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Collective Learning, Spatial Changes, and Regional and Urban Policies

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Cities are the core of the far-reaching sectoral transformation of the national and international economy into the model of the "knowledge economy," and the competitive advantage of cities and regions is determined by a faster adoption of innovation. This article considers the relationships between the changes in the spatial structure and the transition to the knowledge economy, as innovation affects the structure of the territory at the regional, national, and international level, but also how territorial structure and policies affect the patterns of innovation. It first illustrates the differences between the related concepts of information, knowledge, and learning economy. Then it defines the systemic and interactive nature of the process of knowledge creation and illustrates the methodology of territorial knowledge management. That highlights how spatial planning may affect the innovation potential of a region and the differences with respect to the traditional approach in industrial and innovation policies.

Keywords: *knowledge economy; urban policies; territorial knowledge management; innovation policies; regional networks*

The term *knowledge economy* can be regarded as a key word of the future, and it has become an object of both theoretical discussion and pragmatic programs. This contribution aims to investigate the often-missing link between technological change and territory. In fact, the knowledge economy has been analyzed for its technological, economic, and institutional implications, whereas its spatial implications are far less debated.

It clearly appears that there are wide disparities between regions and countries in the diffusion of the knowledge economy. Thus, regional and urban policies should be concerned with the issue of the diffusion of the knowledge economy. In particular, territorial and urban planning are mainly concerned with activities such as building and transport industries that are considered traditional industries with respect to such high-tech industries as production activities specializing in information and communication technology (ICT) and other new technologies. They focus on the physical nature of the built environment and are at odds in considering the immaterial nature of technological change. In fact, knowledge is not a production sector

tightly related to specific employment and built structures but rather, an immaterial factor that does not have a physical representation.

Moreover, territorial and urban planning focus on environmental quality and landscape order and beauty and do not explicitly consider other important societal aims, such as production efficiency, technological excellence, and economic growth, which often have a conflictual relationship with the environment.

The structure of settlements is rather sticky and guided by long-term historic evolution processes that contrast with the fast speed of technological change in various production fields.

It is clear that knowledge-based activities such as the university and research institutions or the new technologies such as ICT have a minor importance within the wide scope of the various human and economic settlements in a region or urban area: They may represent only an emblem or a pilot case study. However, the knowledge economy may represent a general framework or a new paradigm of organization of the society, and it should lead to a different perspective on policies dealing with the various traditional production sectors.

This study aims to analyze the cognitive dimension of the agglomeration economies and to clarify the role to be played by regional and urban governments in the diffusion of the knowledge economy. Thus, after a synthetic survey of the differences between the related concepts of information, knowledge, and learning economy, it first illustrates how innovation affects the structure of the territory. Next, the article describes the interactive nature of collective learning and the importance of the local dimension in the process of knowledge creation. The article illustrates the key factors indicated by the methodology of territorial knowledge management (TKM) and highlights how territorial structure and spatial dimension affect the process of knowledge creation and how territorial structure and spatial planning may affect the innovation potential of a region. Finally, the article investigates the main differences between the traditional approach to industrial and innovation policies and the new approach required in the governance of a modern knowledge economy.

The Relations Between Concepts of Information, Knowledge, and Learning Economy

As many theorists have formulated, through different terms and varying concepts (Bell, 1973; Drucker, 1993; Gershuny, 1978; Masuda, 1983; Stonier, 1983), societal development in advanced industrial countries has led toward an information society, where the major driving forces are the development of ICT, the rapidly increasing use of new devices, and the growth of the service sector (Ahlqvist, 2005).

Since the Bangemann (1994) report, "Europe and the Global Information Society," the notion of information society means—at least in Europe—a modern society with its economic and cultural life crucially dependent on ICT, that is, on

computer techniques, on communication hardware and software, and on the already global network.

According to Castells (1996), the crucial technological turning point was the invention of microchips in the early 1970s. Although the Internet was first conceptualized in 1974 as a "network of networks," the building blocks for its exponential growth were not fully in place before 1995. Since then, the core of information society was seen as consisting of technologies of information processing and communication. Information and knowledge were simultaneously pivotal as production factors and as products.

The concept of the information society is the product of the convergence of several distinct forces during the 1990s: (a) the diffusion of personal computers to businesses, universities, and homeowners; (b) local area networks made cheaply available by the commoditization of Ethernet technology; (c) the maturation of the standards used to connect disparate communications networks, permitting address assignment, e-mail messaging, and file transfers; and (d) the availability of browser technologies that enabled a common, easy to use interface via HTML.

The "information society" has been characterized by (a) ease of information access, (b) interaction richness, and (c) low interaction and information costs. Thus, the driving force of the information society primarily has been resting on technology as a physical thing. However, the information society has increasingly begun to attract interest from the civil society point of view in addition to market needs. Control of one's own life within the information society calls for emphasizing an ability to communicate and interact with others using new tools and modes of operation differently from that required in an industrial society.

Moreover, the development of technology has been shifting toward the social notion, toward the primacy of content and communicative applications. In the pioneer countries of information society, for example, the United States and Nordic countries, the content applications have been growing in importance as the primus motor of technological development. This reflects the changing demands of consumers.

The concept of knowledge economy is related but also differs from that of information society and other widely diffused concepts, such as high-tech industries, ICTs, new economies, and new technologies. It underlines the tight relationship between the learning processes, the innovation, and the competitiveness of the economy. It is usually employed to design a new phase in which knowledge and human resources represent the strategic factors.

The knowledge economy is "an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge" (Nonaka, 1996, p. 18). The knowledge economy is a very different paradigm from previous agricultural, industrial, or service economies; it rests on the value of human potential and how it might be systematically leveraged for the benefit of humankind.

An economy based on ideas rather than material objects has several distinct characteristics. An economy of objects emphasizes mass production, internalized ownership, control, and vertical integration. An economy based on knowledge favors

customization, flexibility, rapid response, and disinternalization or deconstruction of the value chain. This favors alliances as different pieces of the value chain under different ownerships cooperating with each other (Contractor & Lorange, 2002).

However, the knowledge society is a larger concept than just an increased commitment to R&D. It covers every aspect of the contemporary economy where knowledge is at the heart of value added—from high-tech manufacturing and ICTs through knowledge-intensive services to the overtly creative industries such as the media and architecture (European Communities, 2004).

Maskell (1999) argued, "A knowledge-based economy is materializing, where the competitive edge of many firms has shifted from static price competition towards dynamic improvement, favouring those who can create knowledge faster than their competitors" (p. 113). In a knowledge economy, the competitiveness of the firms is determined by the quality of the products and processes, the decrease in decision-making time, the production and delivery times of new products, and the adoption of technological and organizational innovation in production processes within the firms as well as in the external institutional framework.

The notion of a knowledge-based economy draws attention to the fact that since the postwar period, the production process has increasingly relied on knowledge-based activities. The proportion of labor that handles tangible goods has become smaller than the proportion engaged in the production, distribution, and processing of knowledge. The expansion of the knowledge-intensive sector vis-à-vis other routine and physical production processes seems to be one of the major trends in economic development in this period.

