

THE GOVERNANCE
OF REGIONAL KNOWLEDGE NETWORKS
IN MEDIUM TECHNOLOGY CLUSTERS

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Abstract

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.

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1. Introduction

The transition to the model of the knowledge economy implies a distinct change in the industrial development strategies and in the approach to innovation policies, focusing more on knowledge creation than on technology diffusion, more on networks with respect to individual firms and also more on a European perspective in innovation policies for medium technology sectors.

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).

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

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 role of medium technology sectors in European innovation policies

While innovation policies mainly focus on the development of high technologies and R&D investments, European industry is still characterized by a strong specialization in medium technology sectors, such as machinery, transport equipment and chemical products (Cappellin 2004a; Alfonso-Gil and Vazquez-Baquero 2008; Steiner and Ploder 2008; Wink 2007).

Medium tech sectors are characterized by many specialized small firms. Large or medium size firms, however, are also important in these sectors, as for example in the case of the aeronautic, automobile and machinery productions. 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 interactive learning processes (Lundvall and Johnson 1994), in order to increase their competitive knowledge advantage on the global markets and to develop new production fields.

Medium technology sectors have achieved high success in industrial restructuring in recent years and play a key role in European external trade (Cappellin and Wink 2009). The share of medium technology sectors on total manufacturing exports is greater than or close to 50% in almost all

European countries and it has increased during the 2000-2003 period. The trade balance of the European Union in medium technology sectors is positive and it is compensating the trade deficit in the high tech and in low tech sectors.

High technology sectors represent only 1,08% of total European employment, while manufacturing medium technology sectors have a much greater importance since they represent 11,61%. The share of medium technology sectors in manufacturing industry employment is particularly important in the largest and most industrialized countries in European Union. Moreover, with the exception of only few countries, the share of medium tech manufacturing industry on total manufacturing has increased in all EU countries during the period 2000-2006.

		Manufacturing	High Tech	Medium Tech	Low Tech
1	Export*	100,0	17,1	57,9	25,0
2	Value Added**	100,0	19,5	47,8	32,7
3	Employment***	100,0	5,8	53,3	40,9
4	Human Resources in ST***	100,0	10,6	59,2	30,1
5	R&D****	100,0	46,7	48,9	4,4

Source: *2005; OECD STAN Indicators , 2007; **2003; Key figures 2007
;***2004; Eurostat data base, Science and Technology; ****2004; Key Figures 2007

Medium technology industry represent 57,9% of European manufacturing exports, 53,3% of manufacturing employment and 47,8% of manufacturing value added, while the share of high tech industry is only 17,1% in the European manufacturing exports, 19,5% in manufacturing value added and 5,8% in manufacturing employment. Therefore, medium technology sectors do not only have a much greater relevance than high tech sectors, but also have a different “technology profile” from that of the high tech sectors. In fact, medium tech sectors indicate a very high share of total exports, total employment of qualified workers and total employment. While the high tech sectors indicate relatively large value of the shares of total value added and especially of R&D.

The difference between the medium tech and high tech sectors is clearly indicated by the different relevance of qualified human resources (i.e. a proxy of “human capital”) and of R&D (i.e. a proxy of “codified knowledge”) in these sectors. In fact, medium tech manufacturing sectors and even more low technology sectors combine a much higher level of qualified human resources with an unit of R&D with respect to high technology sectors. Thus, knowledge which is embedded in people or “tacit knowledge” is much more important for medium tech manufacturing sectors than for high technology sectors.

Both the focus on the evolution to the model of the knowledge economy and the increasing international interdependence determined by the globalization process highlight the crucial role of medium technology sectors. The knowledge economy requires a broader perspective to innovation and to consider not only high tech sectors, but all the other sectors characterizing a modern economy. Thus, to promote the competitiveness and innovation of medium technology sectors, which represent the largest share and the most dynamic component in European industry, is becoming an issue, which relates more to industrial policy and even to the macroeconomic performance of the aggregate European economy, rather than to European R&D policy and scientific excellence. That explains the importance of promoting strategic industrial projects in the medium technology sectors.

3. The role of knowledge creation in innovation policy

The innovation process in SMEs and in medium technology sectors has a gradual character and it is driven by an intensive interaction between suppliers, customers and other actors. This process of interactive learning leads to the development of “tacit” knowledge which is represented by a complex set of capabilities, which are localized or idiosyncratic and cannot easily be transferred (Cappellin, 2003, 2004; Howells, 2002; Wink, 2003).

Innovation in medium technology sectors may be interpreted not as the linear effect of a R&D investment, but rather as the result of a process of interactive learning, where various factors are combined and represent necessary but not sufficient conditions (figure 1) (Cappellin and Wink, 2009).

