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## Emergence and Transformation of Clusters and Milieus

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# **EMERGENCE AND TRANSFORMATION OF CLUSTERS AND MILIEUS**

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## 1. Introduction

A renewed interest in the location of the productive activity has appeared during the last two decades. The literature analyzes a great number of cases of clusters and local productive systems in which all types of goods are produced and which are located in regions and countries with different levels of development (Altenburg and Meyer-Stamer, 1999; Rosenfeld, 1997; Staber, 1997; Porter, 1998). Electronics in Silicon Valley, in the U.S. and Silicon Glen in Scotland, but also in Guadalajara, Mexico and in Penang, Malaysia; optics in Rochester, New York, and in Orlando, Florida; the car industry in Detroit, Michigan and in Vigo, Spain, but also in Tianjin, China where Toyota has helped create a cluster; ceramic tiles in Sassuolo, Italy and in Castellón, Spain, as well as in Criciuma, Santa Catarina, Brazil; the shoe industry in Brenta, Italy and in Elche, Spain, as well as in León, (Guanajuato) Mexico; and in Marikina, Philippines; textiles and the garment industry in Reutlingen, Germany, but also in the Itají Valley, Brazil and in the Republic of Mauritius. Financial services in New York City, London and Frankfurt, Germany, but also in Hong Kong and Shanghai, in China.

This changing diversity has been dealt with from different points of view; no doubt due to the fact that sociologists, geographers and economists believe that at the present time the organization of production is experiencing a profound transformation process in which the hierarchic models, so characteristic of the large Fordist firm, reduce in hegemony and give way to more flexible and decentralized forms of organization. This has produced multiple interpretations such as the industrial districts (Becattini, 1979), flexible specialization (Piore and Sabel, 1984), the new industrial spaces (Scott, 1988), industrial clusters (Porter, 1990), the knowledge economy (Cooke, 2002), the new economic geography (Krugman, 1990; Fujita et al., 2000), the theory of the innovative milieu (Aydalot, 1986; Maillat, 1995), or economic sociology (Granovetter, 1985).

Thus, a single unique interpretation as to how production is organized within the territory does not exist. Several approaches try to explain the factors that make the industrial clusters appear the mechanisms through which they develop, as well as the reasons for its change and transformation. Furthermore, the arguments and analyses are often ambiguous and informal, possibly ideological or overly optimistic of a changing reality and so under criticism, but not always well argued (Amin, 1989; Harrison, 1994;

Martin and Sunley, 2003). Gordon and McCann (2000) conclude that the diversity of the analytical approaches has led to some degree of confusion in the analyses and interpretations.

The paper proposes discuss the question of spatial organization of production, from the perspective of economic development. It maintains that the spatial organization of production emerges spontaneously as the markets and relations between cities and regions develop, the transportation and communication system consolidates itself, firms improve their form of organization, innovation and knowledge is introduced in the firms, as well as in the transportation and communications system, and the integration of the economic system is speeded up as a result of globalization. In fact, given that development takes on different forms in each historical period, spatial organization of production also changes and transforms itself. Both the territorial strategies of the firms and the economic strategies of cities and regions condition these changes, and thus they are also responsible for the surge and transformation of clusters and milieus.

The paper is organized as follows: Once economic development is presented as an evolutionary process that is territorial in nature, the outstanding features of the different forms of organization of production are pointed out in light of the different stages of the industrial development process and of market integration. Given that innovations are a key element in the economic dynamic the discussion focuses on the outreach and significance that knowledge networks have today. Next, the question of diversity and the dynamic of industrial clusters is dealt with and the factors and forces that favour its change and transformation are put forth. It ends with some comments on the role of the local firm and actors strategies on the spatial organization of production.

## **2. Economic development, and spatial organization of production**

The concept of economic development evolves and transforms, as does society in general, as the countries, regions and cities face and solve new economic and social problems, as innovations and knowledge are diffused by economic and social organizations. But it is not until recently that organization of production is considered a strategic mechanism that determines the economic development process.

Three important moments should be considered in the evolution of the economic system and in the interpretation of which are the factors that condition the economic dynamic. Adam Smith and the classics since the latter third of the XVIII century, amid

the industrial revolution and at the time when the formation and expansion of the national markets takes place gave great importance to the natural resources and points out the appearance of new kinds of firm organization, forming firm systems. Schumpeter in the early XX century, at the time of the electrical revolution, when inventions and innovations transformed the manufacturing economy that gave way to a profound restructuring of the productive activity, and economic integration consolidated itself with the increase in international trade, the intensification of capital flows and the expansion of multinational firms, stresses the role of the innovative entrepreneur, and the innovations in product, process and organization in the development processes. Marshal points out the importance of large firms, an organization of production model that allows obtain scale economies, similar to how it was done by the local firm systems.

During the last quarter of the XX century the question arises again, in a new phase of the formation and integration process of the markets and the irruption of the new information and communication technologies that leads to the informational revolution. At the centre of the theoretic consideration is, as in the past, the question of increased productivity and the mechanisms that favour the growth and structural change processes of the economies. But, in this discussion appears, in its own right, the question of how the organization of production produces a multiplier effect on the productivity, generates increasing returns, and therefore conditions economic development.