Furthermore, the concept of knowledge economy is tightly related to that of knowledge-intensive–based services and of intellectual capital and intangible assets. In fact, it has been asserted that people, rather than such traditional factors of production as capital, will become the main source of value and economic growth in this new type of capitalism and that in future, more and more productive activities will make use of employees' intellect and creative capabilities (Florida, 1995).

Thus, it is crucial to develop the competencies and professional skills of the labor force, the intermediate and top managers. In particular, the factors that determine the survival and success of firms are increasingly less the fixed investment and financial resources and more the know-how, the intangible resources, and the distinctive competencies.

Finally, the concept of the learning economy may represent an evolution of that of the knowledge economy. The theory of the learning economy has been developed by a group of Danish institutional and evolutionary economists engaged in the study of innovation. At the heart of this theory is a belief that "knowledge is the most fundamental resource in our contemporary economy and learning is the most important process" (Lundvall & Johnson, 1994, p. 23). Lundvall and Johnson (1994) argued that it is better to talk about "a learning economy" than a "knowledge-based economy"

because the high pace of change means that specialized knowledge becomes much more of a short-lived resource and that it is the capability to learn and adapt to new conditions that increasingly determines the performance of individuals, firms, regions, and countries.

The learning approach emphasizes a dynamic approach to innovation rather than the more static approach adopted in the knowledge-based economy that emphasizes access to a stock of specialized knowledge. It makes it clear that what really matters for economic performance is the ability to learn (and forget) and not the stock of knowledge. Moreover, the learning economy perspective stresses the importance of informal forms of knowledge, described by Lundvall and Johnson (1994) as "know-how."

Thus, in a learning economy, innovation is understood as an interactive learning process, which is socially and territorially embedded and culturally and institutionally contextualized (Lundvall, 1992). Learning theorists have argued that the process of innovation is highly interactive and dependent on social and cultural institutions and conventions (Morgan, 1997).

The Effects of Innovation on the Territorial Structure

The relationship between technological change and spatial structure has a reciprocal character; it can be considered via an "impact perspective" or a "generative perspective." According to an impact perspective, changes in technology and economy favor urban renewal and the creation of new physical structures and new jobs in modern activities, whereas according to a generative perspective, urban renewal may also stimulate the progress of technological and economic change.

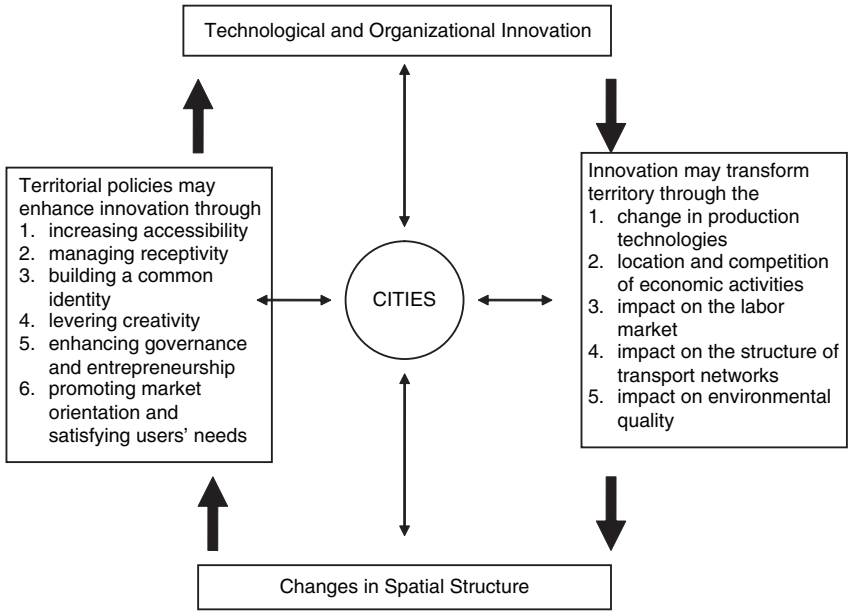
In fact, territorial structure and planning has both a direct and an indirect effect on technological change. It is clear that new large infrastructures, such as bridges, metro lines, skyscrapers, international fairs, museums, and airports require advanced technological solutions and stimulate technological change. In a similar manner, environmental constraints may lead to technological innovation.

However, even more important is the indirect impact of the city environment and of the territorial organization on the innovation process within a city region or in a national economy. For example, major infrastructures and innovative urban planning projects have been instrumental in promoting the economic recovery and transformation of major cities that once specialized in traditional industrial activities.

The relationship between technological change and the territory indicates different issues and calls for different policies according to the spatial scale, which is considered. It may be analyzed in a European and global perspective, an interregional or national perspective, or an intraurban perspective.

Innovation affects the spatial structure by its impact on the five factors indicated in the right side of Figure 1.

Figure 1
The Interdependent Relation Between Spatial Structure and Innovation



The Change in Production Technologies

Industrial production can increasingly be located in areas where space is rather scarce, such as urban areas. In fact, the increased immaterial nature and content of know-how of industrial production is leading to an increasing role of service activities within the manufacturing process, leading to an increased location in urban areas of new jobs. Moreover, the increasing division of work between the various firms leads to a decrease of the size of high-tech industrial plants, which also aids their location in areas where space is scarce, such as cities and mountain areas.

The Location and Competition of Economic Activities

The increasing use of modern equipment is facilitating the use of unqualified labor, thus, leading to a decentralization of production in less developed countries. Moreover, economic development in the new market economies in Eastern Europe and Asia has led to a concentration of the new economic activities in major cities, which are more easily accessible to foreign investors. This has increased the divide between larger and smaller cities and between central and peripheral regions.

At the intraurban level, technological change is leading to industrial restructuring and the crisis of traditional industries, determining the continuous growth of industrial derelict land and contributing to a major deindustrialization process in large metropolitan areas. The negative effect of large derelict land has been counterbalanced by improvement in terms of lower industrial pollution. In addition, the creation of new industrial and service firms is usually accompanied by the construction of new plants, office buildings, and commercial parks. These projects remove land from agricultural use and determine an abnormal consumption of territory, thus, leading to an increase in transport congestion and production costs for the firms themselves.

An important innovation in the organization of retail trade and in individual behaviors is the creation of very large commercial centers, which are located in peripheral urban areas. On one hand, this ensures lower prices and a wider range of products for consumers. On the other hand, it increases the movements of private cars and traffic congestion. Therefore, large commercial centers may prove less economically efficient than the distributions of smaller commercial centers at a walking distance from the zones of residence.

The Impact on the Labor Market

Increased labor productivity has the indirect effect of increasing free time and expenditure power, thus, determining increased opportunities for tourism and the development of once peripheral and emigration localities. Furthermore, modern technologies require a greater use of qualified workers in management, purchasing, marketing, design, and research functions, and these workers are more abundant in large metropolitan areas. This leads modern industrial and service activities to concentrate in large metropolitan areas.

