PART 1

Persistence and Renewal of the Cluster Concept in Contemporary Innovation Policies

1

From Industrial Districts to Knowledge Valleys: the Legacy of the Cluster

Innovation clusters are often presented as a new concept marking a break with a past, where companies and laboratories were not grouped together geographically and encouraged to interact. However, when we take a closer look at the history of spatial concentrations of industrial and technological activities, we realize that their contemporary character is not limited to the 21st century. On the contrary, the first examples date back as far as the 19th century. Whether we are talking about purely theoretical concepts or existing configurations, two types of cluster ancestors can be identified: the purely industrial concentrations, that can still be found today, and those that attempt, as early as the middle of the 20th century, to bring science and industry together within technological clusters.

1.1. The industrial district: the oldest ancestor of the cluster

Contemporary literature on innovation clusters often mentions that they were inspired by the industrial district, a concept dating back to the 19th century, the most significant examples of which emerged in 20th-century Italy.

1.1.1. *The economic approach of industrial atmosphere*

It is interesting to trace the history of the cluster back to the British economist Alfred Marshall, one of the fathers of the neoclassical economics. He developed the concept of the industrial district in one of his reference

works, *Principle of Economics*, published in 1890. According to Marshall, there are two potential industrial organizations:

> On the one hand, the organization under the sole direction of the technical department integrated within a large enterprise. On the other hand, market and face-to-face (reciprocal) coordination of a disintegrated social division of work among smaller enterprises specialized in large segments of the production process (Benko *et al*. 1996, p. 120).

He then introduced a new element into the dominant thinking of the time, according to which productivity was linked to the division of labor within the enterprise (Marshall 2010, p. 119), asserting that work could be divided over a geographical area, between different entities. This is the industrial district, which he defines as the concentration of businesses and skilled craftsmen within a geographically limited space. Marshall sees three fundamental aspects to this: specialist employees, complementary industries and a permanent exchange of information and knowledge. These elements create a pool of skilled workers, thus making the district an efficient labor market. He explains the sustainability of the location of businesses in the same area using the principle of externalities and particularly economies of scale that would reduce production costs. Marshall distinguishes between internal economies of scale, derived from the resources of the businesses themselves, and external economies, obtained through the close proximity of similar but specialized businesses at a specific point in the production process. Moreover, since not all firms can afford all machines, the pooling of equipment allows each to increase its efficiency, without having to make heavy investments. Marshall's original, but insufficiently supported by empirical data, contribution is his concept of "industrial atmosphere", in which he describes the significance of knowledge transfer between enterprises, as well as transmission between colleagues, neighbors, members of the same family, etc.:

> The secrets of industry cease to be secrets; they are, so to speak, in the air, and children learn many of them unconsciously. Work well done is immediately recognized and the merits of inventions and improvements in machinery, processes, and general organization are discussed within the industry straight away. If someone comes up with a new idea, it is immediately

> taken up by others and combined with suggestions of their own and thus becomes the source of other new ideas (Marshall 1990, p. 160).

This therefore gave pride of place to interindividual and intergenerational relations, fostering an atmosphere conducive to learning and the dissemination of knowledge. Nevertheless, at the end of the 19th century, Marshall's industrial district was largely confined to a theoretical conceptualization on the eve of the Fordist period, based on the model of the large enterprise. It was not until the 1970s that the concept was revisited by Italian studies of the Third Italy, then taken up again in France.

1.1.2. *The first Italian districts and their influence in France*

At the end of the 1970s, sociologists Arnaldo Bagnasco and Carlo Trigilia (1977, 1984, 1988) and economist Sebastiano Brusco (1982, 1986) published their research on the Third Italy, the term used to describe regions referred to as intermediate because of their geographical location between the highly industrial regions of northwestern Italy and the Mezzogiorno, characterized by a lower level of economic development. The Third Italy specializes "in traditional (clothing, footwear, leather, furniture, etc.) or more modern (small mechanics, electrical engineering, etc.) activities, whose production process can be easily broken down" (Daumas 2007, p. 133). The industrial organization of this area is characterized by a strong presence of small and medium-sized enterprises that participate only in certain phases of production and do not integrate a vertical model into their processes (as opposed to the mass production processes of large factories, especially in automobile production, further north). This would therefore be a dynamic specific to small businesses (Bagnasco 1977).

These early studies emphasized the social characteristics of this region and, in particular, the family ties in the cooperation of businesses and the learning of trades. In these regions, described as "urbanized countryside", there would be a solidarity of the rural family at the time of the creation of an artisanal or commercial activity, succeeding or completing the original agricultural activity and then finding the political, logistical and social resources from medium-sized towns of the region. The network of parishes, especially in Veneto, is also highlighted as a source of information and exchange of know-how necessary for the creation of small businesses. The authors thus mobilize the Bourdieusian concept of social capital, as a

"durable network of interknowledge and interrecognition relations of varying degrees of institutionalization" (Bourdieu 1980, p. 2), made available to potential entrepreneurs belonging to this local community. The focus is on interindividual relations and the cultural environment. Based on this work and his own analysis of the province of Prato in Tuscany, Giacommo Beccatini proposes a definition of the Italian district (Becattini 1989):

> A socioterritorial entity, characterized by the active association, in a circumscribed and historically determined territorial area, of a community of people and a population of industrial enterprises. In the district, unlike what happens in other environments, such as the manufacturing city, community and business tend to, as it were, interpenetrate (Daumas 2007, p. 134).