After World War II, a new approach to economic development, led by Abramovitz (1952), Arrow (1962), Kuznets (1966), Lewis (1954) and Solow (1956), among others, appears. Their concept of development refers essentially to growth and structural change processes that seek to satisfy the needs and demands of the population and improve their standard of living, and it specifically proposes to increase employment and to reduce poverty.

For its achievement, increased productivity in all productive sectors is necessary, in other words, increased production in agricultural, industrial and services activities by using the same or less amount of work. This improvement in the productive factors returns is what permits diversify production and satisfy the new demands of manufactured products and services. Increased productivity depends on how labour and the other productive factors are combined, and on how the equipment goods, machinery and production methods are used and which are the mechanisms

through which knowledge is introduced and energy applied within the productive process. In sum, increased production (per capita) in the long term is possible thanks to the accumulation of capital and to the application of technological innovations in the productive process.

The start of a new phase of economic integration, as of the 1980s, presents a new scenario for development, when the growth models inspired in the fundamentalism of capital are no longer acceptable. This is so not only because the breakdown of the Soviet Union and the fall of the Berlin wall proved the superiority of the market economy over a planned economy, but also because, as shown by Easterly (2003), the policies carried out in many developing countries and implemented by international aid programs from the developed countries and international organizations failed.

Since the eighties Schumpeter's (1911, 1939) ideas resurge, as well as of those economists (Young, 1928; Rosenstein-Rodan, 1943; Myrdall, 1957; Hirschman, 1958) who contributed in the post war years by establishing the basis for integrating the externalities and increasing returns in the concept of development, and contributed in creating what Krugman called "High Development Theory." Among the different approaches that have emerged during the last twenty years is the reintroduction of Solow's theories on behalf of the new generation of growth theorists like Romer (1986) and Lucas (1988).

At the same time, since the beginning of the eighties a new territorial approach appears, that can be called endogenous development, and that considers development as a territorial process (not a functional process) that is methodologically based on case studies (not on cross-section analysis) and that considers that development policies are more efficient when carried out by the local actors (and not by the central administrations). This interpretation argues that spatial organization of production is one of the key forces of the development processes, as shown by the growing importance of firm networks in the regions and cities that lead the economic transformation processes.

Giorgio Fua (1994), intellectually linked to Abramovitz, maintains that the development capacity of an economy depends on the immediate sources of growth, as are the size of the working population, the amount of hours worked and the availability of equipment goods and social overhead capital. Yet, what is really decisive for sustainable development are the factors that Fua defines as structural, such as

entrepreneurial and organizational capability, population training and skills, environmental resources and how the institutions function.

Philippe Aydalot (1985), a follower of Perroux and Schumpeter, adds that the development processes have three main characteristics: First, he refers to the fact that the development actors must be flexible productive organizations, as occurs with the small and medium size firms, capable of overcoming the rigidity of large Fordist organizations. Second, and more strategic, defends diversity in techniques, in products, in tastes, in culture and in policies, which facilitates opening up various development paths for the different territories, according to each of their potential. Third and last, is more instrumental, and states that development processes are the result of having introduced innovations and knowledge through the investments made by the economic actors. This is a process that is territorial in nature given that it is produced as a result of the forces that shape the milieu in which the firms are inserted; in other words, thanks to the interaction of the actors that shape what Aydalot calls innovative milieu.

This approach permits us see that development does not necessarily have to be focused in large cities, but can be diffused in urban centres of different size, as explained by Giacomo Becattini (1979), an expert on Marshall. The entrepreneur (both individual and collective), plays an outstanding role in the development processes that makes him into the motor force of growth and structural change due to his creative capacity and innovative nature (Fua, 1983). Fua and Becattini add, however, that the firms are not isolated entities exchanging products and services in abstract markets, but are located in specific territories and are part of the productive systems strongly integrated within the local society. In other words, society organizes itself for the purpose of producing goods and services more efficiently and giving way to industrial districts, systems of small and medium size firms, that bring out network economies within the territory and this contributes to the development of the economy.

John Friedman and Walter Stöhr open up this approach and look at development and dynamic of the productive systems from a territorial point of view. They give great importance to the initiatives of the local actors through their investment decisions and participation in the definition and implementation of policies (Friedman and Weaber, 1979). They also point out that the economic progress of a territory is only possible when the firms and actors within the territory interact, organize themselves and invest with the view of developing the local economy and society. Following this line of

thought, they defend “bottom-up” development strategies that allows mobilize and channel resources and capacities within the territory (Stöhr and Taylor, 1981).

This view of development gives an important role to the forms of organization of firms, and so, to the spatial organization of the manufacturing and services activity. According to economic growth theory, one of the central issues of long term development is undoubtedly how to buffer the law of diminishing returns that would normally lead the economic system to stagnate. As argued elsewhere, (Vázquez-Barquero, 2002, 2005) flexible organization of production, diffusion of innovation and knowledge, and urban and institutional development, are development forces that generate efficiency in the performance of the productive system. Each one of these becomes an efficiency factor in the process of capital accumulation, to the extent that they stimulate economies of scale and scope, and reduce transaction costs. However, it is the combined effect of these development forces that generates increasing returns to scale, and thus increased productivity and development.