Cities are the labor market for the "knowledge workers," who are characterized by new needs and who have different behaviors. This implies different time organization, more demand for meeting places, more demand for culture and education, more residential mobility, more car traffic, more demand for ICTs, more media and travel services, expansion of airports, creation of high-speed trains, more international and interregional diversity, more preference for city-center living, less crime, and less atmospheric pollution but more noise pollution.

The Structure of Transport Networks

Technological change has determined the need for a higher division of labor and specialization of productions of the various firms and countries. This is determining a continuous increase of trade and transport flows, which is much greater than the value of the respective national products.

The development of international trade is tightly related to the growth of the containers and maritime transports, and this has led to the creation of a limited number

of new major hubs, which have a capacity of millions of teus and are located in once peripheral regions, such as Gioia Tauro in Calabria, Italy, and Algeciras in Andalusia, Spain, or serve as transhipment points toward other minor but also large final ports of origin and destination. These new technologies open new development opportunities to once underdeveloped regional economies, creating the possibility of new industrial activities to be linked with other firms in increasing transnational supply chains. Moreover, container transport has led to an increase of the otherwise decreasing competitiveness of rail freight transport with respect to road transports and may lead to lower environmental impact. However, the increased division of labor brought by innovation is leading to an increase of not only freight transport but also people transport, thus, explaining the increase in air transport and the need to invest in new major airports.

Furthermore, a higher economic integration of European regions and countries, especially of the new member states, requires the construction of major trans-European networks. However, they may also lead to a higher concentration of economic activities in large cities, which represent the origin, the intermediate nodes, and the destination poles of these major interregional infrastructures.

The increased importance of speed is the factor leading to the growth of new transport operators, such as TNT, DHL, FedEx, and UPS, which have been created or favored by the outsourcing of transport and logistic activities from parent industrial and service firms and have led to the creation of new logistic centers and airports serving as specialized hubs for these activities.

The increasing division of production processes between various firms in the framework of complex supply chains made by different levels of suppliers and subcontractors is leading to the adoption of "just-in-time" methods, which imply a decrease of the stock level and of intermediate stocking points, which may reduce the space to be devoted to commercial/transport companies. On the other hand, *just in time* implies a higher frequency of smaller shipments that is leading to greater congestion of transport infrastructures and the need for larger space consumption.

New suburban highways are required to relive the congestion in major metropolitan areas, whereas the high demographic concentration in these areas is leading to major obstacles in the construction of these infrastructures.

The need for fast communication drives the construction of high-speed train lines and determines the launch of major infrastructure projects that are going to change the shape of the urban landscape. On the other hand, the new railway stations, required by the high-speed trains and created within or at the outskirts of major cities or close to major airports, represent new nodes that attract new activities and new factors of urban agglomeration.

New innovative infrastructures, such as optic fiber cable networks and the adoption of Internet-related technologies are to be developed in the major urban areas and may increase their competitiveness with respect to smaller cities.

Environmental Quality

In the old industrial regions, the adoption of inadequate technologies, aiming only to increase physical production such as has occurred in the socialist economies, has damaged the natural environment and determined a negative legacy, making the attraction of new activities, qualified personnel, and external investments more difficult.

Technology, and more broadly innovation, not only increases production capabilities but also may improve living conditions. For example, large modern metropolises are characterized by the diffused adoption of modern technologies, which has created a unique living environment where the provision of a wide diversity of modern services and goods—both for individuals and firms—and the satisfying standards of environmental quality are a magnet in the attraction of young and educated people and financial resources.

The Local Dimension of the Process of Knowledge Creation

According to a cognitive perspective, the creation of a scientific breakthrough or an innovation may be analyzed as the result of a process of interactive learning and of knowledge accumulation. Knowledge sciences (Rizzello, 1999) show that improvements in the human knowledge base are possible only when outside stimuli reach the individual's cognitive system and these stimuli are integrated and processed within the cognitive system. In fact, models of neural networks indicate that the creation of knowledge is the result of an adaptive learning or searching process, which leads to new synaptic connections of various nodes.

First, the joint impulses or signals coming from other firms or actors should overcome a certain threshold of intensity: a condition facilitated by the existence of common standards of communication and routines. Any new stimulus from outside of the cognitive system is then analyzed to determine whether it fits into the already existing cognitive system, categories, experiences, and cultural values. In the positive case, an interactive process begins, leading to the search for consistency and compatibility. Then, a firm or actor can identify a new pattern or a solution to an existing problem, stimulating the change and adaptation to the external stimulus (Gould, 1991).

This process of adaptation, reconversion, and coevolution of the relationships between the various actors and firms has an incremental character and it follows specific paths (Laughlin, 1996). The compatibility with other actors and the success in the adaptation leads to the creation of new connections or to the reinforcement of existing connections through the development of appropriate routines and institutions (Hayek, 1937), which allows the saving of the limited cognitive capacity of individuals and organizations and facilitates the process of reciprocal integration (Loasby, 2003; Rizzello, 2003).

On the other hand, if the stimulus is not compatible with the firm or actor's cognitive system, it is rejected. In particular, a cognitive blockade or lock-in effect may be determined by a too low accessibility or by a too low receptivity. The accessibility is affected by the existence of infrastructures and institutions that may decrease the distance between any two nodes. On the other hand, the receptivity is mainly related to the scope of the diversified knowledge available to the actor or the firm considered because that allows it to identify useful forms of complementarity in the relations with other actors or firms. It is also clear that time is a crucial factor as it facilitates perceiving a continuous stimulus or adapting gradually to it.

In particular, the creation of new knowledge implies an intense process of interaction (Nonaka & Konno, 1998), which is characterized by transfers both of tacit knowledge and of explicit knowledge and requires face-to-face contacts and a physical proximity, like contacts through long distance ICTs.

The process of learning does not occur through accumulation of knowledge within the firms in isolation, as innovation processes are tightly related to interactive learning processes and to the various forms of cooperation within the networks made by firms and many other actors. Technological change is based on the integration of various abstract logical concepts and of various economic actors with different and complementary knowledge and competencies. Thus, learning is the process whereby previous existing knowledge is selected and is viewed in a new perspective.

The basis for cooperation and survival in the knowledge economy is differentiation and similarity between the knowledge nodes. In fact, a knowledge economy thrives on diversity of knowledge as such diversity should enhance complementarity and cooperation.

The differences between the various actors and firms and their interdisciplinary integration are part of an evolutionary process, as the different technical competencies are not static but rather, in continuous evolution. External exchanges feed this evolution, but each actor and firm within an innovation system keeps his or her own individuality. In fact, each actor can contribute to a common project, just because he or she masters a specific know-how, while at the same time being subject to an evolution by embedding external contributions, reacting to external stimuli, and facing new problems.