Studies on the Third Italy thus revive and further develop Marshall's concept of the district. They particularly emphasize the local accumulation of know-how, individual interdependencies and the interpenetration of businesses with a community of people.

Inspired by the Italian studies, research is also being conducted in France with the aim of identifying "territorial configurations similar to districts" (Guillaume 2008, p. 298) in other countries. This has led to work on "localized industrial systems" (Raveyre and Saglio 1984), as well as, under the impetus of a team from Grenoble, the economists Courlet and Pecqueur addressed "local productive systems" (Courlet and Pecqueur 1991, 1992). Raveyre and Saglio worked on the Oyonnax agglomeration, where industry was based on a single activity: the production of plastics. For them, this fabric of SMEs in the same sector cannot be analyzed as a scaled-down large enterprise, because the conflicts of power and the relations of competition and cooperation are not regulated in the same way as in large groups. These SMEs are involved in complex systems of relations (Raveyre and Saglio 1984, p. 159). For them, what is important is the local social act into which industrial firms are inserted, because defining a localized industry "is not a simple statistical aggregation operation" (*ibid.*, p. 160). They seek to look beyond the simple observation of a competitive situation and to determine the social construct of the localized industrial system, which is composed of a set of historically constituted standards and rules of conduct (*ibid.*, p. 168).

In the localized industrial system, collective mutual aid exists between firms in the event of difficulties or necessity.

On the other hand, Raveyre and Saglio consider that cooperation is not only defensive but also oriented towards strategies of development and adaptation of the technical potential of local industries (*ibid*., p. 165). The system produces, through innovations, a disruption of the organization of work that translates into new trades and new training. Finally, another key element for the authors lies in the relations that the system maintains with local political authorities, which constitute a fundamental issue for the system's sustainability (*ibid.*, p. 174). In the local production systems studied by Courlet and Pecqueur (1992), the definition is broader than for the districts. They may therefore refer to similar activities in which enterprises cooperate on peripheral dimensions (transport, exports, etc.) or to complementary activities (Courlet 2002, p. 89) and, as a result, a network of subcontractors emerges (Guillaume 2008, p. 298). In some cases, businesses do not necessarily belong to the same sector and, unlike the district, do not participate in the multiple stages of industrial production. Moreover, the relationships are not familial, but professional and informal in a local productive system. In his work on the "Alpine furrow", however, the geographer Bernard Pecqueur (1995) qualifies this aspect and identifies relatively poor direct relations between businesses. Each has its own regional, national and even European and global geography, and what link businesses together are the territorial resources they share. Housing, amenities, infrastructure, facilities and the skilled labor market thus tend to unify them.

Despite some variations, both the Italian and French studies agree that the unit of analysis is not the enterprise, but the "district" as a whole, with interconnected firms (Brusco 1990). The focus has thus shifted from the enterprise itself to the space around it.

1.1.3. *The rise of districts: the end of the Fordist enterprise?*

Some authors see the sign of a more general economic change in the organization of industrial districts, in which Fordist mass production gives way to the industrial development of flexible specialization. This observation is mainly defended by regulationist economists (Boyer, Aglietta, Saillard, Coriat, etc.), who consider the accumulation regime concept as a

tendency inherent to the capitalist mode of production, and which corresponds to regularities ensuring a general and relatively coherent progression of capital accumulation. These regularities operate within institutions that govern, among other things, competition, money, wage relations, etc. Depending on the place and the period, these institutional configurations may change. The Fordist mode of regulation articulated macroeconomic regularities on an international scale, while at the same time being subject to national compromises (Boyer and Saillard 2002). During the intense period of Fordism, the national scale was considered the relevant level of accumulation.