### **3. The dynamic of organization of production, innovation and development**

Therefore, the spatial organization of production is a process associated with the strategy of the most dynamic firms, the dynamic of development forces and with the same process of development. Increased competition in the markets and the search for investment returns stimulate the firms to adopt innovations and make good use of the resources (including intangibles) and specific assets of cities and regions. Thus, the transformation of the organization of production is conditioned by the introduction of innovations and knowledge in the productive systems, in transportation and communications and in the markets, but also by the dynamic of institutions and urban development, as can be seen when each stage of industrial development is analyzed.

#### **3.1 Industrial districts and industrial revolution**

The industrial revolution, which began in the mid XVIII century, represents one of the great economic transformations that changes the forms of organization of production and gives rise to the formation of national markets (Landes, 1969). For the first time we see a specific mode of localization and agglomeration of firms, the industrial district, that Adam Smith and Alfred Marshall theorized about.

The first industrial revolution is characterized by the manufacturing of new goods (textiles, iron) in small factories where the work was organized by dividing each



of the tasks in different parts with the help of new machinery (spinning-jenny in 1764; the steam engine in 1769; the mechanical loom, with steam, in 1785), of new materials (cotton) and the use of steam. The “putting out system” is slowly abandoned and the new firms are located in small cities, provoking population flows from the rural areas to the cities. With the improvement of transportation through the canal system (the commercial activity of canal boats is at its peak in the 1840s), the beginning of the railroad (in 1830) and the creation of the telegraph (in 1837), an important revolution in transportation and communications took place that allows the formation of national markets in the more dynamic economies of Europe and America. Landes (1969) argues that the industrial revolution took place in the U.K. at that time, because of British effort, imagination and entrepreneurial spirit, but also because the transformation of values, culture and institutions prevailing during centuries, responded to the new needs and demands.

Alfred Marshall (1890/1920), who witnessed the economic, social and technological transformations of the late XIX and early XX century, based his writings on those of Adam Smith (1776/1937) on labour specialization, in order to interpret the fact of concentration of specialized industries in specific localities. The basic explanation for the agglomeration of firms in an industrial district lies in the fact that geographical proximity stimulates the creation of external economies of scale, as a result of the creation of a specialized labour “pool”, the circulation of ideas and knowledge among the different firms and the specialization of the different firms in different productive activities.

Becattini (1979, 1990) interpreted the ideas of A. Marshall and tried to explain the good performance, during the seventies and eighties, of some Italian regions (growth in number of employees, production, exports and per capita income), whose productive system was organized around “concentrations of many small business of a similar character in particular localities” (Marshall, 1890/1920).

To the factors proposed by A. Marshall, Becattini adds new features that the more developed industrial districts have adopted over time, among which the following stand out: the specialization of the different firms in the different phases of the productive process; the incorporation of the productive activity in the social life of the city, in which the firm became the “interface” between the economy and society; the relevance of the social and cultural factors in the development of the productive system and of the local economy. Thus, Becattini understands the industrial district as “a

territory, historically and spatially defined, that is characterized by the active presence of the population and the local firms” (1990: 39).

### 3.2 The industrial complex and the electrical revolution

During the period between 1870 and 1920, a new industrial revolution comes about, more intense and important than the previous one, and characterized above all by the introduction of electricity in the production of public and private goods and services (Hall and Preston, 1988). It will again transform the way in which production is organized and will give way to the consolidation of the international markets.

From the latter third of the XIX century a variety of new products appear (such as automobiles, chemical products) that are produced by large factories and industries, located in large cities (and in cities close to the raw materials) thanks to the use of new equipment goods (electrical machinery) and electricity (in the decade of the seventies in the XIX century Edison develops a series of generators related to the system of incandescent illumination). The large firm is born, as a new form of organization of production (with the introduction of the assembly line in 1905) located in large cities, where a great supply of cheap labour and a high demand for local products are to be found.

The railroad develops much of its potential (a resurging is produced in the early 1870s), naval transportation introduces the steam engine (1890s), the automobile appears (1895) and aviation (1905), and the telephone (an innovation of the 1870s) as well as the radio (the first successful long distance transmission by Marconi was in 1901) begins to spread. All of which leads to the consolidation of the national markets and the widening and strengthening of the international markets of raw materials and commodities.

Industrial development is based on technological innovation and the new organization of production, as well as on institutional change (Chandler, 1990). Innovation depends more and more on laboratory research, and industrial education becomes necessary for economic progress, and higher education and science were essential to industrial development. Changes in business organization and the turn of the century merger movement required large finance resources and the development of financial organizations. The enlargement of international markets favoured the spatial and strategic development of multinational corporations and the increasing internationalization of the economy. Finally, the role of the State is more and more

present within economic life, providing technical education in some cases and supporting the emergence and development of big firms in new activities through tariffs, patents and government regulations among other actions.