In fact, the analysis of the process of learning and innovation underlines the importance of the "integrative capabilities" of sectoral clusters because different fragments of knowledge, competencies, and so forth must be not only accessed but also integrated in specific configurations through interactive learning. Geographical proximity between actors and firms plays a key role in various phases or factors of the process of learning and knowledge creation (Antonelli, 2005).

The process of knowledge creation has an interactive and combinative character and both the combination of complementary pieces of knowledge and the interaction between various complementary actors are facilitated by a closer geographical proximity and greater cognitive proximity (Cappellin, 2003a).

The local environment and the aim to solve the problems of local users are important in providing a stimulus to innovate to the various firms. Spatial concentration of economic activities allows exploitation of not only economies of scale but also economies of scope or synergies between various activities, as existing knowledge may be reconverted to satisfy new emerging needs. On the other hand, external stimulus should be compatible with the internal integrity ("neurognosis") of the local production system and should lead to a gradual process of adaptation (Rizzello, 2003). In fact, the aim to preserve identity and to ensure the survival of the local economy facing external competition may represent a powerful challenge leading to innovation.

The process of searching for an innovative solution is constrained by cognitive proximity and usually first occurs through the analysis of the complementary resources existing at the local level. A low cognitive distance explains the importance of client-supplier relationships in the process of innovation and comakership.

As knowledge creation requires the combination or use of various complementary resources, the concentration of firms in large metropolitan areas (Cappellin, 2000) or local industrial clusters (Steiner, 1998) facilitates innovation because it decreases transaction costs between the actors, enhances business opportunities, and facilitates entrepreneurship because of the high diversity of origins, sectors, and competencies existing in these areas and the easy access to a wide scope of new emerging needs and complementary resources.

Knowledge creation is tightly related to the sectoral specialization, the industrial culture, and know-how existing in the innovation systems to be considered. This facilitates the early identification or design of new patterns, combining previously existing ideas and pieces of information and knowledge. It also constrains the discovery of new patterns in the attempt to ensure consistency and compatibility with existing solutions, leading to path dependency and in some cases, lock-in effects.

Local history and memory, such as archaeology vestiges, which are the result of centuries of interdependence between local actors, are a distinctive characteristic of individual places. Common history leads to common cultures, patterns, and visions of the future and reciprocal trust, as well as to the creation of local institutions and routines, which represent the local "social capital" (Maskell, 1999), facilitate connections, and decrease cognitive distance between local actors.

The innovation process within small and medium-sized firms, such as those working in machinery production, is deeply different from the innovation process based on formalized R&D activities, as is typical in the large firms working in so-called science-based sectors.

The organizational model of technological change in a cluster of small and medium-sized firms specialized in a specific production sector or in a larger regional innovation system (Braczyk, Cooke, & Heidenreich, 1998), made by a plurality of actors—large and small firms working in various sectors—is based on network economies, which operate by means of the interaction and interconnection of different

actors who individually hold perhaps limited, albeit highly specialized and certainly complementary, knowledge.

The sense of belonging represents the base of an "associative approach" or "associative governance" that leads to the creation of clubs, forums, consortia, or different institutional schemes of partnership (Cooke & Morgan, 1998).

Geographical clusters or local production systems are characterized by a shared cognitive frame or by common conceptions and an idiosyncratic knowledge, which teach the various firms belonging to the cluster how to look at things from a different perspective. This process necessarily calls for a physical contiguity and embeddedness in the local territory, which allows a rapid circulation of knowledge and innovations.

Local production systems are places of collective interactive learning processes based on emulation as well as on combinatory and integration capabilities. The mutual knowledge and thrust reduce the opportunistic behaviors and the uncertainty in the overall economic system (Bellet, Colletis, & Lung, 1993; Rallet & Torre, 1998).

Local resources are organized and shared between the various local actors in the framework of local and interregional networks made by nodes or partners and by a set of relations, flows, hard and soft structures, transaction costs, rules, incentives, and behaviors.

Although explicit and codified knowledge may be exchanged on the market, tacit knowledge cannot be sold and requires mechanisms of allocation different from the market. The transaction of knowledge should be mediated by networks and other forms of organization that allow increasing trustworthiness, thereby limiting the negative effects of asymmetric information and reducing transaction costs (Cappellin, 1988).

Networks not only increase the efficiency of local resources but also enhance the growth of local resources and ensure the sustainability of the local development process.

"Network externalities" may be expressed by Metcalfe's law, according to which the more individuals, institutions, and organizations participate in a network, the higher is its economic value and its innovation capacity.

Networks are often perceived as an organization form based on intentional cooperation between the market, which is based on the concept of competition, and the hierarchy, which is based on the concept of authority. However, in this contribution, the concept of network is different than that of cooperation/alliances. For example, the buyer and the seller have essentially conflicting interests and they bargain. Thus, two firms may belong to the same network even when they do not explicitly cooperate, but they are tightly integrated, such as in the vertical supply chain of a given product. Moreover, the contracts between the firms in a network may be rather stable, although they may not explicitly be long-term contracts. The stability of the networks is also ensured by the existence of adequate hard and soft infrastructures, which represent a public good and are created by not only the individual actors themselves but also the public authorities.

Network building is clearly facilitated by physical proximity. On the other hand, only through the creation of specific networks is physical proximity capable of generating many different types of agglomeration economies (Cappellin, 2004), technology spillover (Audretsch & Feldman, 1996), and untraded interdependencies, which would otherwise not occur without the existence of these networks. Thus, physical proximity in many cases represents a facilitating but not a sufficient condition to generate positive externalities.

Networks may have different characteristics and they may be distinguished in the following three types (Cappellin, 2003b):

- "Ecology networks" are often indicated as "agglomeration economies" or "complex adaptive systems" and characterized by strong interaction. Ecology networks are made by relationships of objectively observable stable interdependence or integration. They are also based on behavioral adaptation, strong specialization, complementarity, and idiosyncratic relationships and lead to various forms of traded and untraded interdependencies or spillover effects. Basically, ecology networks are the result of geographical agglomeration and characterize the areas of concentration of the firms belonging to the same sector or the urban areas. It is also clear that ICTs may favor the creation of these types of networks. They are the result of external economies and technology spillover, which are also defined as "localization economies" or "urbanization economies" and spread in a rather automatic and casual way between the various firms and actors living in a specific local environment.
- "Community networks" are based on the sense of identity and common belonging. This subjective element distinguishes them from ecology networks. Thus, community networks require the sharing of a homogeneous culture and common values and are characterized by the existence of trust relationships and common institutions and specialized intermediate social organizations, which are defined as social capital (Coleman, 1988). These networks are places of collective learning and the development of a common production know-how. However, they lack the capability of central coordination and strategy making. Typical examples of community networks are the industrial districts or clusters and regional innovation systems.
- "Strategy networks" are based on cooperative agreements between firms and other organizations. These are the result of negotiations, agreement on specific strategies, and the creation of formal and explicit "joint ventures" by participating actors. Strategy networks also imply the reciprocal commitment of specific resources, which are invested to achieve common goals and future but uncertain benefits. Strategy networks imply forms of central coordination, the creation of procedures for the exchange of information, the codification of individual implicit knowledge, and the investment in the creation of common codified knowledge. Strategy networks may be represented by the strategic alliances made by pools of large and small firms or by regional innovation systems that explicitly want to become a "learning region."