However, this economic and social regulation, which was being carried out within large enterprises, is no longer appropriate. Indeed, the crisis of Fordism is reflected in a crisis of territory at the level of the nation state (caused by a triple movement of tertiarization, deregulation and globalization) and a crisis of legitimacy of the welfare state with the emergence of mass unemployment (Carré and Levratto 2011, p. 360). In this context of capital internationalization and the crisis of the state, institutional arrangements are regional (EU, NAFTA) and international (WTO, for example), rather than solely national. In France, some authors see a disappearance of the Colbertist state (Mustar and Laredo 2002) and the emergence of new public actors, such as Europe and local authorities. As a result, the new post-Fordist regulations would be posed jointly in terms of sector and territory (Laurent and Du Tertre 2008). This approach is in line with theories that consider that a new geography of flexible accumulation is emerging in reaction to the Fordist mode of accumulation (Storper and Scott 1990). In a seminal work, Michael Piore and Charles Sabel (1986) develop the concept of flexible specialization as an alternative model to Fordist mass production, based on the emergence of local industrial models, notably the Italian districts (Hirst and Zeitlin 1992). Industrialization with flexible specialization is understood to be:

> A form of production based on individual initiatives or on those of small enterprises that will work together to build, through rather complex and informal transactional systems, products intended for the market (consumer products or production components) […]. This specialization in a segment favors flexibility in the production of the components and elements of the final product, which in turn leads to greater flexibility in the

> overall network of enterprises, which is then likely to offer a wide range of products to the market (Durand 1991, p. 48).

These SMEs, each specialized in a different segment of production, constitute a system that adapts to technological developments. For some authors, this specialization comes at a time of crisis for the mass consumption model: the rise of individualism leads the consumer to no longer want uniform goods (Capecchi *et al*. 1987). The weakening of these standardized goods markets has disrupted the large Fordist enterprises, the symbol of which being the automobile industry. Slow growth marked by weak demand would have determined the "shift of centrality" from large industry to small production units considered more flexible and more responsive to demand surges (Vercellone 2003). On the other hand, others consider that it is more a question of an entrepreneurial thrust that sought to express itself outside the conditions of domination of big business. Unable to compete on the basis of production costs, new production models were invented, based on product diversification (Durand 1991). Some observers agree that this post-Fordist bifurcation is embodied in the shift from an economy of quantity to an economy of variety, under the pressure of the relaxing of borders and increased competition (Veltz 1996). Hatchuel refers to this as a "Taylorism of variety" (Hatchuel *et al*. 2002, p. 32). Moreover, the flexible specialization model combines the advantages of the large enterprise (economies of scale) and those of the small business (productive flexibility), allowing for a better capacity for innovation (Garofoli 1992).

Literature on the district, and its variants, analyzes spatial concentrations of businesses that have formed on their own, based on family or neighborhood ties, or even with the aim of integrating the production chain of a territory. In this sense, Bagnasco evokes a "spontaneous social capital" specific to the Italian district[1], that is, "accumulated over the course of history within networks that define local society" (Novarina 2012, p. 21). He contrasts it with the "created social capital" that public authorities try to reproduce. Indeed, while the models we have just seen are the result of local initiatives, the spatial concentrations intended to rapidly bring science and industry together are the result of public policies, whether they be French technopoles or American science parks.

1 We recall that, in his study, Bagnasco emphasizes the structuring character of the Venetian parishes as places of information and exchange of know-how.

1.2. Spatial concentrations of technological activities

The second half of the 20th century brought about, on the academic side, mainly economic concepts of territorial innovation systems, as well as several policies promoting the bringing together of science and industry at a local level.

1.2.1. *The time of technopoles: reconciling regional planning and innovation*

In France, the technopole concept was part of the vast policy of decentralization that began in the 1950s and continued until the decentralization acts of the 1980s. The first attempts to create technopoles emerged in the 1970s, as in the case of the Meylan innovation and scientific and technical research zone (*Zone d'Innovation et de Recherche Scientifique et Technique*, ZIRST) in the Grenoble area and, especially, Sophia Antipolis near Nice, which remains the most striking French example. However, it was during the following decade that technology parks appeared all over France:

> Following the decentralization of 1982, the idea that development and coordination actions can promote the constitution of technological poles, and thus the economic development of cities or regions, spread among local elected officials, who were strongly encouraged in this by companies specialized in the development of business parks (Grossetti 1995, p. 3).

The state became involved in this development, initially through DATAR (*Délégation interministérielle à l'aménagement du territoire et à l'attractivité régionale*), and then gradually a multitude of operators emerged: mixed syndicates, associations, mixed economy companies, etc. As a result, in the 1990s, several works on technopoles were published, in an attempt to decipher the phenomenon and categorize the various experiments that were flourishing in France and abroad. For Jean-Yves Faberon, the emergence of technopoles in France is at the crossroads of three different policies (Faberon 1990): first, a regional planning policy (metropolises, new towns, conversion clusters and growth clusters resulting from the Guichard Report of 1986); second, an innovation and research policy (including the July 15, 1982, act aiming to develop regional technology clusters in which

research and the socio-economic world are decompartmentalized for the development of technologies) and finally, a decentralization policy promoting the emergence of regional technology clusters. The state is thus strongly committed to the development of these work and production spaces, convinced by the concept of cross-fertilization (Savall and Zardet 2005). In *La fièvre des technopoles*, Jacques de Certaines (Certaines 1988, p. 28) identifies three types of technology clusters. First, desaturation clusters aiming to relieve metropolitan congestion: in France, Sophia Antipolis falls into this category; in the United States, Route 128 comes to mind in relation to MIT (Massachusetts Institute of Technology) and in Japan, Tsukuba in the suburbs of Tokyo. Second, conversion clusters operate in areas that have undergone major crises, for example, in the former mining basins of northern and eastern France, such as Meylan-Grenoble, Nancy-Brabois or Metz 2000. Finally, Jacques de Certaines observes a third type of technopole: development clusters as a deliberate strategy for developing a region through territorial anchoring of cutting-edge technologies (he cites the examples of Montpellier Languedoc-Roussillon Technopole and Rennes Atalante).