The organization of production is transformed as a result of the appearance of the large firm and of the industrial complexes that settle around it as a result of increased commercial relations between suppliers and clients. Alfred Marshall (1890/1920) understood that the large firm is a new type of organization of production that helps the firms obtain internal economies of scale as a result of the optimization in the use of raw materials, intermediate goods and equipment goods. Nevertheless, it is Weber (1909/1929) who first establishes the relation between production and spatial organization of industry and establishes the optimum firm location in relation to the transportation cost, the price of inputs and the demand for finished goods (Gordon and McCann, 2000).

Hoover (1937, 1948) makes an excellent synthesis of the advantages of agglomeration of firms, since he combines the effects of the internal and external scale economies in his interpretation. Following Marshall, he points out that internal economies of scale are the result of the efficiency of the large firm in the management of inputs for manufacturing a growing number of goods for a wide market. He also adds that external economies of scale are produced as a result of the location of the firms of a certain sector in a specific location, and of urbanization economies, associated with the agglomeration of a variety of industries and services in a city.

All of these ideas lead to an economic development paradigm, widely spread during decades by identifying it with the industrialization processes through investments made by both the large firms in large cities and the public administration in large infrastructures. Yet, even though the idea that development is produced thanks to the impulse of investments made by industrial firms is maintained, one of the great contributions of Schumpeter (1911, 1939) is forgotten, which is that long term development can only be generated if innovations and knowledge are introduced in the products, processes and forms of organization.

Fostering the structural change of an economy through the industrialization processes was a well accepted proposal in the Soviet Union during the twenties (Lenin was a great admirer of Ford's ideas) and industrial complexes have for decades been considered an instrument for industrial development in planned economies. In market economies, industrial development policies were based on the concept of growth pole,

which is Perroux's (1955) version of industrial development, yet the importance of the diffusion of innovations and knowledge in development was ignored.

### 3.3 Industrial clusters and the informational revolution

Since the mid eighties, strong institutional transformations are produced and a new industrial revolution appears, stimulated by the new information and communication technologies that lead to a new form of organization of production and to the formation of global markets.

With the introduction of the transistor (1947), the electronic computer (in 1958 the second generation using transistors is produced) and the personal computer (1978) a strong process of productive restructuring takes shape, and the development of the more advanced industrial activities (biotechnology, electronics, pharmaceuticals) and services (financial, management, cultural, leisure) generates a strong structural change of the productive system. It is led by very different size firms, located in cities large and small, in countries with different levels of development. The organization of production is more and more flexible, due to changes in the organization of large firms as well as to the formation of firm networks and to strategic agreements and alliances between innovative firms. Transportation and communications become more efficient and information technologies and transportation speed up the economic integration (thanks to the opening up of markets and profound institutional changes, such as the fall of the Berlin wall, the commercial opening of China and the change in commercial policies in Latin America, India and some African countries) giving way to global financial, trade and service markets (Dunning, 1998, 1999).

In an increasingly competitive world, spatial organization of production takes on new forms, the old industrialized regional industrial centres are restructured and new centres begin to appear both in developing and developed countries. Porter (1990, 1998) includes the concept of cluster in his dynamic competition theory, which recognizes the globalization of goods and factors markets, where continuous improvements and innovations in product, process, factors and organization are made; yet nevertheless, the strategic positioning of the firms is the key for economic success.

Porter understands that in order to compete under the best conditions firms and organizations tend to group geographically, linking themselves to each other and so creating a system of relations that stimulate the firms' competitive strategies, and thus, of the cluster itself. The clusters include, on the one hand, suppliers with specialized

inputs (parts, machinery, service, specialized infrastructures), and they often extend to clients, firms that produce complementary products and firms from other industries with whom they share inputs, technology and skilled labour. Some clusters even include both private and governmental organizations that supply specialized training, information, research and technical support.

Martin and Sunley (2003) believe that the interpretation of Porter's clusters is at least ambiguous. It lacks clearly defined boundaries, both industrial and geographical, it gives an important role to geographical proximity that he does not manage to define precisely; and he uses the term in a very generic manner, both for referring to national industrial groups and firms related among themselves but dispersed between different locations of a country as well as to refer to groups of similar firms focused in one specific location, or to regional firm groups. Furthermore, Porter's interpretation is very generic, and so, is not sufficient for proposing a general theory on clusters, since it is incapable of identifying the mechanisms of the socioeconomic and institutional processes that make up its background and development.

#### **4. Knowledge networks**

As we have just seen, change in the spatial organization of production is a process related to the economic dynamic of the countries, regions and cities. According to Schumpeter (1939), innovation is the key factor explaining both the spatial organization of production and economic development, although as North (1990) points out, institutions also matter. Furthermore, from the perspective of the functioning of the mechanisms of capital accumulation, the widening and strengthening of the markets depends, among other factors, on the introduction of innovations in the transport and communications systems, which in turn influences the spatial organization of production.