Defining a region as a learning region means the actors of the system are committed to an interactive learning process, which allows the development of

knowledge, know-how, and other capabilities required for creating innovation and retaining regional competitiveness (Maillat & Kebir, 1999). The objective of a learning region is that of integrating tacit or implicit traditional knowledge, which is bound to the local context, with the codified knowledge available at the world level to stimulate the regional endogenous potential.

In particular, a learning region may represent the final outcome of the evolution of an "industrial district," which undergoes an ongoing evolution thanks to the active role of the processes of learning, adaptation, and innovation.

Networks may be considered a "public good" or a form of social capital, which is shared by different individuals. In both cases, the problem of free riders seems to be important.

Networks are assets because they allow a decrease in transaction costs between the various partners participating in the network, affect the process of knowledge creation, and generate profits for the firms. However, networks are often not an automatic outcome but rather a human artifact that must be created. They require a specific investment in the design of the routines, in the building of the supporting structures, and in their maintenance. Similar to physical capital, social capital requires specific investments to avoid depreciation. On the other hand, networks become stronger and wider with participation and use, as they are the result of cumulative learning processes.

Transforming Tacit Into Codified Knowledge Through TKM

Regional innovation policies should design appropriate methodologies to promote the creation of a learning region and to organize the cognitive relations between the various local firms and actors, which represent a key advantage of agglomeration economies.

As knowledge management aims to exploit the economic value of intangible assets within the firms and to make easily accessible to each internal actor the tacit knowledge available within an individual firm, so TKM aims to organize the cognitive relationships between firms in the case of local clusters or networks (Cappellin, 2003b). Thus, TKM converts localized and tacit knowledge of firms and individual workers into organized and explicit knowledge, collective knowledge, to be shared between all actors of a sectoral/regional cluster. It also aims to facilitate the acquisition from outside of knowledge, which may be crucial for the competitiveness of the overall regional production system.

TKM is a methodology that aims to promote innovation within existing firms and the birth of innovative firms by enhancing the local endowment of intellectual capital through a systematic action on those processes, which drive knowledge creation within the firms and between these latter and the local actors. TKM emphasizes the

concept of networking and integration and relies on the concept of interactive learning and knowledge creation as developed in social sciences and knowledge sciences.

The key difference between TKM and knowledge management is the fact that the individual parts of a cluster of small and medium-sized firms seem to change in an almost coordinated manner. Technological progress is implicit or of a nonvolunteer type, different from the R&D projects guided by a unique decision-making body as in the large firms model. It follows technological trajectories and evolutionary processes, which are not optimizing but of an interactive type and based on recursive adjustment processes of the various actors involved.

TKM should not focus on bilateral relations between a particular research center and an individual potential user, although it should aim to promote the creation of "knowledge and innovation networks," which may be defined as communities of interactive learning and are characterized by the sharing of information and know-how.

TKM represents a tool that may be used in a "multilevel-governance" approach applied to the steering of innovation networks. In fact, TKM aims, first of all, to make more explicit and formal the organization of knowledge interactions, through which the firms and the actors in a traditional production system circulate the required information and competencies among them in an implicit, complex, and slow process.

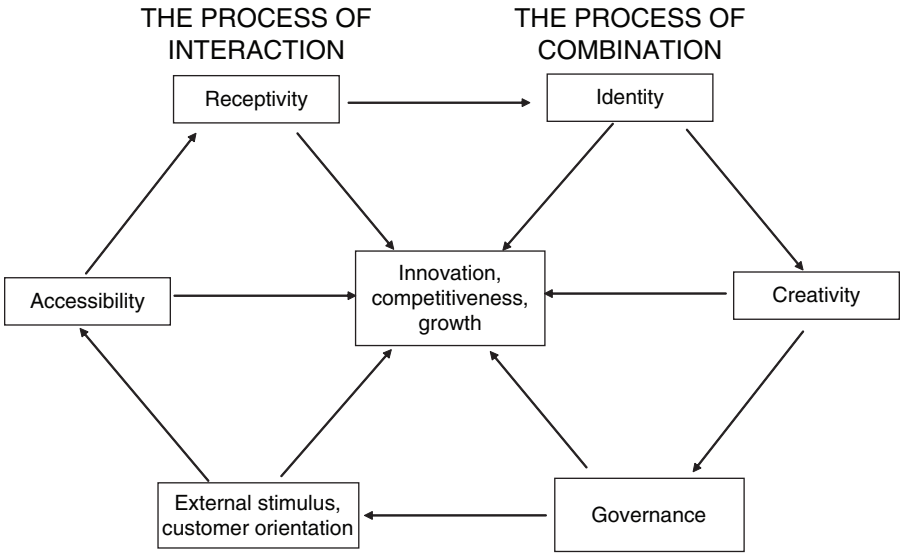
By making formal the informal relations between firms, as well as between research and education institutes and firms, TKM can shorten the time of innovation, increase the speed of productivity, and increase and promote the spin-off of innovative firms. TKM aims for "noise reduction" within innovation networks and the reduction of opportunism and conflicts not by imperative means as in a hierarchy but through a culture of dialogue, mutual understanding, negotiations, solidarity, and trust.

As transport infrastructures are crucial to the integration of various firms, to develop modern just-in-time systems and to reduce production time, the existence of organizational infrastructures and public and intermediate institutions is crucial for the various local actors to integrate with each other and to enhance these knowledge networks, which characterize a knowledge economy.

Second, as in the case of the knowledge management approach within individual firms, the explicit objective of a TKM may also be that of creating value from information and codified and tacit knowledge embodied in the human resources and firms in a specific territory. In particular, according to the approach of TKM (Cappellin, 2003b), the process of innovation and the creation of value are related to the six factors indicated in Figure 2:

1. *Focus on customer satisfaction*. The adoption of an innovation is the result of the focus on a localized framework and clear definition of a specific problem, which calls for a solution and motivates a search of different complementary competencies. Cognitive processes and innovation within firms are the result of repeated attempts and a gradual search activity stimulated by the motivation to reduce the

Figure 2
Territorial Knowledge Management



tension created by specific problems and the challenge these latter may represent to the survival of the firm rather than by the explicit desire to seek a profit maximization solution, which is the result of deductive reasoning.