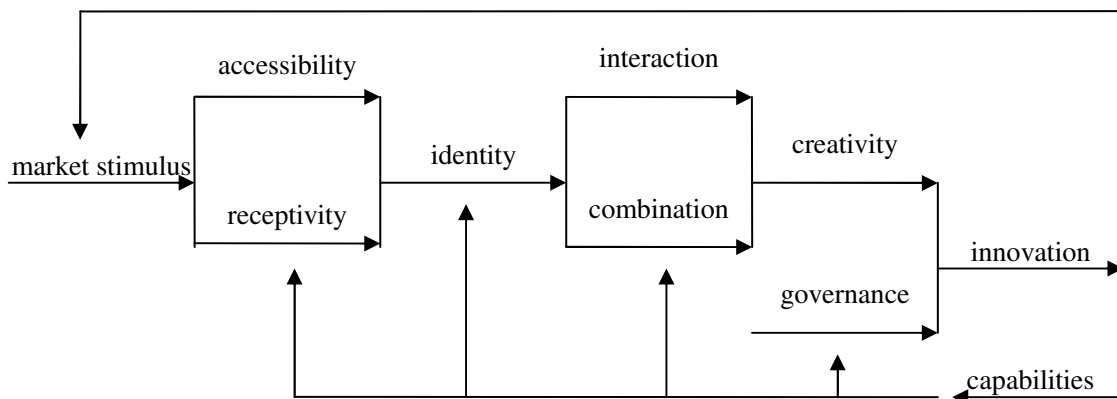


Figure 1: The process of interactive learning and innovation

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 a higher accessibility to potential complementary partners, and it also requires an appropriate receptivity of these latter (Boschma 2005; Torre and Rallet 2005). The creation and strengthening of a common identity (Becattini 1990; Crevoisier and Camagni 2000), 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 the original combination of different and complementary pieces of knowledge through a process of interactive learning between various local actors. Then, new ideas can be translated into economic innovations only through an appropriate organization and governance, which implies the commitment of appropriate resources and the integration of the new ideas with complementary production capabilities. These phases seem to correspond to the indications of the literature on cognitive economics (Nonaka and Konno, 1998; Rizzello, 1999; Loasby 2003) and to the key factors in the Territorial Knowledge Management approach (Cappellin 2003b and 2007).

Moreover, innovation is leading to a process of learning and the development of new capabilities, which improve the various factors indicated above. Finally, innovation is going to change the external environment and it may represent the stimulus to innovation for other firms. That indicates that innovation is a dynamic and cumulative process.

The emerging “knowledge clusters”, characterized by intense knowledge interactions between the various local actors, are the result of the evolution from the traditional “industrial district” based on the exploitation of economies of scale external to the firms but internal to the cluster (Capello 1999; Capello and Faggian 2005; Cappellin 1998; Cappellin and Orsenigo 2000; Cooke, Heidenreich and Braczyk 2003; Cooke and Morgan 1998; Karlsson 1997; Maillat and Kebir 1999; Simmie 2005), to the model of the “knowledge economy” (Asheim and Clark 2001; Asheim, Coenen, Moodysson and

Vang, 2007; Bougrain and Haudeville 2002; Cooke, De Laurentis, Tödting and Tripl 2006; Geenhuizen and Nijkamp 2006; Lundvall 1992; Nelson 1993).

In a policy perspective, the research done in the IKINET project (Cappellin and Wink 2009) has clarified that:

- a) medium technology sectors are the largest positive component in the European trade balance;
- b) also SMEs and not only large firms compete through innovation;
- c) the most important innovations are not the results of a single entrepreneur, but of the interaction between various economic actors;
- d) R&D is not the main factor of innovation in medium technology sectors, but rather tacit knowledge, human competencies, learning processes and networks;
- e) while codified knowledge may diffuse in international networks, the process of knowledge creation works in a localized framework;
- f) innovation policies in medium technology sectors should shift from a focus on technology transfers to a focus on knowledge creation;
- g) human resources should not be considered as a factor of resistance to the adoption of innovation but rather as the source of core capabilities and the key actors in learning and knowledge creation;
- h) networks represent institutions which are favouring knowledge creation and innovation;
- i) the spontaneous clustering processes of innovative activities is not always sufficient for competitiveness and it needs to be complemented by the design of an explicit cluster strategy.

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, and it can be interpreted according to a “systemic” approach. This approach focuses on the related processes of knowledge creation and collective interactive learning (Lundvall and Johnson 1994; Florida 1995; Keeble, Lawson, Moore and Wilkinson 1999; Lawson and Lorenz 1999; Morgan 1997; Steiner and Hartmann 2006), on the iterative adaptation between the different partners and on an implicit automatic selection of the most competitive innovations. While a linear approach aims to promote transfers of information and modern technology or to provide customized expertise to individual firms, a systemic approach (Lundvall 1992; Antonelli 2005) focuses on promoting knowledge networks and cooperation between the various local and external actors in regional innovation systems and on the development of their internal capabilities.