Dunning maintains that in the last three centuries, the main source of wealth "has switched from natural resources (notably land and relatively unskilled labour), through tangible created assets (notably buildings, machinery and equipment and finance), to intangible created assets (notably knowledge and information of all kinds) which may be embodied in human beings, in organization or in physical assets" (2001: 186). He argues that it is precisely the increased contribution of services to the GNP that, in most cases, is causing that the "created intangible assets are replacing natural and created tangible assets as the main source of wealth", particularly in the case of

developed economies. Because of this, when the transformation and change introduced by the key elements of the economy of knowledge (the microprocessor and computer), the difference between high and low technology industries would be less significant. Knowledge would become heterogeneous merchandise, which is transforming the economic and social reality.

Nevertheless, innovation has always been at the core of development during each of the key moments of the economic dynamic. Innovation is nothing less than the application of knowledge to the production of goods and services that are commercially relevant. In other words, innovation necessarily enfoldes the application of new technology in goods and services that are sold in national and international markets. Therefore, the explanation of today's distribution of economic activity and the interpretation of spatial organization of production leads us necessarily to consider innovation and knowledge as the forces for cluster development.

When Marshall refers to industrial districts he points out the importance of knowledge shared between firms in a district with the expression "industrial atmosphere". Perroux (1955) on the other hand, interpreted industrial complexes through the notion of growth pole and argued that the productive activity was led by innovative firms, located in a productive pole, capable of spreading innovation and knowledge through the network of auxiliary firms that settle around it. Porter (1998), in turn, states that clusters play a vital role in a company's ongoing ability to innovate and in the diffusion of knowledge: the interaction with other firms allows for learning, and knowledge about the technological necessities on the one hand; and on the other, the pressure of competition and the constant comparison with other firms stimulate the capacities and the advantages of the cluster for innovation.

All of this leads to the idea of associating the cluster with the knowledge economy (Cooke, 2002; Maskel 2001). Clusters would exist because of the advantages that the knowledge generated by the firms that work in an innovative atmosphere can give. Once a firm accomplishes success with a new product, the result of new knowledge, within the market, an ever larger group of imitators would appear interested in producing the same product, which would give way to the appearance of the cluster. The formation of the cluster produces a strong attraction on the newcomers, who in turn strengthen the cluster even more and expand its knowledge base (Tallman et al. 2004).

Hudson (1999) points out that there is growing recognition that knowledge is the most strategic resource in the present form of organization of production, which is why

learning has become the most important process since it is through it that knowledge is created and transformed. Lawson and Lorenz (1999:307) point out that the process of generating knowledge is based on three basic ideas: on the one hand knowledge, that is mostly tacit and is embodied in organizational routines and procedures of the firms; on the other hand, the production of new knowledge within the organizations depends on the combination of diverse knowledge; and last of all, firms usually find it difficult to make effective use of new knowledge because they face a resistance to making changes in the organizational routines and procedures in which knowledge is embodied.

Thus, learning is “path dependent” in the sense that the creation of knowledge supposes the existence of acquired knowledge. Yet, learning is to a large extent interactive (Lundvall, 1992), which is why it is necessary for firms between which ideas circulate, to share a language and culture. As Camagni (1991) points out, learning is not merely the acquisition of information, but rather a process through which information is transformed into knowledge and for which the firms need to develop a “decoding function” that will allow them incorporate outside information. Therefore, in order for the learning process to be produced it is necessary that the firms have a collective language, in other words, that learning and language share the same codes.

Although, as Hudson (1999) maintains, it is necessary recognize that the national context of the innovation and learning system plays an important role, the local learning and knowledge system is, perhaps, more significant (Maskel et al., 1998). Gilly and Torre (2000) point out that the physical and organizational proximity facilitate the exchange of goods and services, resources and information between firms and the other actors of a locality, and stimulates interaction among them, as well as the creation and diffusion of knowledge (tacit knowledge, undoubtedly). Furthermore, in the learning processes it is required for firms and actors to share a set of rules and regulations that will allow for the cooperation and diffusion of innovations and knowledge through a collective learning process.

The notion of local environment (“milieu”), allows establish that the territory plays a strategic role in the creation and diffusion of ideas and innovations (Crevoisier et al. 1990; Perrin, 1990). As Maillat (1995) explains, innovations and technological change surge in a specific territory, and are associated with local know-how, the qualification of human resources, and knowledge institutions that undergo research and development. The creation and diffusion of innovations is a phenomenon based on the relations and interactions of the firms with the milieu. The performance of the firm, the

economy and society, the innovative capacity of firms and the milieus creative and productive culture, the economic and technological history of the location, are all factors that condition the learning processes and the answer on behalf of the firms and organizations to the challenge of competition.

In an ever more competitive and “globalized” world, the production of knowledge and learning are necessary elements for making quality goods and services and in order to have a competitive position within the market. Geographical and institutional proximity favours interaction and diffusion of knowledge, which allow reduce transaction costs and helps firms improve their investment profits. Thus, the term “learning region” is used when speaking of more dynamic economies that lead the structural change process on a global level (Florida, 1995; Maskel et al., 1998).

As Hudson (1999) maintains, there is perhaps too great an obsession in associating the success of a city or territory only with its learning and knowledge capacity. As previously mentioned, the concepts of “learning firm” and “learning region” are not new ideas, since the economic development process has always been carried out through innovative firms and territories. Furthermore, other forces exist that jointly with the diffusion of innovations and knowledge and organization of production are essential for the economic dynamic, as are the urban development of a territory and the change and adaptation of the institutions. It is precisely the interaction between these forces that stimulate the development processes (Vazquez-Barquero, 2002, 2005).