2. *Manage accessibility and technological capital*. Because cognitive processes and innovation in firms often develop in the framework of a specific "local" problem and require the in-depth knowledge of clients' needs and of suppliers' complementary capabilities, geographical proximity and appropriate technologies such as ICT may favor the development of relations with various other actors and firms. The access to external complementary competencies and to a variety of building blocks of codified and of tacit knowledge requires the creation of hard and soft infrastructures both in a local context and at the interregional level, which allow the organizing of knowledge and innovation networks.
3. *Manage receptivity and human capital*. The openness of the various actors and nodes within the knowledge and innovation networks should be enhanced to avoid lock-in effects and become capable of acknowledging the need of complementary external knowledge and assimilating it. The capability of various actors involved in an innovation process to interact may be considered a form of tacit knowledge; it is hindered by the cognitive distance determined by differences in education level and cultural background but also by different sectoral or technological specializations, the lack of broad diversified experiences, and a too low capability of learning.

4. *Build a common identity and improve institutional/organizational proximity*. Actors to be involved in innovation should share common aims, mental models, and trust and loyalty. To promote knowledge sharing and the willingness to collaborate requires a change in the corporate culture. The identification of common challenges to survival and development create a sense of belonging to the same community or group and are a prerequisite for collaboration in innovation. Collaborative attitudes by the firms in a sectoral cluster can be considered a form of tacit knowledge and are tightly related to the creation of various intermediate institutions, such as industry associations, specialized services, or just common agreed routines, that are part of the social capital of the regional economy considered.
5. *Lever creativity and manage internal organizational capital*. According to cognitive theories, creativity is related to pattern making or the capability to establish original contacts or synapses between different potentially complementary information, technologies, and know-how, thus, leading to new discovery and inventions. Creativity is crucial to diversifying the structure of the local economy into new productions. Creativity, the capability to discover original solutions, cannot be planned in advance; however, it can be facilitated by favoring the diversity of the various actors to be involved in the innovation process and the exploitation of their idiosyncratic characteristics. In particular, to increase creativity, firms should aim to leverage morale and the empowerment and commitment of people to secure for potential inventors the freedom, security, and willingness to invest in risky exploratory analysis and in a lengthy process of systematic search.
6. *Ensure the governance and enhance entrepreneurship*. The implementation of innovative solutions requires the capability to cope with key problems of the organization and to manage the complex relationships between many different actors and mobilize them. That requires entrepreneurship capabilities and the integration of knowledge with complementary material resources to transform knowledge into action. The adoption of innovation requires the tight collaboration of various actors and the facilitating role of intermediary organizations and institutions, which may coordinate the joint effort. The governance of the innovation process requires an explicit effort in institution building and institutional learning, as the creation and maintenance of social capital or of public goods require appropriate investments by all partners belonging to a given innovation system. The existence of routines, institutions, and governance activity has a positive effect on all the above-indicated phases of the knowledge management process.

According to the TKM approach, cause and effect relations link these different dimensions of knowledge creation and the innovation process. The basic logic of their reciprocal relations is the following. The focus on specific customer needs determines a tension leading to a search for a solution and to change. Accessibility interacts with receptivity. The building of a common identity leads to cooperation and joint investments. Creativity emerges by the commitment of complementary competencies and from decentralization of decision making. New ideas can be translated in economic innovations only through an appropriate organization and governance.

The creation of knowledge and the adoption of innovation are the result of a cumulative process, as the knowledge developed in previous periods, the internal capabilities of the individual actors, and in particular the creation of institutions for the governance of the knowledge creation process represent key factors that affect the future path of evolution of the innovation system considered.

The Effects of Spatial Structure on Innovation

The above-indicated scheme of the six phases considered in TKM may serve as the framework to identify how the spatial structure may affect the knowledge creation process and how regional and local spatial policies may promote the innovation performance of the regional economies.

Increase Accessibility

New modern transport infrastructures and an increased accessibility provide the opportunity for the creation of new economic activities, especially in most peripheral regions and in the new member states of the EU. It is clear that easier communications are required to facilitate the adoption of new technologies and the invention of new products. Moreover, improved transportation facilitates the adoption of just-in-time methods of organizations and the subcontracting by large companies to smaller companies.

Finally, a high transport integration, through the creation of new major high-speed train links or the improvement of private and public transports, may stimulate broad alliances and networks between contiguous cities in various polycentric urban regions in Europe (the Ruhr area, Brussels–Antwerp, Milano–Torino). This is leading them to plan large joint investments, such as the joint creation of fairs, airports, and other superior services.

Manage Receptivity

The provision by local governments of higher education institutions is increasing human capital and the receptivity to innovation. In addition, cities are characterized by a multicultural composition, being the residence of many immigrants from various parts of the world. The wide range of different perspectives and voices may lead to an attitude of receptivity and tolerance, which favors innovation. On the other hand, the process of social integration of different cultures may be easier in intermediate cities, whereas in large cities, foreign immigration may lead to ethnic segregation and tensions.

Building a Common Identity

Cities are the locus of major events, such as Olympia games, world championships, and major international expositions, which often provide the opportunity for mobilizing local actors and institutions in the construction of new major infrastructures and innovations and have a long-lasting effect in the image of a given city.

A similar effect is played by modern beautiful architectures that may mark a turnaround and give a new identity to specific decayed areas, such as industrial derelict areas or anonymous peripheral dormitory neighborhoods, and transform these sites into around-the-clock, live-and-work communities by stimulating a new wave of complementary private and public investment.

The location of new universities, research institutions, and science parks has proved to be of great importance in transforming these areas and improving urban quality as well.

Lever Creativity

It is clear that it is impossible to anticipate creativity. However, it is possible to promote creativity and the support to research institutions may play a crucial role. The creation of universities and research institutions by local governments promotes the development of international relations and the receptivity and openness to external technologies and favors the attraction of highly qualified workers. In particular, they provide to firms and institutions of an urban economy easy access to advanced technologies and qualified professional competencies, which may contribute to an increase in the competitiveness of these firms and institutions.

Often the relationships between a city and technology are interpreted as the problem of ensuring an adequate location for universities and major research institutions. In this perspective, it seems that innovation promotion implies a further burden to local government finances. However, innovation and research may have indirect and important effects on the urban environment. In fact, these institutions contribute to the development of a well-qualified, young labor force: a major factor explaining the growth of innovative activities in the urban areas.

Enhance Governance and Entrepreneurship

Innovation requires an adequate organization of the various actors involved in this process. Urban planning leads to the creation of policy networks in urban areas. An effective governance requires the existence and integration of various actors with different complementary capabilities and cultural receptivity, along with the flexible organization of negotiation procedures between various different interests. In particular, innovation requires the management of conflicts and the promotion of cooperation between various disparate actors.

The size and complexity of urban problems and the renewal of the economy of a region require major investments. The impossibility for local governments to finance major investments single-handedly has led to the adoption of innovative methods of financing, such as "project financing," in the case of power generation, road building, urban rail, and airports. Project financing represents an innovation in public management and indicates the complexity of the factors affecting the adoption of an innovation.