In particular, the crucial points which differentiate a systemic approach from a linear approach in promoting innovation in medium technology sectors are highlighted by table 2. 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 the use of modern equipments. On the contrary, the most important factor is represented 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, the systemic approach of innovation highlights that 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 a disjoint result, but rather the speed of a continuous process of innovation, where each change is the evolution of previous changes. Entrepreneurship and governance, through public-private partnership, are required to organize the joint effort of different actors and firms. The focus shifts from stimulating competition between the local actors to promoting connectivity and iterative processes of reciprocal adaptation and selection of the best productive combinations.

Innovation policies should promote the process of knowledge creation and creativity, which is based on diversity, tight interaction between different and dispersed actors and on the capability to establish new connections between different pieces of information and knowledge. In fact, networks organize diversity and facilitate the combination of information and knowledge. The existing technological know-how or “synthetic” knowledge in production activities should be connected with greater creativity, improved quality of products and modern services and with the capability to respond to new needs of users.

Table 2: 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 approach of learning networks underlines that time is the key dimension of innovation. The competitiveness of firms in regional innovation systems requires a faster speed of the process of change with respect to the competing firms and regions. Well structured production and innovation networks reduce transaction costs and adjustment costs and that allows a faster speed of the process

of change, to accelerate the policy making process and to decrease the decision and implementation times. In fact, 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 rather diversified typology of institutions play a leading role in defining a long term strategy of innovation of medium technology sectors within the different regions. These institutions represent the “social capital” of these regions and play the role of immaterial infrastructures, which organize the knowledge flows between various firms. Moreover, institutional solutions to overcome lack of resources by SMEs are regionally specific and influenced by long-term historical and cultural heritage within the region.

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 must cooperate to increase and diversify their knowledge base. Thus, cluster policies require new forms of governance of the relationships between the various local actors and also the identification / selection of new actors. Thus, while medium size firms have developed vertical flows of tacit knowledge within their respective supply chain, they need to be supported in order to develop horizontal linkages between different technologies. 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.

4. The difference between the governance, free market and government approaches

Multilevel governance depends on complex policy networks. It is different both from the free market model and also from the traditional top-down planning approach. Multilevel governance is the most appropriate form of regulation of the complex relationships in the innovation and knowledge networks of medium technology sectors. These three different policy making models focus on three different instruments for the organization of the economic relations between two actors, such as the mechanism of regulations and top down coordination in the hierarchical model, the mechanism of prices in the market model and the mechanism of contracts and agreements in the governance model. The differences between these three forms of organization and regulation of economic relationships are synthetically indicated in table 3.

In the “government” model, decisions are taken by a public authority and enforced on the base of a principle of authority. The hierarchical model explains the regulation of economic relationships by the State but also within the individual large firms. On the contrary, the free market model is based on the principle of competition, and it advocates that “the best policy is no policy” and public intervention is leading to distort the efficient allocation of resources automatically insured by the market (Bianchi, 1995). Third, the governance model is based on the principle of partnership and agreement between various actors, which are reciprocally recognized and legitimized.

Different behavioural mechanisms and motivations characterize the three models of regulation: orders, control and respect of authority and adaptation characterize the hierarchical model of government, freedom, competition and also conflict and exit characterize the model of free market, and trust, negotiation and leadership characterize the model of governance.

While most of the political science literature investigates the comparison between governance and government (Boyer 1990; Marsh and Smith 2000; Pierre 2000; Powell 1990; Rhodes 2008; Streeck and Schmitter 1985), an economic perspective leads to focus on the problem of the respective

advantages of the governance model and the free market model in the regulation of economic relationships in a modern capitalist system: an issue which characterizes the current debate on privatization and marketization. This debate is related to the respective advantages of liberal market economies and coordinated market economies (Hall and Soskice 2001), as the management of interdependencies between individual, collective and corporate actors in coordinated market economies or in corporatist societies is different from the government model and also the market model. In coordinated market economies, actors are entitled to regulate autonomously important aspects of sectoral and economic development according to principles of vertical and horizontal subsidiarity (Lehmbruch 1977; Cappellin 1997; Karl and Wink 2006) and strategic interaction or non-market relationships among firms and other actors have a key role in the investment decisions and innovation.