## **5. Diversity and dynamic of the clusters and local productive systems**

Continuous waves of innovations, the integration of the markets and progressive changes in the organization of production, have created a great variety of clusters and local productive systems. The diversity of clusters and the diversity of their paths is a reflection of the firms’ learning capacity. Despite what authors like Martin and Sunley maintain, the juxtaposition of different forms of spatial organization of production today clearly shows the diversity in the levels of development of the territories, but also the vitality of the development process in all types of economies.

When analyzing the industrial and service spaces, with respect to the organization of the productive system (if it is articulated around large firms or firm networks, and the degree of integration of the firms into the value chain of the territory where they are located) a variety of organization models with very different paths of growth can be



identified (Garofoli, 1994; Markusen, 1996; Maillat and Grosjean, 1999; Dunning, 2001). Among them, the following stand out:

- Local productive systems formed by firm networks and whose productive activities are integrated in the value chain of the city or region where they are located. The productive system has a labour market that works under their own rules, and innovations and technical knowledge emerge and spread easily within the cluster. At the same time, the interaction between firms creates externalities that articulate the local productive system to the territory and whose effects on firm costs and profits are not reflected in the market price. Thus, they are innovative milieus like Jura in Switzerland or Silicon Valley in California, which have enabled their firms to have a high competitive capacity within the market (Maillat et al., 1997; Saxenian, 1994).
- Local productive systems whose firms are integrated into the value chains of other cities or regions, due to the fact that some of the important stages of the production (such as research and development or strategic services to firms) are made outside the territory in which the firm is located. A good example is the industrial district, of Montebelluna in Italy, known for its mountain shoes and plastic ski boots (Camagni and Rabellotti, 1997). The adoption of technological innovations has induced changes in the organization of production and the decentralization of certain phases of production to Southeast Asian countries. The introduction of capital and firms from outside has stimulated the location of the economic decision centres of the area in other regions and cities, and so, even though the local productive system maintains its supremacy, it has lost its independence. The clusters and “filieres” located in developing countries, that work for foreign firms, as occurs with the clothing manufacturers of recently industrialized East Asian countries (Gereffi, 1996), can be included in this type of local productive system.
- Local productive systems formed around large firms that carry out all the functions (or the most important) in the same place in which they are located and whose activities are integrated in the local production system. The firm or leading firms buy from local and outside suppliers and sell, mostly, to outside markets. The labour market of the productive system and the diffusion of technical knowledge is controlled by the large firm and the important investment decisions are made locally. This is the case of the classic industrial

complexes, like Fiat in Turin, the Toyota industrial complex near Tokyo, and even Pescanova in Vigo, a firm specialized in alimentary products, or the pharmaceutical industry in Basel. In this type of cluster multinational firms can play an important role as promoters of clusters in developing countries. A good example is that of Nokia, located in Xingwang Industrial Park, in Beijing Economic Development Zone, that is becoming the most important electronic communications cluster in Asia, since it is there where almost half of world production is carried out, including mobile phones (Wang, 2005).

- Local productive systems articulated around firms that form part of an external production filiere and lack important local productive links, or ties. The productive system is dominated by large firms that use the space in which they are located like an enclave that allows them produce and maintain a system of relations that uphold the economic and social relations. These would be the case of independent firms or subsidiary plants that produce for an external multinational firm. Relations with local firms are rare; the labour market is controlled by the large foreign firm as well as the diffusion of innovations and knowledge. This would be the case of the “export processing zones” and “free trade zones” that the UNTAD in 1997 estimated to be eight hundred in the entire world, of which at least 15% were located in China (Douglas, 2001).

Firm agglomeration that surges as a result of the increase in services and the concentration of the activity in large cities is also becoming more important. Global cities and urban regions hold a strong attraction for financial service firms and entrepreneurial service firms (as occurs with New York where the financial activity focused on Wall St. and advertising firms on Madison Ave.). The most dynamic functions of the advanced service sector (like marketing, design, technical assistance, R+D, information) have gone forward outstandingly given the need to satisfy the growing demand for entrepreneurial services, and as Simmie and Sennett (1999) point out, tend to focus in global cities (urban areas of London or Paris and other important commercial nodes) forming innovative multi-clusters (in conjunction with high technology industrial activities). Lastly, the integration of world markets has also contributed to the development of services clusters in certain international cities like São Paulo, Buenos Aires, Mexico City, Santiago, Beijing, Kuala Lumpur, Singapore and Shanghai.

We can see that the geographic concentration of firms (call them district, complex, cluster or milieu) are always experiencing a transformation and change process, that is associated with the creation and diffusion of innovation and knowledge, as well as with change in the dynamic of the markets. Thus, like the firms, the clusters and the local productive systems in general, are born, grow and transform (Pouder and St. John, 1996; Porter, 1998; Vázquez-Barquero, 1988). In other words, the introduction of the notion of a cluster life cycle permits us identify three stages of cluster evolution: emergence, development and transformation.