In their book, *Technopoles of the World: The Making of 21st Century Industrial Complexes*, Manuel Castells and Peter Hall analyze the different forms of industrial organization that technopoles can take (Castells and Hall 1994). Based on an empirical study of the principal global concentrations of technological activities, they distinguish between different types of technopoles, which show how broad the reference can be: high-tech industrial complexes (Silicon Valley, Route 128); science cities, where scientific research predominates, but where the link with the local industrial fabric is weak (the example of Tsukuba in Japan is highlighted); technology or science parks, which, for the authors, are the result of public initiatives for the economic development of the territory (Sophia Antipolis in France, Cambridge in the United Kingdom); even metropolitan areas such as Paris, Tokyo and London. From all these case studies, Castells and Hall identify three main motivations for technopoles: reindustrialization, regional development and the creation of synergies. The authors specify the long time needed to achieve these three objectives: 20–30 years to see the first effects.

Thus, for Faberon, the primary function of a technopole, and often the only one achieved, is to welcome business (Faberon 1990). In order to do this, various financial benefits are granted: free assistance services, notably through help in setting up projects, industrial property, interest-free loans, help in setting up a business through reduced rents and research and

development subsidies. In addition, the site on which the technopole is located must be close to research and training institutions. It must also be well served by means of communication, proximity to highways, an airport, rail links, etc. Finally, as the quality of the buildings and the environment contribute to the image of the cluster, the site must have good landscaping and architecture and must include facilities (favorable living conditions, good health and school facilities, cultural life, etc.). The technopole is seen as a complete space combining three interrelated zones: an industrial fabric and work spaces, a core of institutes and research laboratories and residential areas for researchers and their families (Tatsuno 1987).

Thus, the technopolitan space is embodied in:

> A place of spectacular urban planning, high-end leisure facilities, and cultural events […]. Indeed, creation is not limited to discoveries and applications in the scientific and industrial fields […]. It is the sum of human activity which is carried along in the wake of the intelligence revolution. A revolution which, in order to bear all its fruits, must in fact encompass all spheres of existence, which supposes that intelligence does not remain limited to the economic field alone (Garnier 1988b, p. 169).

The technopole is therefore seen as a "new city in which the informal contacts generated by cultural, sporting and civic activities would have contributed to cross-fertilization" (Rasse and Arasziewiez 2007, p. 3). Nevertheless, some of the literature on technopoles, in addition to showing that the accumulation of all these factors does not necessarily guarantee innovation performance (Castells and Hall 1994; Cooke 2001), questions the artificiality of these spaces and the consequences for technopolitan workers. A detour through Japan and the work of Sheridan Tatsuno demonstrate the artificial dimension of the creation *ex nihilo* of the Tsukuba technopole (also studied by Castells and Hall):

> Many Tsukuba residents miss nothing more than walking through crowds on narrow sidewalks, sitting elbow to elbow in unimaginably tiny cafes and restaurants to warm their bodies and minds with sake and rich beers to maintain their long-standing relationships with the local butcher, baker, and

> police officer… It may be the city of brains, but it has neither heart nor soul (Tatsuno 1987, p. 139).

These critical comments on the artificiality of the technopole as a means of creating innovation spaces in areas that are, we might say, technology-free, occur early in the literature, but are still the minority view. Most of the literature on technopoles provides us with information on the mechanisms put in place, usually by public bodies, to generate a local culture, an innovation-producing environment. By highlighting a series of factors conducive to the creation of innovation, it differs from the literature on innovative environments, which seeks to determine how the "environment" is likely to innovate on the basis of the existing fabric (and in particular on the basis of a long-standing local culture, the history of the actors involved, etc.).

1.2.2. *A spontaneous and innovative environment conducive to a "technological atmosphere"?*