Promote Market Orientation and Satisfy Users' Needs

New urban needs, public regulations, and public expenditure represent a key factor leading to the adoption and development of new technologies. Technology is driven by the need to solve new spatial problems and by the work of architects and planners. New modern architectures and the building of new modern infrastructures not only represent innovation in themselves but also stimulate the use of new technologies as they drive the development of new materials, which are studied through research in chemistry and nanotechnologies, and allow the adoption of new organization and management methods in modern office buildings, which lead to the adoption of ICTs and facilitate the adoption of new forms of e-government.

Another driver of innovation is the organization of international fairs, providing opportunities for commerce related to industrial and agricultural production as well as attracting millions of clients and users who represent diverse trends and tastes of the world.

Urban agglomerations, being the main source of waste, afford an opportunity for the recycling of waste and for the construction of new plants for thermal exploitation of waste disposal, thus, creating new opportunities for the use of modern environmentally friendly technologies and stimulating the search for new possible methods for saving energy.

In a similar manner, the high level of pollution in some regions and countries are leading governments to impose constraints on polluting technologies and to allocate financial subsidies to the research and use of nonpolluting technologies such as fuel cell cars.

The Role of Local and Regional Institutions in the Transition to the Knowledge Economy

The concept of knowledge economy is tightly related to those of institutions and of multilevel governance, social capital, and immaterial infrastructures. In particular, it is crucial to identify forms of coordination and "institution building" that are most appropriate in the case of a knowledge economy.

The innovation processes are tightly connected with the division of labor, the specialization and integration of various production phases, and labor competencies.

This increasing labor division requires a framework, which allows connecting the contributions of different firms and actors. Therefore, a social and institutional framework is required by the processes through which tacit knowledge is transformed into codified knowledge and incorporated into a complex innovation.

Knowledge circulates within networks through formal and informal institutions. Although explicit or codified knowledge may be exchanged on technology markets, tacit knowledge has an asymmetric character and is nontradable; it requires allocation mechanisms that are different from the markets. In addition, competencies and skills cannot be transferred effectively through conventional markets.

New institutional theory argues that the strategic significance of institutions in development processes lies in the economies that its functioning provides. Institutions have a key role in the governance of knowledge and innovation networks as they can reduce transaction and production costs, increase trust among economic and social actors, improve entrepreneurial capacity, increase learning and relational mechanisms, and reinforce networks and cooperation among actors.

Institutions and economic policies play a crucial role in the development of systemic interactions between industrial firms, the financial system, and the training of human resources and scientific institutions, as well as in the development of forms of production integration, leading to local and also global supply or value-added chains.

Institutions reinforce identity and reciprocal thrust, allow the limiting of the disadvantage of the asymmetric circulation of information, reduce uncertainty and the risks related to the unforeseeable results of innovations, increase the incentives to invest for medium- and long-term projects, and support investments in specialized training that may increase various actors' receptivity to innovation.

The relationship between technological change and territorial structure has a time dimension because the built environment is characterized by inertia and incremental changes. However, the pace of change may vary in different countries and regions, as it is largely endogenous and depends on the receptivity of economic actors and the accompanying policies adopted by national and local institutions. Through public-private partnerships, state assistance can leverage the large private investment required for the creation of new modern infrastructures and allow for urban transformation. In fact, good multilevel governance is the main instrument for accelerating urban renewal processes and overcoming the NIMBY (not in my backyard) or BANANA (build absolutely nothing anywhere near anyone) syndromes.

The speed of information flows and decision-making processes is tightly related to the stability of organizational forms; it depends on the existence of a well-developed institutional system or social capital and immaterial structures and infrastructures that facilitate relationships between various actors participating in the innovation process and reduce the transaction costs. In fact, the instability and the risks associated with market mechanisms lead the various actors of a given innovation system to search for a shelter in more structured organizations and in a framework of shared values, leading to collaborations and the avoidance of negative forms of competition.

Thus, institutions enhance the capital accumulation processes and economic development in cities and regions.

On the other hand, hierarchical authority (planning) and private initiative and competition (free market system) may prove to be illusionary shortcuts. They may accelerate the early decision-making phase. However, they most often finally determine long-lasting conflicts in the implementation phase between the various interests affected by large projects.

Within a network, the policy maker cannot adopt typical hierarchical methods, such as traditional planning (government), but it should be capable of guiding or steering (governance) the network of the various economic, social, and institutional actors to promote the flows and orient the relationships between these latter for promoting self-sustained economic development processes.

The expression *governance* is used to indicate decision-making systems in which decisions are not made through traditional hierarchical processes with a public authority at the top (government) but instead, through open forms of collaboration between a variety of public and nonpublic actors, which may vary according to the policy area and the level of government to be considered. Governance operates within the framework of complex networks and is characterized by decision-making processes where forms of horizontal and vertical negotiation are most important and where the exercise of a hierarchical power is only a component, and often not the most important.

Multilevel governance defines a new mode of regulation and coordination based on heterarchic negotiations concerning interfirm networks and public-private partnership. It is based on negotiations or strategic alliances between multiple stakeholders to secure agreed objectives that are mutually beneficial.

Institutions and governance should aim to achieve the appropriate balance between two different models of organizations, such as the "community model," which aims to promote a common identity and minimize the transaction costs between actors, and the "network model," which aims instead to promote diversity and to exploit network economies or synergy effects.

In particular, the governance of an innovation network, especially in a regional and urban framework, requires a flexible balance between apparently contradictory characteristics and processes such as

a. homogeneity between the various actors within the network versus diversity and specialization of the complementary competencies and characteristics of the individual actors;
b. thickness of the network or tight integration between the various actors versus leadership and relative isolation of the nodes characterized by outstanding excellence;
c. hierarchical coordination between the various nodes versus preservation of the autonomy of the various actors, characterized by distinctive competencies and roles, to avoid forms of collusion and ensure flexibility; and
d. explicit top-down cooperation between the various actors versus complex negotiation procedures, which aims to mediate recurrent conflicts of interests between the actors.

Finally, national but also regional and urban policies for the transition to the knowledge economy seems to be different from the traditional industrial policies. This explains why there are often contradictory approaches in the strategies and approaches of innovation policies. In fact, different from the traditional industrial policies, the transition to a knowledge economy seems to require that actors