The local productive systems emerge as a result of very specific processes. Occasionally, the markets appreciate the production in which the local economy has a comparative advantage, due to the fact that it has specific natural resources available, as occurs with the marble industry in Olula-Macael, Spain in the early XX century. Other times, it is because of the local community's reaction to the crisis in the former productive system or the loss of the traditional markets of agricultural products that spur new initiatives in expanding markets. This occurred in the Valle del Vinalopó in Valencia, Spain when a phylloxera epidemic destroyed an important part of the agricultural production in the XIX century and the cluster devoted to shoe manufacturing emerged in small cities like Elda and Petrel. The same would happen in those cases where the productive activity loses its markets and is replaced by another activity that is or is not related to the previous one.

Krugman (1990) maintains that the appearance of firms and the formation of a local productive system can be the result of chance, as occurred in Dalton, Georgia, that become the manufacturing center in the production of carpets in the U.S. by accident. Josep Maria Bernabé (1983) suggests that the emergence of firms and the formation of local productive systems obeys imitation mechanisms of industrialization experiences in areas that are contiguous or nearby, and that stimulate the entrepreneurs of the local economy to imitate them, using the resources available in the territory.

In the cases of endogenous industrialization studied in Spain (Vázquez-Barquero, 1988), one can see that the start up that initiates structural change becomes a development and industrialization process, thanks to some development conditions: a certain entrepreneurial capacity, the local awareness of "new" products and markets, the availability of savings from agricultural and/or commercial activities, the supply of a cheap labour force, and the existence of a developed social capital and culture.

Clusters also appear because innovative firms stimulate their surge and development or because multinational firms decide to locate in a specific place (Dunning, 2001). As Martino et al. (2006) discuss, the optics/photonics industry in Rochester, New York, first developed with the establishment of three firms specialized in imaging and/or optics: Eastman Kodak in 1881; Bausch and Lomb in 1853; Xerox corporation in 1906. Around these companies an industrial cluster was established, and imaging, optics and photonics academic programs were created throughout the region, with the support of government funding.

When the emergence of the cluster is conditioned by the strategies of the external firms, the attraction factors are relevant for the process. The location factors that generate an attraction to firms depend on their strategies (and these can be the existence of expanding markets or the cost of the factors). Yet, in the case of innovative firms, it is the availability within the territory of resources and specific assets, for instance: strategic infrastructures, qualified human resources, technological and entrepreneurial knowledge accumulated within the territory, as well as the local sense of identity and the prestige of the city or region's image.

The emergence of clusters in recent times also comes about thanks to public support, as occurs with Telecom Corridor in Richardson, Texas, and the biotechnology cluster in Cambridge, England. More outstanding perhaps is the transformation of Austin into one of the leading knowledge economy clusters in the U.S. and that came about as a result of the interaction between firms, the government and the university, what has been known as the "triple helix". The result has been the formation of a high technology cluster, based on obtaining projects, such as the research consortium in semiconductors between Sematech and MCC, and companies like .M, Dell, IBM and Motorola. The result was the creation of two hundred high technology firms, each year, during the nineties, which meant thirty thousand new jobs annually and an annual growth rate of over 9% (Etkowitz and Leydesdorff, 1997).

Once the local firm system begins to take shape, a local network for the exchange of resources, goods and services between the firms and local organizations and institutions appears (Pouder and St. John, 1996; Porter, 1998). The firms' economic success generates a strengthening of relations within the system, and favours specialization, and integration of public services needed by the local firms. The appearance of new local firms and the attraction of firms from other areas strengthen local networks and productive systems.

In the cluster development phase, the agglomeration process is facilitated by mechanisms such as: the diffusion of innovation, urban development and institutional dynamics. Interaction between firms facilitates transmission of information and the diffusion of innovation and knowledge, and the cluster develops its own learning process and diffusion of innovation becomes very creative. The clusters react to changes in the environment through job mobility in the local market, the exchange of product, process and organization technology, and informational flows of all kinds. Innovation becomes, therefore, a collective learning process and the culture of innovation and change is spread throughout the territory.

Cities and localities where the clusters are anchored become a space where economies associated with agglomeration and externalities favour lowering production and coordination costs in cluster firms. The urbanization process makes production and culture more diversified, favours interaction among firms, and encourages innovation and learning throughout the local fabric. Thus, urban development stimulates agglomeration economies and the cluster dynamic.

Firms within the cluster share a culture, history and institutions that emerge spontaneously within the cluster's organization process. They facilitate exchange and market and non-market transactions, and reduce production costs. Trust and cooperation develop within networks and industrial milieus, where they provide profits to the cluster firms. The appearance of new forms of social capital comes about in response to the cluster's and to society's new demands and they take place when they create the mechanisms that guarantee that economic efficiency arises.

The emergence and development of a cluster is a process of self-organization based on the firm's strategies, and the interaction between the firms and the territory. Economies of scale, reduction of transaction costs and agglomeration economies make clusters an efficient organization of production mechanism, and favour the growth of local firms, and their competitive advantage strengthens their presence in the market. However, market forces do not guarantee the steady growth of clusters and local productive systems.