In the mid-1980s, regional and industrial economies differentiated between, on the one hand, "the regions that are winning", to use the title of Benko and Lipietz's book literally (Benko and Lipietz 1992), and on the other hand, those that are losing. The concentration, or otherwise, of research and development activities thus appears to be decisive. The European Research Group on Innovative Environments (*Groupe de Recherche Européen sur les Milieux Innovateurs*, GREMI) is investigating some 15 regions in Europe in a comparative approach in order to answer the question of why are some regions developing while territories with large manufacturers are in progressive decline. In this perspective, the analysis grid becomes the notion of environment. Linked to the life sciences, its definition is understood as "a set of external factors that act in a permanent or lasting way on living beings" (Coppin 2002, p. 32). Cangilhem emphasizes the predominance of the deterministic dimension in the notion of environment developed in biology (Cangilhem 2000). This systemic character is largely revisited in the concept of the innovative environment, insofar as the authors consider that innovation is no longer the product of single enterprises, but of the social, economic and political factors necessary for the innovation process. GREMI's authors combine an industrial analysis with a spatial analysis of innovation and base this on three axes (Camagni and Maillat 2006): the technological paradigm (the capacity of the enterprise

to develop a technology with a view to differentiating itself from its environment), the organizational paradigm (the capacity of the enterprise to establish relationships with the other actors in its environment) and the territorial paradigm (the capacity of the enterprise to identify and take advantage of the attributes of its territory: know-how, competencies, as well as institutions, etc.).

One of the best known examples is the study of the Jura Arc (Maillat *et al*. 1992), which analyzes the transition from an industrial district centered on the watchmaking industry to a technological district focused on microtechnology. In this transformation, the role of the environment is highlighted insofar as innovation has taken place on the basis of the existing fabric: a shift from mechanical to electronic skills, the gradual integration of electronic products from watchmaking into printed circuit components, etc. (Pfister and Nemeti 1995, p. 29). In this regard, Benko tells us that innovative enterprises do not pre-exist in local environments, but are secreted by them (Benko 2007). Gradually, local training courses are adjusting the content of their teaching to this reconversion, such as the Lausanne Polytechnic, the Swiss Laboratory for Watchmaking Research and the Swiss Center for Electronics and Microtechnology. This adjustment is also favored by the environment, that is, the local industrial culture and the mobility of people on the labor market.

While Marshall spoke of an industrial atmosphere in his works on the district, theories on the environment tend to show that a technological atmosphere conducive to innovation can exist in some fashion within a territory. Among these works on the concentration of technological activities, divergences appear on the relevant spatial scale of such systems: from very localized business parks (Bernardy and Boisgontier 1988) to regional innovation systems (Cooke 2001) and urban innovation systems (Grossetti 2001).

Ultimately, all of these configurations can be understood according to the concept of "local innovation systems" (Gilly and Grossetti 1993), namely:

> A set of organizations (companies, research centers, universities, etc.) and individuals producing technological innovation on the basis of regular research and development activities within a given area (Grossetti 1995, p. 4).

The 1980s were therefore conducive to the research into the phenomenon of concentration of technological activities by social scientists, who linked it to the transition from industrial to cognitive capitalism.

1.2.3. *The era of cognitive capitalism: the race for creativity of individuals and territories*

Just as some observers attributed the emergence of industrial districts to a broader economic paradigm shift, some literature sees the changes of the 1970s and 1980s as a shift from industrial to cognitive capitalism, that is:

> In this new form of capitalism, the cognitive and intellectual dimension of work becomes dominant, and the central issues of capital development and some forms of property development are directly related to the transformation of knowledge into a fictitious commodity (Vercellone 2008, p. 72).

From then on, this economy would be based, not on knowledge, but on its exploitation, becoming, like information, a property in its own right. Moulier-Boutang, with reference to Karl Polanyi, believes that the new great transformation is embodied in cognitive capitalism, through global financialization and the digital revolution resulting from NICTs (Moulier Boutang 2007, p. 72). In this context, knowledge, creation and invention, which Moulier-Boutang synthesizes in the concept of immaterial work, are at the center of the mode of production. André Gorz, a philosopher in cognitive capitalism, draws up a non-exhaustive list of common goods that are ultimately usurped by the labor, privatization and commodification of this capitalism: biodiversity and common spaces, either urban or natural; genetic heritages; cognitive, cultural, affective and communicative resources of individuals; living knowledge in general, the product of cooperation and human interaction (Gollain 2010, p. 552). Thus, Gorz considers that cognitive capitalism is the crisis of capitalism. Having lost its relevant categories, capitalism seeks to surpass itself by exploiting an abundant resource, human intelligence, in order to produce scarcity (Gorz 2003, pp. 81–82). We have entered a capitalism that mobilizes competition through intensive innovation, in which the cognitive and creative capacities of individuals are at the service of an increased search for innovative products (Hatchuel *et al*. 2002, p. 32). It is therefore believed to have the power to counteract major trends, such as the relocation of industrial jobs or, to use

the accepted expression, to slow down the "deindustrialization" of France (Guillaume 2008, p. 296) by converting industrial basins into valleys of knowledge. The logic of post-Fordist specialization and the production of scarcity linked to the development of cognitive capitalism are thus at the heart of local policies, which are seen as genuine "remedies for industrial decline".