Table 3: Forms of organization and regulation of economic relationships			
	Government	Free market	Governance
1. Principle	Authority	Competition	Partnership
2. Result aimed	Order	Equilibrium	Agreement
3. Information provided	Regulations	Prices	Contracts
4. Instruments of organization	Control and adaptation	Pricetaking	Negotiation and leadership
5. Individual motivation and behaviour	Respect of authority	Autonomy, exit or conflict	Trust and bargaining
6. Complexity	Hierarchy	Individualism	Interdependence
7. Factor of efficiency	Economies of scale	Perfect mobility and flexibility	Transaction costs and adjustment costs
8. Interdependence	Vertical integration	No external economies	External economies
9. Number of actors	Individual actor	Infinite number	Limited number
10. Level of integration	Maximum integration	Minimum integration	Intermediate integration
11. Field of action	Sectors	Markets	Policy networks
12. Problems addressed	Authoritarianism	Monopoly	Conflicts of interest
13. Corrections to problems	Democracy	Antitrust policy	Specialization and dynamic coordination
14. Political Ideal	Egalité	Liberté	Fraternité
15. Juridical base	Civil law	Common law	Selfregulation and subsidiarity
16. Space of relevance	Any State and Corporations	Liberal Market Economies	Coordinated Market Economies
17. Goods	Scale intensive goods	Commodities	Specialized goods
18. Factor of competitiveness	Economies of scale	Lower prices	Time advantage
19. Type of innovation	Radical innovation	Incremental innovation	Systemic innovation
20. Knowledge base	Basic research	Codified knowledge	Tacit knowledge
21. Time framework	Static	Static	Dynamic

Differently from the other regulation models, in a market model, the actors refuse to obey and also to agree and they prefer to compete each other. The actors adjust their willingness to supply and

demand goods or services in response to the price signals generated by markets. Markets are self regulating and the coordination of economic relationships may be indirectly or automatically done by the market, who assigns productions to the most competitive firms, as the result of the competition between the many existing suppliers and of the optimal choice by the many possible users. On the contrary, in a governance model, the coordination is the result of the negotiations and explicit agreements between a limited number of individual stakeholders.

The increasing wider adoption of a governance model represents the result of the adaptation to a continuously changing environment, rather than a deliberate change of strategy. In fact, it is embedded in the ongoing structural dynamics, which are largely common to all European countries. In particular, it is now widely recognized that the interventionist top-down model (“government”) in the innovation policies is neither possible nor desirable, since innovation for its very nature cannot be reduced to command and it has a pro-active character and is open to new discoveries. Thus, the dirigist approach of economic planning and of the “welfare state” should be changed into an approach based on the concept of partnership and subsidiarity. This is particularly decisive for medium-tech industries, as they are made by many different actors, who would hide their knowledge in the case of a command-and-control approach.

The governance approach in policy-making is tightly related to innovation, as this latter erodes the disciplinary borders and internal hierarchies, which characterize the government model. For example, Schumpeter’s creative destruction clearly determines conflicts and does not respect consolidated hierarchies. Governance is also tightly related to the internationalization process, as this latter undermines closure and hierarchies and erodes the regulation capabilities of the states. Moreover, the internationalization of economies insures to the innovators the freedom of exit from those hierarchical organizations, where they cannot accept a dependent role.

