corporate rigidities or back to an hierarchical model. Free markets lead to the freedom to collude not only within the same sector. In fact, firms expand externally and diversify into disparate activities and sectors, both in industry and

in service and finance, creating overlapping fields of activity and that leads to the emergence of conflicts of interests and lack of focus. On the contrary, the network model advocates the need for a clear specialization and division of the fields of activity of the various firms and actors.

Industrial activity is certainly enhanced by a favourable local and national environment and may be hindered by too high taxes and too complex regulations. However, innovation is not only promoted by a favourable local environment and innovation and knowledge creation also require more intense forms of interaction between different actors and more complex forms of combination of complementary knowledge.

Individual firms, both SMEs and large firms, may have internal creative capabilities, but their innovation can be limited by the fact that they can not find internally all competencies required to respond to external stimulus.

Networks may represent a form of organization or a governance structure, which is more effective in promoting creativity or knowledge creation, than a pure competitive market or an hierarchical organization. Creativity, continuous change and innovation require interactive learning processes between many different actors and cooperation between the various firms is more efficient, than the other extreme situations of the isolation of individual firms competing one with the others or the consolidation of production in a large firm, where relationships are regulated by a central authority.

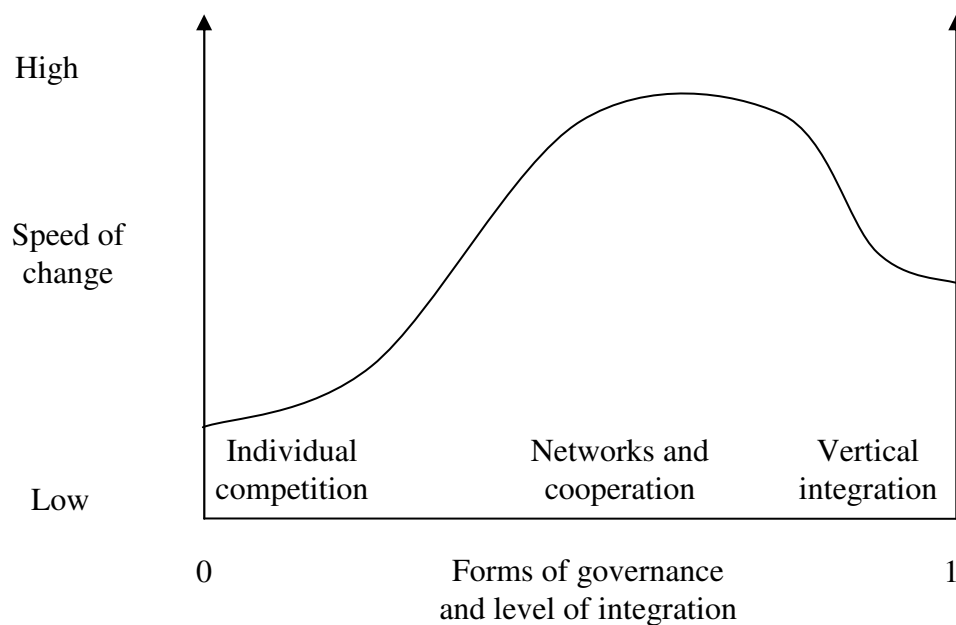


Figure 4: The relationship between increased connectivity and creativity

Governance plays a key role in determining the flexibility of an innovation network and in reducing the “switching costs” to 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. New institutional and organizational structures are needed in order to facilitate the structural adjustment to a knowledge economy, enhance social interactions and accelerate the speed of the process of adoption of innovation

Governance aims to decrease the transaction costs between the actors and the switching costs for promoting an higher speed of change. The governance of innovation processes requires to tackle the problems which hinder the speed of innovation, such as bottlenecks, missing links, inertia, resistances, corporate rigidities, collusion, privileges and rents, redistributive inequalities and to

overcome fragmented decision making and to reduce organizational conflicts between the various actors.

On the one hand, a too high competition between the local firms is hindering the possibility to combine their limited resources. On the other hand, a network organization allows firms to have easy access to rare complementary competencies by other local firms, thus increasing the capability to respond to external stimulus, to exploit external opportunities and to face external threats and that leads to higher creativity and speed of change.

On the other hand, a too high integration, such as in a large firm or in the supply chains, which are vertically integrated by a leader firm, may be less capable to exploit the potential of creativity than a network, as too large organizations are more closed with respect to external stimulus and competencies. In fact, as peripheral technologies may be core activities for another firm, large firms are increasingly proceeding to acquisitions of other firms or have created flexible alliances with other firms, in order to accelerate the rate of innovation. Thus, as indicated in the figure 4, an intermediate level of connectivity and cooperation may lead to a faster speed of change than the extreme cases of individual isolated firms and of a vertically integrated large firm.

Table 6: High flexibility requires both high creativity and strategic governance			
	Knowledge economy: competitiveness through innovation, high creativity		
Ecological networks: free market, competition	Dualism and conflicts	High flexibility and Fast speed of change	Strategic networks: governance, cooperation
	Cost competition	Exploitation of economies of scale	
	Industrial economy: cost competition, low creativity		

In particular, the shift from an industrial to a knowledge economy implies a change from cost competition to time competition, which is based on innovation and creativity.