In addition, in the early 1990s, there was a rapid spread of management theories from across the Atlantic, which developed a reading of the territory in terms of competition. They observed the effects of centripetal forces of agglomeration and at the same time centrifugal forces of international activities. Krugman was particularly interested in the differences between territories based on the positive externalities of agglomeration (Krugman 1991). At the same time, and in the same vein, Michael Porter developed the principle of comparative advantage, the keystone of his cluster concept. He transfers to territories an industrial logic of building assets in a competitive relationship within a market (Porter 1993). Specialization enables a comparative advantage to be put forward. In a capital mobility context, we are witnessing an explosion of competition between territories to attract the most qualified workers and businesses. Advantages are not given, but deliberately constructed (Carré and Levratto 2011, p. 360). From the point of view of economic development policies, this implies a shift from a territorial policy focused on local redistribution issues to a policy focused on externalities and attractiveness issues (Béhar *et al*. 2013, p. 20).

As early as 1989, David Harvey, in a critical view, drew attention to this shift from "managerialism to entrepreneurialism" in local policies. The "managerialism" of the 1960s was focused on services to residents, whereas "entrepreneurialism" is based on policies oriented towards an exogenous economic development strategy (Harvey 1989, p. 3). Harvey, too, places this orientation in the context of the recomposition of capitalism since the 1970s (the transition from a Fordist-Keynesian regime of capital accumulation to a regime of flexible accumulation), which has led to the development of interurban competition for resources, jobs and capital. This competition has been largely accompanied, even encouraged, by the state, notably through the logic of the call for projects, which acts as a means of territorial differentiation (Brenner 2004). By entering into this competition, local public actors have become veritable promotion agencies for their territory in order to attract investors, especially from overseas. The standard-bearers of this promotion are therefore the specific advantages that the territory

possesses compared with its rival territories (Carré and Levratto 2011, p. 336). Beyond this mission of promotion, the public actor must take charge of the economic and social regulation that was previously assumed by the large Fordist enterprise that du Tertre and Laurent define under the term territorial regulation as:

> The capacity of a localized and institutional social system to guarantee accumulation processes in its territory, to maintain economic activities there, to develop and protect its natural resources and technological achievements and to guarantee social peace. Territorial regulation thus results from the necessity to regulate the conditions through which sectors are deployed and resources are allocated (Laurent and Du Tertre 2008, p. 15).

In this context, the public actor must encourage, mobilize, coordinate and structure interactions and resources (Béhar *et al*. 2013, p. 17). Thus, using the logic of Porter's comparative advantage, Anna Lee Saxenian questions the difference in development between the American West Coast innovation hub, Silicon Valley, and the East Coast hub, Route 128 (Saxenian 1994). By looking at the structure of the social networks of the two clusters, Saxenian opens the way to an abundance of literature on the role of geographical proximity, on the typology of commercial and scientific exchanges and on the place of non-market interindividual relations in the coordination of actors (Lanciano-Morandat *et al*. 2009, p. 178).

1.3. The valleys of knowledge: interindividual relations as a source of innovation

The end of the 20th century saw the emergence of a craze for valleys conducive to industrial and technological development, thanks in particular to the informal links forged by geographical proximity.

1.3.1. *Informal links in the heart of Silicon Valley*

Since Saxenian's work on Silicon Valley, the cluster concept is based on the idea that it can be crossed by interindividual relations that are conducive to informal exchanges, which are themselves conducive to the development of scientific and industrial collaborations (Saxenian 1996). The author

explicitly refers to Porter's comparative advantage. Indeed, she attempts to uncover the advantage that Silicon Valley has over its Bostonian counterpart, Route 128. For her, the development of the Californian cluster is strongly linked to the structure of the social networks that cross it. Based on regional data, Anna Lee Saxenian notes that Route 128 created three times fewer jobs in the early 1990s than its Californian neighbor (Saxenian 2000). It was less efficient, particularly in terms of its volume of exports of electronic products and its ability to concentrate the most successful national companies. According to the author, economists neglected the role of social networks in the success of such industrial concentrations, and, for their part, sociologists implicitly accepted this neglect, reinforced by the idea that market processes are not suitable objects for sociological study, since social relations play only a minor role in them (Granovetter 1985). Thus, faced with two distinct industrial systems with similar characteristics (similar technology, set up after the war, etc.), Saxenian proposes an approach based on social networks in order to distinguish them and explain their different developments. For her, Silicon Valley is based on dense learning networks between actors from related technologies that encourage entrepreneurship and experimentation. Competition is intense, but it is supported by informal communication systems that create mutual adjustments and learning.

In the eastern United States, Route 128 is more composed of significant autarkical structures and the links between individuals are therefore characterized by a principle of corporate loyalty (Saxenian 2000). In the relationships between businesses, customers and suppliers, individuals refer first and foremost to the vertical hierarchy of the organization to which they belong, before circulating information horizontally between firms. For Saxenian, the performance of Silicon Valley, or its advantage, to use Porter's terminology, depends on local social and institutional determinants, such as professional or commercial organizations, far more than economic and fiscal factors (wage differentials, real estate costs, local taxes). For example, The Semiconductor Equipment and Materials International or The Software Entrepreneur's Forum organize meetings, dinners, seminars and training courses and participate in the creation of these social networks (Grossetti 2004, p. 170). From this point on, we can observe how interactions embedded in a given framework (in this case the businesses in the Valley) can be decoupled in another context (professional association, for example).