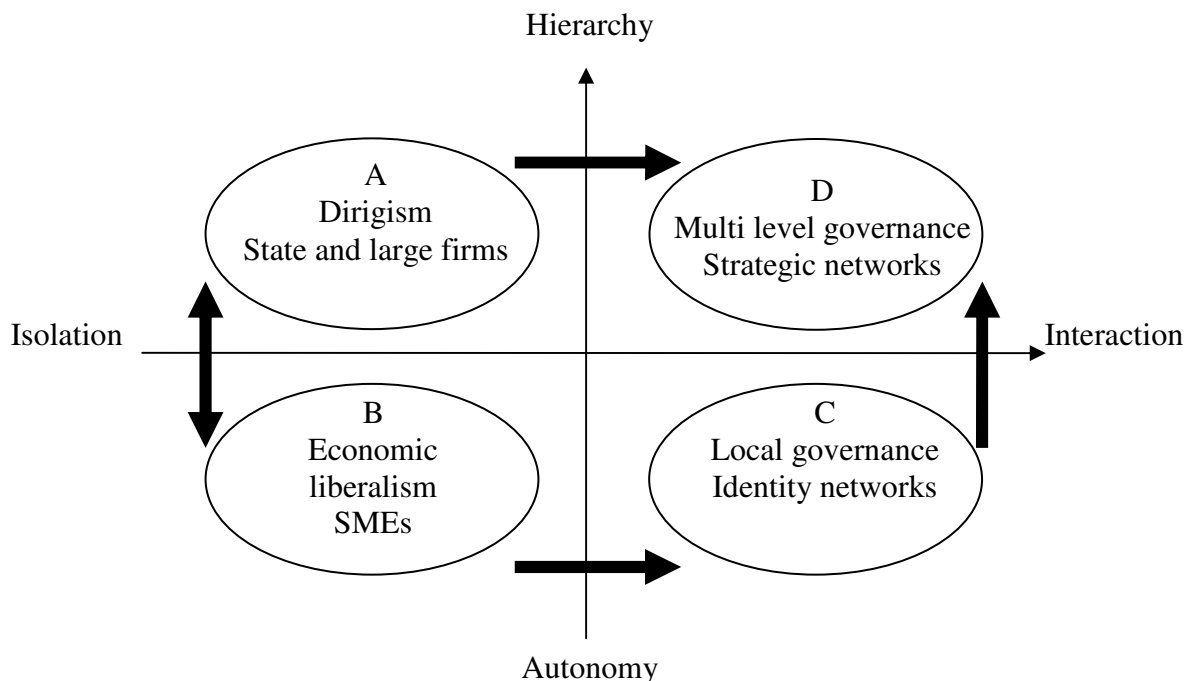


Figure 2: The evolution in the relevance of four organization modes

However, also a free market approach, based on the mechanism of price regulation, is not appropriate to tackle the issue of innovation. In fact, the governance model represents a change from a free market model and it seems to correspond to a new phase of development, where technology has an increasing systemic dimension, rather than a single firm perspective and the speed of adoption of innovation has become more crucial than the decrease of production costs in

the competition between the firms. These changes require a greater integration of the various actors and the emergence of networks between them.

Since the exchange of knowledge and especially of tacit knowledge cannot be effectively coordinated by conventional markets, the density of intermediate institutions and the adoption of a governance model enhance innovation, as they favour reciprocal trust, identity and shared values and collaborations, while avoiding opportunistic behaviours, adverse selection and moral hazard.

The distinction between the governance model and the opposite models of hierarchical organization in the state and in large firms (“dirigism”) and perfect competition between many small firms (“economic liberalism”) can be interpreted on the base of their respective position in two major dimensions: ‘hierarchy versus autonomy’ and ‘isolation versus interaction’ (figure 2). 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 a higher level of explicit economic interdependence and it implies the sharing of common values, a sense of belonging or a common identity.

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

Moreover, both the free market model and the network 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 implies the freedom by the actors to interact with various actors and to negotiate and organize many different combinations of complementary competencies.

Therefore, various recent changes, which characterize medium technology sectors, such as:

- the 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 shift from a hierarchical approach to a “bottom-up” approach, which emphasizes the individual freedom, as indicated by the arrows in figure 2. At the same time, there is also a greater need for a shift from the perspective of individual innovation to a systemic process of innovation, based on the integration of various and complementary actors and leading to a wider adoption of innovation, as indicated in the governance model.

However, the increasing perception of the negative effects of globalization and the unregulated market mechanism leads to advocate a greater role for the state. That determines a cyclical shift between the market model and the state model. Thus, the increasing complexity and interdependence of innovation processes lead to assign in various cases a greater role to national and European initiatives in the governance of knowledge and innovation networks.

A neo-liberal model advocates greater wage and labour flexibility and greater competition as the panacea to every economic problem. However, in a modern knowledge economy the concept of innovation seems more important than that of price flexibility, and the concept of integration between the various economic actors appears more crucial than to promote the already high competition in the national and international markets. While the free market model advocates in any case only more competition and more flexibility, the network and governance model focuses on the

need of a greater integration between the economic actors and a faster innovation. Thus, the governance model is linked to the existence of intermediary functions, a greater stability of relationships, a long-term perspective and the supply of adequate public investments.

Governance aims to decrease the transaction costs (Williamson 1981; Cappellin 1988) between the actors and the adjustment costs to new technologies (Cappellin 1983), as that promotes a higher speed of change. The governance of innovation networks allows to tackle those problems, which hinder the speed of innovation, such as bottlenecks, missing links, inertia, resistances, corporate rigidities, collusion, privileges and rents and redistributive inequalities, to overcome fragmented decision-making and to reduce organizational conflicts between the various actors.

The free market model focuses on competition in an horizontal perspective. However, it does not prevent forms of collusion and quasi integration in a vertical perspective and between different sectors. In fact, in many modern capitalist economies, are frequent various forms of collusion between the firms of different sectors: such as financial, insurance, industrial and media companies, based on the direct and indirect financial links, the exchange of positions in the boards of these organizations, the tight personal relations between the firm representatives in the boards of the various industry associations and the indirect relations with the political world and the national government. That determines pervasive conflicts of interest between the supplier and the user, the controlled and the controller and it insures an advantage to specific groups of actors with respect to the other actors and it also is one of the main reason of the increasing income disparities. In fact, a market, which operates freely without rules, inevitably leads to collusion and concentration of the economic and financial power into few private actors.

Forms of intersectoral collusion or integration represent a danger and create a rent situation. Intersectoral integration leads to conflicts of interests and it endangers that "separation of powers" which is the base of a pluralistic democracy, as in the Montesquieu's principle of separation between the legislature, executive and judiciary powers. In fact, totalitarianism is occurring when all political and economic power is concentrated in a single group of actors or ruling class. The more developed is a society the greater should be the division of labour between sectors and also the division of powers between the different firms and organizations.

These collusions are aimed to short term financial profits and to defend and exploit specific rent positions. They represent the major obstacle to systemic or inter-sectoral innovation and diversification in European industry, as new innovative initiatives could conflict with the incumbent organizations and could undermine the existent power alliances between them. Clearly, SMEs in medium technology sectors are excluded from these exclusive networks and are hindered in their diversification and growth.