a. adopt a learning-heuristic approach, which is a bottom-up approach based on the concepts of systems, horizontal linkages, dynamics, and evolution rather than an innovation-strategic approach, which is a top-down approach based on the concepts of static structure, vertical linkages, and harmonization;
b. focus on not only codified knowledge and diffusion of information and technology, which represent output indicators, but also the development of know-how and tacit knowledge, interactive learning processes, and embedded capabilities such as skills and competencies, which represent input indicators;
c. adopt not only a firm perspective or a sectoral/technology perspective but also a territorial/regional perspective and an institutional perspective. These different perspectives are related to the concept of a national/regional innovation system and underline the importance of promoting institutional building and learning through the creation of new procedures, intermediate institutions, and new forms of relations between public institutions;
d. focus on not only the supply side or the increase of production capabilities but also the demand side or the satisfaction of the new needs of a society. Policies should assign a greater role to concepts, such as well-being, welfare, identity, social cohesion, living environment, and sustainability. A third important component is the design and implementation of political/institutional procedures. The problem concerns managing conflicts, reaching consensus, sharing values and identities, and dealing with ethical issues. Often "how to do" is more important than "what to do," and institutions build more than strategy design;
e. have a larger scope than traditional innovation/technological policies, as policies for the knowledge economy should not concentrate only on R&D financing and financial support to research institutions and high-tech sectors; they should adopt a wider policy agenda and an integrated approach aiming to integrate other economic policy in other domains such as labor market, education, industrial, regional, and trade policies; and
f. not only promote the diffusion of benchmarks and imitation of the top leaders, according to a "linear approach" in technology transfers, but also aim to decrease the existing divides by the development and inclusion of the actors at the bottom/followers. A "systemic approach" in innovation leads both to revalue the importance of intermediate technologies, small and medium-sized firms, and medium- or low-qualified workers and to focus on the role of key nodes and links in the knowledge networks.

This new policy approach, which may be applied to the six levers of TKM indicated above, underline the important role to be played by urban and regional governments in the process of transition to the model of the knowledge economy.

References

Ahlqvist, T. (2005). From information society to bio society? On societal waves, developing key technologies, and new professions. *Technological Forecasting & Social Change*, *72*, 501-519.

Antonelli, C. (2005). *Models of knowledge and systems of governance* (Working Paper No. 01/2005). Torino, Italy: Università di Torino, Department of Economics "Cognetti de Martiis."

Audretsch, D., & Feldman, M. (1996). R&D spillovers and the geography of innovation and production. *American Economic Review*, *86*(3), 630-640.

Bangemann, M. (Chair). (1994, May 26). *Europe and the global information society*. Recommendations to the European Council High-Level Group on the Information Society, Brussels, Belgium. Available at http://europa.eu.int/ISPO/infosoc/backg/bangeman.html

Bell, D. (1973). *The coming of post-industrial society: A venture in social forecasting*. New York: Basic Books.

Bellet, M., Colletis, G., & Lung, Y. (1993). Economie de proximites. *Revue d'Economie Régionale et Urbaine*, Economics of proximity, *3*, 357-361.

Braczyk, H. J., Cooke, P., & Heidenreich, M. (Eds.). (1998). *Regional innovation systems: The role of governances in a globalized world*. London: UCL Press.

Cappellin, R. (1988). Transaction costs and urban agglomeration. *Revue d'Economie Regionale et Urbaine*, *2*, 261-278.

Cappellin, R. (2000). Urban agglomeration and regional development policies in an enlarged Europe. In J. Bröcker & H. Herrmann (Eds.), *Spatial change and interregional flows in the integrating Europe: Essays in honour of Karin Peschel* (pp. 117-129). Heidelberg, Germany: Physica-Verlag.

Cappellin, R. (2003a). Networks and technological change in regional clusters. In J. Bröcker, D. Dohse, & R. Soltwedel (Eds.), *Innovation clusters and interregional competition* (pp. 52-78). Heidelberg, Germany: Springer-Verlag.

Cappellin, R. (2003b). Territorial knowledge management: Towards a metrics of the cognitive dimension of agglomeration economies. *International Journal of Technology Management*, *26*(2/3/4), 303-325.

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

Castells, M. (1996). *The rise of the network society*. Oxford, UK: Basis Blackwell.

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, *94*(Suppl.), 95-120.

Contractor, F. J., & Lorange, P. (2002). The growth of alliances in the knowledge-based economy. *International Business Review*, *11*, 485-502.

Cooke, P., & Morgan, K. (1998). *The associational economy: Firms, regions and innovation*. Oxford, UK: Oxford University Press.

Drucker, P. F. (1993). *Post-capitalist society*. New York: HarperBusiness.

European Communities. (2004, November). *Facing the challenge: The Lisbon strategy for growth and employment: Report from the high level group chaired by Wim Kok*. Luxembourg, Belgium: Office for Official Publications of the European Communities. Available from http://europa.eu.int/comm/lisbon_strategy/index_en.html

Florida, R. (1995). Towards the learning region. *Futures*, *27*(5), 527-536.

Gershuny, J. I. (1978). *After industrial society? The emerging self-service economy*. London: Macmillan.

Gould, S. J. (1991). Exaptation: A crucial tool for an evolutionary psychology. *Journal of Social Issues*, *47*(3), 43-65.

Hayek, F. A. (1937). Economics and knowledge. *Economica*, *IV*(13), 96-105.

Laughlin, C. (1996). The properties of neurognosis. *Journal of Social and Evolutionary Systems*, *19*(4), 363-380.

Loasby, B. J. (2003). *Organisation and the human mind*. Stirling, UK: University of Stirling, Department of Economics.

Lundvall, B. A. (Ed.). (1992). *National systems of innovations: Towards a theory of innovation and interactive learning*. London: Pinter.

Lundvall, B. A., & Johnson, B. (1994). The learning economy. *Journal of Industry Studies*, *1*(2), 23-42.

Maillat, D., & Kebir, L. (1999). "Learning region" et systemes territoriaux de production "Learning region" and territorial systems of production. *Revue d'Economie Regionale et Urbaine*, *3*, 430-448.

Maskell, P. (1999). Social capital, innovation, and competitiveness. In S. Baron & T. Schuller (Eds.), *Social capital: Critical perspectives* (pp. 111-123). Oxford, UK: Oxford University Press.

Masuda, Y. (1983). *The information society as post-industrial society*. Bethesda, MA: World Futures Society.

Morgan, K. (1997). The learning region: Institutions, innovation and regional renewal. *Regional Studies*, *31*(5), 491-504.

Nonaka, I. (1996). The knowledge creating company. In K. Starkey (Ed.), *How organizations learn* (pp. 18-31). London: Thompson Business Press.

Nonaka, I., & Konno, N. (1998). The concept of "Ba": Building a foundation for knowledge creation. *California Management Review*, *40*(3), 40-54.

Rallet, A., & Torre, A. (1998). On geography and technology: Proximity relations in localised innovation networks. In M. Steiner (Ed.), *From agglomeration economies to innovative clusters* (pp. 41-56). London: Pion.

Rizzello, S. (1999). *The economics of the mind*. Aldershot, UK: E. Elgar.

Rizzello, S. (2003). *Towards a cognitive evolutionary economics* (Working Paper No. 03/2003). Torino, Italy: Università di Torino, Centro di Studi sulla Storia e i Metodi dell'Economia Politica "Claudio Napoleoni."

Steiner, M. (1998). The discrete charm of clusters: An introduction. In M. Steiner (Ed.), *Clusters and regional specialization* (pp. 1-17). London: Pion.

Stonier, T. (1983). *The wealth of information: A profile of the post-industrial economy*. London: Thames Methuen.

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