In another study of Silicon Valley, Michel Ferrary particularly observes the social networks of the French community living and working in the

Valley. These French expatriates meet in "non-economic social institutions" (the French school in Palo Alto, the Maison Française, the film club, French restaurants), ethnic celebrations (the July 14 national holiday, the Beaujolais Nouveau day), newspapers and associations with a more economic purpose (Doing Business in French, Eurotrash, Silicon French). They develop strong ties of friendship, support and appreciation through cultural and social activities during which they meet (Dibiaggio and Ferrary 2003). According to Ferrary, they mobilize this community in the economic activities in which they are engaged. We can therefore see that literature highlights the virtuous development of these territorial concentrations by emphasizing the effects of geographical proximity in the constitution of social networks.

1.3.2. *The relational logic essential to geographical proximity*

Since the beginning of the 1990s, the economics of proximity (Bellet *et al*. 1993, 1998; Rallet and Torre 1995; Gilly and Torre 2000; Dupuy and Burmeister 2003; Pecqueur and Zimmermann 2004; Torre and Filippi 2005) has sought to take account of the conditions necessary for the coordination of agents (Talbot and Kirat 2005, p. 9). This question has been the subject of research concerning the links, or otherwise, between geographical proximity and social interactions. The abundant work has led to "the emergence of a kind of specific scientific community, with its own conferences and regular publications" (Bouba-Olga and Grossetti 2010, p. 2). In the course of their work, this school has managed to define a certain number of types of proximity, but a concern for readability has led its authors to restrict the canonical forms of proximity to two (*ibid.*, p. 4). Thus, they agree to say that alongside geographical proximity is organized proximity. The former is doubly relative: on the one hand, it is relative to the means of transport and, on the other hand, it proceeds from the judgment of the individuals on the distance that separates them from other individuals or groups. The latter is not geographical, but relational in nature and is based on an organization's ability to have its members interact (Talbot and Kirat 2005). Beyond this vertical distinction, the authors have made a horizontal division within organized proximity between the logic of belonging (to the same structure, for example) and the logic of similarity (sharing common representations and a common system of values). The authors stress that the two proximities can be combined and thus facilitate knowledge sharing. Nevertheless, geographical proximity does not guarantee organized proximity, the absence of which translates into an extreme weakness of cooperative relations,

solidarity links or shared representations (Torre and Zuindeau 2012, p. 354). Moreover, some authors postulate that spatial proximity may lead to negative externalities of agglomeration, such as industrial espionage, unbridled competition, local market saturation or the poaching of qualified personnel (Depret and Hamdouch 2009, p. 32).

Given the limits of geographical proximity (negative externality, absence of spontaneous links, etc.), other relational logics between scientific and industrial actors have been studied. Estades, Joly and Mangematin propose three relational logics (Estades *et al*. 1996): proximity, club and market. These three logics were later completed by Grossetti and Bès (2001), who then distinguished a "network logic" in which the contact results from a relational chain linking the two officials responsible for the collaboration. Most often, this relational chain has its roots in the university courses studied by the two officials. This network logic partially challenges the logic of proximity established by Estades, Joly and Mangematin, insofar as, for Grossetti and Bès, personal networks do not only stem from local proximity. They also identify "institutional logic", which is almost similar to the "club logic" of Estades, Joly and Mangematin, since both refer to the intervention of an external body, most of the time governmental, which provokes interactions between enterprises and laboratories. Finally, the two studies establish a third similar logic: that of the market. Estades, Joly and Mangematin consider that partnerships of this type are often the result of the will of industrialists who need solutions provided by researchers, whereas Grossetti and Bès consider that both scientific and economic actors can lead this market logic (Grossetti and Bès 2003, p. 343).

Ten years after the Grossetti and Bès study, Julien Barrier also identifies three major patterns of academic and industrial interaction (Barrier 2014). For him, the relationship is most often created on the initiative of industrialists who seek to: (1) enter into collaboration with researchers in order to acquire specific knowledge and know-how in a well-defined field, (2) optimize an existing technology that enables researchers to test theoretical models in an industrial context or (3) jointly explore, upstream of the development or application phase, concepts or research objects that are beneficial to the scientific production of academic researchers (Barrier 2014, p. 63). Geographical proximity is therefore gradually being supplemented by analyses that focus on other types of proximity and relational logic. Alongside these proximities, the sharing of a common social capital, which is decisive for establishing links, has also been the subject of several works.