These forms of intersectoral collusion cannot be tackled by the traditional competition policies and require a broader governance of the relationships between the various economic actors. Regulation or governance is required in a network in order to prevent forms of vertical and horizontal integrations and collusions, which may damage other actors. Regulation allows separation of functions and recognition of the respective legitimacy of each actor and avoids to confuse their role. In particular, the network model is based on the principle of specialization, as each node should perform a different function or role within a network. In a network model the relationships between actors are based on monetary or real exchange, negotiation, but also on specialization, division of labour and separation of roles and of activity, in order to avoid conflicts of interest. Governance should insure the separation of the fields of activity of the different firms and organizations, in order to prevent conflict of interests and to insure a system of checks and balances. Relationships in a network should be based on negotiations and agreements and neither on competition leading to conflicts or to the defeat and exclusion of some actor, nor on hierarchical power relationships

leading to mergers or collusion. Governance enhances the combination of complementary capabilities on the base of public and transparent negotiations and agreements.

In conclusion, each model of regulation of the relationships may lead to problematic situations and requires adequate instruments to correct them. Democracy avoids the problem of authoritarianism in the government model. Competition or anti trust policy is required to avoid collusion and monopolies in the free market model. Governance avoids the problem of intersectoral collusion and conflicts of interest in the case of networks.

The governance model promotes the integration of the various autonomous economic and institutional actors and enhances the development both of the market relationships and a pluralistic democracy. The procedures of negotiation in a governance model link the major economic and institutional actors through an interactive and sequential learning process. Both market and hierarchies clearly still continue to exist, but they are both working in the framework of decision processes having a negotiation nature.

5. Levels of integration, speed of change and the evolution to the knowledge economy

Free market, governance and government are three different forms of regulation of economic relationships characterized by different levels of integration. 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, represents the lowest level of integration. On the contrary, the hierarchy model, where the relationships between the actors are very tight and have to comply with the indications of a superior power, which may be the state or a large integrated company, represents the highest level of integration. Thus, the networks of firms, which are highly specialized in specific production phases, represent an intermediate case based on a principle of negotiation and cooperation.

The concept of innovation underlines the importance of time advantage, as indicated by various other related concepts, such as: just in time, lead time, time to market, speed of change, speed in decision-making and coordination and time lags in the adoption of innovation. The levels of integration implicit in the three forms of regulation indicated above are related to various speeds of change as it is represented by figure 3. In fact, on the one hand, a too high competition between the local firms is hindering the possibility to combine their limited resources. Individual firms, both SMEs and large firms, may have internal creative capabilities, but their creativity and speed of innovation can be reduced by the fact that they cannot find internally all competencies required to respond to an external stimulus. That leads firms to create alliances or to merge in medium size firms, which may have a key role in steering the local clusters and in promoting change and a long-term strategy.

On the other hand, a too high integration, such as in a large firm or in hierarchical organised supply chains, which are vertically integrated by a leader firm, may be less capable to exploit the potential of creativity than a network. In fact, a large firm made by disparate business units may be rather close with respect to external stimulus and external competencies. Therefore, outsourcing of non-core productions and the focus on those areas where the firm enjoys a technological advantage would be the most efficient strategy. In fact, peripheral technologies for a firm may be core activities for another firm and large firms have increasingly created financial participation in other firms or flexible alliances or networks with other firms to accelerate the rate of innovation. Thus, an intermediate level of integration may insure a higher speed of innovation than the extreme cases of individual isolated firms and a vertically integrated large firm. 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 stimuli, to exploit external opportunities and to face external threats leading to higher creativity and speed of change.