The governance of knowledge and innovation networks allows an higher connectivity, than in the case of a free market framework. That favours creativity and leads to higher flexibility and faster speed of change, as indicated in table 6. Instead, a pure market framework would lead to an increasing divide between the insiders and the outsiders and to potential conflicts, which would slow the process of change. Thus, an inclusive strategy may reveal to be more appropriate in order to promote sustainable change in the long term.

4. The approach of knowledge networks in innovation policy

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

New instruments of innovation policies are those which aim to steer the knowledge networks and 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.

Innovation requires flexible forms of cooperation between many different private and public, regional and international actors, such as large firms, SMEs suppliers, knowledge intensive services, higher education and research institutions, financial intermediaries, public administration and many other partners such as professional association and media. Innovation requires the combination of different competencies within a process of collective learning, as firms are forced to cooperate to increase and diversify their knowledge base.

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.

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.

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 (IKINET project, 2007). The results of the IKINET project 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.

Competence centers are a new instrument of innovation policy and the experience of some countries where they have been created in the last few years should be extended to many other European countries, which still lack an explicit national program for the creation and management of a national network of competence centers.

Competence centres contribute to develop a new vision and a long-term strategy and increase the awareness of needed changes in the clusters and increase the stimulus to innovate by firms and other actors in the clusters.

Competence centres are different from research centres of excellence and should aim to promote the accumulation of knowledge between different firms and sectors through processes of interactive learning, rather than to focus only on the investment in R&D. Exchanges of tacit knowledge and building of specialized competencies should play a key role.

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 should adopt a selective approach and aim to identify and develop new strategic projects by exploiting intersectoral cognitive interdependencies at the local and international level, rather than to sustain the existing fields of specialization in a given cluster.

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.

In fact, the selection of these 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 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.

Competence centres aim to free the innovation and entrepreneurial potential of a cluster or region innovation system, since innovation depends on the contribution of many partners and small and medium size firms may take innovative choices to be followed later by large firms. Openness to new actors within the various clusters is a decisive prerequisite for sustainability, in order to avoid path-dependencies and lock-in effects or the emergence of an elitist club made by few firms isolated from the rest of the cluster.

Cluster policies require new forms of governance of the relationships between the various local actors and also the identification / selection of new actors. They should promote flexible forms of multilevel governance through horizontal cooperation between firms belonging to different sectors and an improved cooperation between local, regional, national and European organizations and institutions, rather than hierarchical forms of coordination by large firms within their respective specific supply chain, in order to exploit economies of scale and cost decreases.

Competence centres should not only focus on the needs of individual companies or on the strengthening of the vertical supply chains. They should also adopt a territorial perspective, i.e. dealing with horizontal relations between the different sectors, and an institutional perspective, i.e. promoting new forms of multilevel governance.

Competence centres may stimulate the firms to change their corporate strategy to a forward looking model and represent a stimulus to the international openness of the regional clusters by promoting forms of collaboration with external partners, such as international research institutions and large international firms.

Universities may play a key role in modern “knowledge based clusters”. Universities can develop new fields of activity (“third sector”), for example organize life long training programs together with professional associations and also promote the creativity and entrepreneurship of their researchers by joining firms in innovation projects and in the creation of new firms.

Traditional industrial clusters require a greater integration of industrial firms with modern knowledge intensive business services (KIBS) and also an improvement of the relationship between industrial firms and the financial institutions, such as private equity, in order to improve the evaluation procedures of risk in investment in innovation.

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.

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.

5. 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.

While the internationalization of the markets of the products and the internationalization of the industrial supply chain are well developed, the internationalization of knowledge links is still lacking behind. Barriers of SMEs to international clusters can be rooted in different problems. For more conventional SMEs, general deficits of contacts and experiences are particularly relevant, while for more advanced SMEs commercialisation strategies and institutional security are more relevant. Accordingly, different organizations can act as gatekeepers to secure necessary openness of cluster structures in these cases. For any public support, not the type or structure of gatekeeper should be decisive but the actual impact on integrating SMEs.

Even medium size firms are reluctant to internationalize in a knowledge perspective or to promote new forms of international interactive learning with foreign partners, due to the fear to lose their proprietary know-how, as they believe that it represents their most important tacit competitive asset.

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.

Gatekeepers are particularly important for lagging regions, as in these regions necessary density of partners might not be given to form clusters, but single partners might use contacts to regional gatekeepers to find access to clusters in other regions.

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 spatial dimension of innovation is also increasingly clear and that has lead to adopt policy schemes, which focus on the regional clusters. The choice of the new specific production fields of specialization and the creation of specific “competence centres” in many European countries may be the result of previous local initiatives or may be left to the regional governments, which better know the production specializations of their region and the potentials of the various sectoral clusters.

However, the national government 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.

ACKNOWLEDGEMENT

The paper is based on the results of the FP6 European project CIT2-CT-2004-506242: IKINET – Interregional knowledge and innovation networks (<http://www.ikinet.uniroma2.it/>). Eight partners have been involved in the IKINET project: Università di Roma "Tor Vergata" (coordinator),

University of Wales Cardiff, Ruhr-Forschungsinstitut für Innovations- und Strukturpolitik – Bochum, Instytut Badań Systemowych – Polska Akademia Nauk – Warszawa, Joanneum Research Forschungsgesellschaft – Graz, Institut National de la Recherche Agronomique – Paris, Universidad Autonoma de Madrid and Applica sprl – Bruxelles.

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