1.3.3. *Social capital as a driver of innovation*

A number of works emphasize the role of individuals' social capital in facilitating the development of economic activities (Bourdieu 1980; Coleman 1994; Burt 1992). Coleman was particularly interested in the relationships and knowledge of individuals. In this approach, the social network becomes a resource in the same way as cultural or economic capital. In his works on Rational Choice Theory, he defends the idea that the individual determines his choices, not only on the basis of the economic calculation in terms of cost/benefit ratio but also on the basis of his relationships and knowledge. These authors do not question the idea that individual behavior is determined by economic incentives and financial resources. They add that they are also determined by motivations and social resources such as reputation, legitimacy and address books (Lanciano-Morandat *et al*. 2009, p. 180). This position is in line with the Bourdieusian thesis that capital must be accumulated in order to be fully operational. Another resource is then regularly evoked in the study of these social exchanges: trust. Social capital is not enough, and some authors argue that the condition for economic progress is the development of trust between people, understood to be the expectations nurtured by one individual towards the explicit or implicit promises of another (Dasgupta 2011, p. 50). Thus, in line with this work, some have analyzed the social capital of entrepreneurs as a decisive resource in the realization of a cluster (Feldman 2001; Feldman *et al*. 2005), considering that a network analysis of firms is, in fact, a network analysis of individuals:

> The firm is, in the best of cases, considered as a network of individuals, or as being akin to an individual. We remain in a universe where the active force is the individual and where the collective is constructed or reduced to a set of relations between these individuals (Callon and Ferrary 2006, p. 39).

Further to the main distinction made by the proximity school between a geographical and organized dimension, Michel Grossetti and Olivier Bouba-Olga propose a new decomposition of socio-economic proximity by an approach at the level of individuals. They distinguish between two types of situations: proximity of resources and proximity of coordination, for which, first of all, resources are cognitive ("in the heads of the actors"), and they evoke a plethora of notions used in the social sciences to describe the behavior of actors from the inside: "strategies", "dispositions", "affects",

"habitus", etc. The authors specify that these resources are shareable between them (language, values, standards) and can be mobilized to coordinate (Bouba-Olga and Grossetti 2010, p. 8). The resources are also material and social proximity is played out at the level of the resources possessed (assets, income, qualifications, social status, etc.). Alongside the proximity of resources, they mention the proximity of coordination, which is made up of both mediation mechanisms and social networks. They cite the often used example of the resources mobilized in the labor market: individuals rely as much on intermediaries (job applications, classified ads, recruitment agencies, etc.) as on personal relationship networks (word of mouth). Grossetti believes that these chains of interindividual relations are the most empirically founded of the various theories describing proximity effects (Grossetti 2004, p. 168). Indeed, many case studies highlight the existence of local interindividual social networks that cross organizational boundaries.

Another view also relies on the social capital of individuals but underlines the relations between individuals and the advantages created by the constitution of a network. A significant proportion of literature is based on the concept of embedding in the study of concentrations of industrial and/or scientific activities. This notion was developed by Granovetter in a celebrated article on the relations between principals and subcontractors in construction companies (Granovetter 1989). Within these interactions, he highlights the fact that the actors are personally involved in the economic relations they maintain. This personal dependence between individuals forms the notion of embeddedness. Relationships between enterprises cannot be understood without paying attention to the personal ties that unite the individuals involved in these interactions. Granovetter adheres to the tradition of social network analysis, which considers that interactions are the only acceptable starting point for sociological analysis. However, according to Grossetti, this approach tends to reduce economic activity to these sets of social relations (relational reductionism), when he considers that:

> The social structure is not reducible to a network, it also includes groups (or circles, fields, worlds, etc.), in other words collective entities endowed with boundaries of name, affiliation procedures, etc (Grossetti 2006b, p. 85).

Consequently, alongside the notion of embedding, Grossetti and Bès use the notion of decoupling developed by Harrison White (1993). While he is one of the founders of the network approach, White also considers that it can easily lead to a naturalization of relationships, leaving aside other types of social structures: families, organizations, groups, etc. Therefore, embedding always refers to the dependence of an actor on the personal ties he has with others, and decoupling is, conversely, the self-nomination of this actor with respect to these relationships in a new embedding process. In this context, Grossetti and Bès speak rather of network dynamics in order to evoke the two complementary processes of embedding and decoupling. On the question of where relationships originate, Grossetti and Bès rely on the work of Claude Fischer (2011), who, based on an empirical study during the 1970s, tells us that most individuals meet through structures deemed stable and lasting (family, work, neighborhood, school) and that brief encounters in a bar or restaurant rarely convert into strong ties. Thus, when we look at the genesis of relationships, the notion of embedding works in reverse, with individual relationships embedded within collective structures. Nevertheless, they may become autonomous from those frameworks from which they originate, which is called decoupling. Grossetti and Bès indicate that this process "can be perfectly transposed to firms whose exchanges are initiated in a given framework (a "market") and can unfold in other frameworks" (Grossetti and Bès 2003, p. 53). There is an abundance of this literature on social networks in economics, sociology, management sciences, etc., which particularly feeds the concept of the cluster as a product and producer of informal exchanges conducive to innovation.