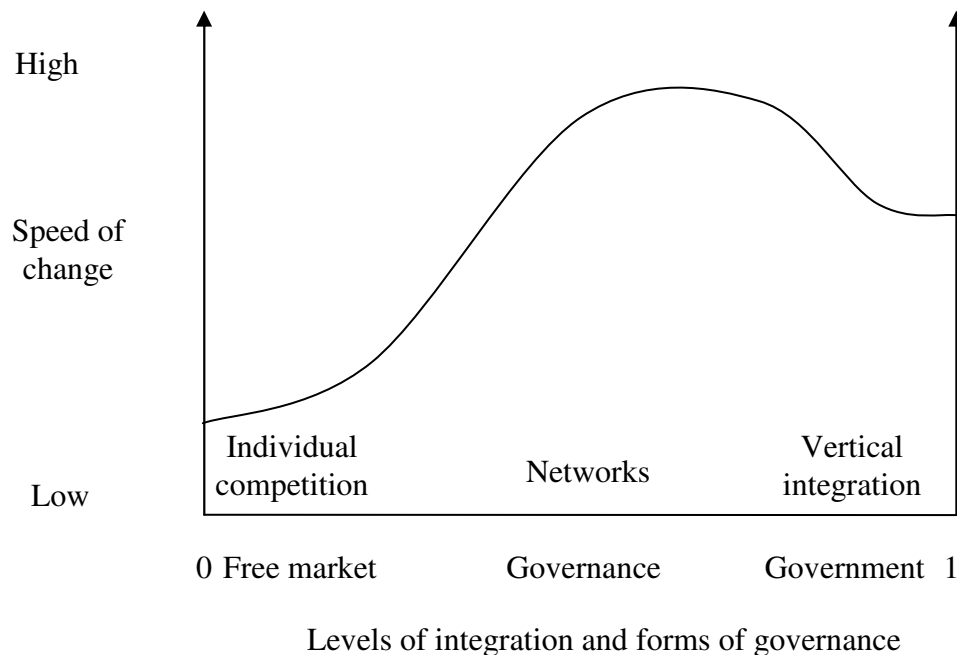


Figure 3: The relationship between increased integration and creativity

Networks may represent a form of organization or a governance structure, which is more effective in promoting creativity or knowledge creation, than both a pure competitive market and a hierarchical organization. Creativity, continuous change and innovation require interactive learning processes between many different actors, and the cooperation between various firms is more efficient than the two extreme situations of the isolation of the individual firms competing one with the others or of the merging of all production into a large firm, where the relationships between actors are regulated by a central authority. Governance plays a key role in determining the flexibility of an innovation network and in reducing the “switching costs” or adjustment costs to innovation (Cappellin 1983), thus avoiding the risk of a lock-in effect in territorial clusters and promoting a 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.

6. The governance of networks and the characteristics of “competence centres”

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

In particular, the empirical and theoretical research on innovation within medium technology sectors (Cappellin and Wink 2009) highlights the need for an evolution of regional innovation policies:

- a) from the traditional free market approach or the hierarchical planning approach to a modern governance approach,
- b) from the focus on individual firms to the governance of the network of firms,
- c) from the distribution of R&D public funds to the connection of innovative capabilities,
- d) from a focus on exploitation of specific technologies to one on exploration of diverse technologies,
- e) from sectoral specialization to intersectoral integration and sectoral diversification,
- f) from a focus on process innovation and cost competition to one on product innovation and time competition,
- g) from a focus on accessibility to technological sources to one of receptivity by the local actors,
- h) from the supply R&D infrastructures to the identification of the new demand by the final and intermediate users,
- i) from the distribution of public funds to the stimulation of private investments,
- j) from informal cooperation based on trust to formal commitment on strategic projects.

Competence centres are new instruments of innovation policy, which is suitable for the SMEs in medium technology sectors. They have been created in various countries such as: France, Austria and Finland and have different names (i.e. poles de compétitivité, kompetenzzentren, centre of expertise, competence clusters). 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.

The creation of competence centres and a focus on knowledge links indicate the need for a new framework for innovation policies at the regional, national and European level. Competence centres contribute to develop a new vision and long-term strategy and increase the awareness of needed changes in the clusters and the stimulus to innovate by firms and other actors in the clusters.

Regional “competence centres” focused on new fields of production, related to traditional specializations in the various regions, may promote the collaboration between firms of different sectors having complementary competencies.

Competence centres are different from research “Centres of Excellence” or “technological districts”, which are mostly linked 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. In fact, competence centres should aim to promote the accumulation of knowledge between different firms and sectors through processes of interactive learning and exchanges of tacit knowledge and building of specialized competencies should play a key role, rather than to focus only on the investment in R&D. However, competence centres, by focusing on innovative industrial projects and focusing on the competitiveness of a national and regional industrial and innovation system may clearly also contribute to the enlargement of the technological and general information base, required for cultural and social development.

Competence centres are also different from the traditional “Technological Centres”, which have been created by local and regional institutions and aim to provide new technological and business services to individual SMEs within territorial clusters. On the contrary, competence centres aim to the design and management of large joint projects with several firms and other partners for the development of innovative productions for the industrial diversification of a cluster. Competence centres should not only focus on the needs of individual companies or vertical supply chains. On the contrary, they should also adopt a territorial perspective, i.e. dealing with horizontal relations between different sectors, and an institutional perspective, i.e. promoting new forms of multilevel governance. They should identify emerging needs in existing and new markets and create coalitions of regional and also international partners needed to solve the problems.

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. Competence centres should carry out an exploration activity leading to the design of many large and small projects. They should identify emerging needs in existing and new markets and create coalitions of regional and also international partners needed to solve the problems.

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 regional clusters by promoting forms of collaboration with external partners, such as international research institutions and large international firms. Openness to new actors within the various clusters is a decisive prerequisite for sustainability 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.

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 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. 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 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.

Regional policy should identify regional fields of competence and relevant target areas of new technology. The following three fields of competence can be identified as candidates 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.

Public support via projects sometimes only leads to short-term structures, which run into risk of losing the engagement of partners after the end of external funding. However, pure long-term public funding would destroy incentives of the private partners to look for efficiency. Thus, a suitable way out for funding cluster structures could be public-private partnerships and collaboration with private financial intermediaries together with public funding for more long-term strategic projects of public interest.

A systemic approach to innovation, focusing on knowledge creation, interactive learning and the development of creative capabilities highlights that regional and national policies for competence centres should:

- respond to the emerging needs of the user side, identify and aggregate new demand, explore new markets with high growth potential or 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 new large strategic projects of innovation, requiring the coordination and cooperation of many partners, in the existing clusters and regions, rather than the creation of new geographical clusters,
- raise new funding through public-private partnership, involve modern financial intermediaries in strategic industrial projects and provide key competence in the selection of innovative projects submitted for financial support, 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, adopt new forms of “governance” of the knowledge and innovation networks and design an explicit long term strategy of the competence centre,
- promote the participation of new partners in innovation networks, such as KIBS and universities, thus promoting a greater effort on innovation and a mid term development strategy,
- represent a bridging institution and promote local contacts between SMEs and large firms, on the one hand, and between them and the research institutions, on the other hand,
- promote international links between competence centres of different countries, the participation to European projects and enhance a greater international integration and competitiveness in an increasingly complex and connected world.

7. The national and European dimension of the networks of competence centres

The choice of 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 know better the production specializations of their region and the potentials of the various sectoral clusters. However, a complex interaction is needed between regional policies and national or European innovation policies (Cappellin 2004b, 2004c and 2005; Kaiser and Prange 2004; Wink 2008a). Several sectors (such as aerospace, environment, energy, finance, major international infrastructures, etc.) seem to require a 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.

National governments may take various important initiatives, such as to:

- launch programmes for the creation of networks of competence centres in regions, which do not have them,
- focus on the problems in the implementation phase of the competence centres, and not only on the creation of new competence centres, and identify success factors and evaluation criteria,
- generate new organizational and institutional solutions and create a consensus on a new common model of action,
- develop some systemic linkages between the various competence centres at the national and European level, organize working groups and periodic events, allow an easier exchange of knowledge, promote international learning and benchmarking, create a platform for exchanging experiences and best practices and compare the management models,
- define concrete set of proposals and possibly interregional strategic projects based on the cooperation of various competence centres and promote the creation of new competence centres in fields of national and international relevance,
- promote studies dealing with innovation, human resources, internationalisation, etc. in clusters and organize training sessions dealing with cluster management,
- design new public-private funding solutions and involvement of private capitals and regional banks.

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.

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.

While the internationalization of product markets and industrial supply chains is well developed, the internationalization of knowledge links is still lacking behind. 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 loose their proprietary know-how, as they believe that it represents their most important tacit competitive asset.

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 in order to participate to large RD European projects. Instead, EU policy should focus on:

- support of competence centres as intermediaries for SMEs,
- subsidisation of public-private funding of competence centres in lagging regions aiming to extend the cooperation between these regions and leading agglomerations,
- initiate contests on strategic lead projects on a regional and interregional level enhancing the participation of new companies,
- promote projects integrating medium-technology industries with universities and high technology services aiming to extend industrial value chains and to diversify in new qualified productions,
- promote European linkages between regional competence centres by standardisation of information, qualification courses for the managers of competence centres, technological norms and support to bridging organisations,
- adopt strategic regulations to strengthen European technical safety and environmental standards in the global market and promoting the development of new productions.

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. Creativity does not only consist in the adoption of specific product and process innovation within an individual firm, but also in the design of medium term projects having a collective nature with the participation of various SMEs and large firms. In fact, regional innovation policies should promote large innovative common projects in the existing clusters and also between the various regions, rather than aiming at the creation of new clusters. The enhancement of creativity requires the facilitation of the vertical relationships along the supply chain between client and suppliers, but also the horizontal relationships between different sectors both locally and with partners in other regions, such as other clusters, international research institutions and large international firms.

The lack of geographical proximity may be compensated by an adequate organizational or institutional proximity, which may allow to transfer tacit knowledge at large distance within organizations and institutions. Thus, networks may represent the appropriate organizational structure to organize diversity, facilitate the sharing and combination of tacit knowledge and stimulate creativity. In fact, tacit knowledge is not “transferred” as in the case of codified knowledge, but it rather represents a capability which can be learned, as the result of a process of interactive learning. This latter process leads the actors to develop, with the collaboration of actors in other regions, specific new creative competencies, which will allow them to adopt process and product innovation. Thus, the so called “intersectoral and interregional transfers of tacit knowledge” may be the result of a European regional and innovation policy, which promotes and organizes a

process of collaboration and interactive learning between different sectors and regions through the creation of international networks of competence centres.

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