They can lose their competitive advantages because of the weaknesses of the leading firms' strategic response to the challenges of market competition, and the cumulative causation mechanisms effect on the cluster's functioning. The losing of positions within the markets by the more dynamic firms, as a result of changes in the clients needs and demands which the firms have failed to see, and the surge of new

competitive firms and clusters that are more efficient in the use of innovations, could give way to the relocation and shut down of firms. On the other hand, a diminished innovation capacity as a result of the fact that local firms lose contact with the process of creation for new ideas and knowledge, and a weakening of institutional development and social capital that reduces cooperation between firms and breaks down the existing social agreements, should weaken the firms and clusters economic results. The breakdown in the clusters functioning creates the conditions for the transformation of the productive system.

## **6. Transformation of clusters and the forces of development**

Clusters and the local productive systems are therefore efficient forms of spatial organization of production that have spontaneously emerged as a result of firm strategy in answer to changes in market competition. They are in constant transformation, continually adapting and responding to the challenges of innovation, to the changes in the business environment, through productive restructuring and structural change.

Local productive systems last a long time. The industrial district of Prato, Italy for example, during hundreds of years, introducing knowledge and innovations in firms, adopting new production processes, improving the internal organization of the district, and increasing its social capital (Becattini, 2001). Nevertheless, they also transform by giving way to new industrial activities, as Rosenfeld (1997) points out. Thus, the semiconductor industry in Silicon Valley gave way to the equipment goods and personal computer industry; in the Rhur Valley, Germany a new cluster emerged specialized in environmental technologies precisely because it had acquired specialized knowledge in environmental subjects for years, in order to solve the traditional pollution problems caused by the iron industry.

It can be argued, as Cooke (2002) suggests, that the same thing happens to clusters as to innovative firms in that they change the productive activity continuously, as a result of increased competition within the market. Nokia, for example, that began as a forestry firm, after which it specialized in the production of paper and transformation machinery, after which it specialized in wiring, computers and data services and become the most important producer of mobile phones in the world today. Undoubtedly, the transformation of clusters is a more complex phenomenon, since it requires transformations in the organization of manufacturing, innovation development and institutional adjustment.

The transformation of local productive systems can follow very different paths, as can be seen by analyzing the behaviour, at present, of the different cases mentioned above (innovative milieus, industrial districts, industrial complexes and economic enclaves). In the case of local firm systems well integrated in the territory (innovative milieus), the situations will vary depending on the productive system's capacity for response. Saxenian (1994) argues that globalization fosters the creation of innovative firm systems and improves the position of productive systems based on firm networks. Therefore, in this case the endogenous development processes of cities and regions where they are settled, tend to stay on, and are compatible with the dynamic of the globalization processes.

On the other hand, Markusen (1996) argues that increased competition and the introduction of process and organization innovations can transform the internal organization of the productive system. As shown by the case of Detroit, which at the beginning of the XX century was an industrial district comparable to Silicon Valley today, the formation of the automobile industry oligopoly and the flight of other productive sectors from the city have led to a more hierarchical productive system which has hindered diversification and caused serious problems in productive adjustment. The Rochester cluster, however, as Martino et al (2006) point out, has undergone a significant restructuring process in the past twenty years and transformed its internal organization structure. Kodak, Xerox, and Bausch and Lomb no longer play a dominant role within the cluster and the productive system became an innovative milieu of specialized photonics/optics related local firms.

In the case of local firm systems (industrial districts) that are partially integrated into filieres from other regions, the evolution can also differ considerably. On the one hand, due to the weakness of their relations with local value chains (lack of research and development segments or producer service activities within the locality) the impact of globalization can generate dynamics very unlike endogenous development processes. Increased competition can lead to the disappearance of the district and the absorption of remaining productive factors (labour force, for instance) by other districts, as occurred in the case of the footwear district of Val d'Uxo, Spain by the ceramic district of Castellón (Vázquez-Barquero and Sáez Cala, 1997).

But the strengths of these systems (associated with the existence of specialized firms, with firm mechanisms of entrepreneurial and institutional interaction and with local learning capability) can be attractive for external firms searching for milieus with

external economies which are not sufficiently exploited. In Montebelluna, productive restructuring has brought about decentralization of production to Southeast Asian countries and the arrival of external economic actors has externalized the decision-making centres.

In the case of productive systems (industrial complexes) led by external firms whose productive activity is integrated in the local production filiere, several scenarios may take place. In an analysis of the economic dynamic of Seattle, Markusen (1996) finds that the formation of technological poles around leading and innovative firms is a common strategic response to the challenges of competition in an increasingly globalized world. The specific characteristics of Boeing in Seattle have contributed to productive diversification in the region with the expansion of new technology sectors such as computer software, biotechnology or shipping activities giving rise to a singular path of endogenous development.

Finally, in the case of productive systems made up of firms with no local roots, and integrated in external production filieres, that is, mere enclaves of external firms, their permanence in the region is unpredictable. All depends on whether the cost/price conditions and the value of the resources that led to their initial location in the area continue to exist. But, it also largely depends on the technological dynamic of the cluster, as occurred with the production of personal computers in Taiwan (Kishimoto, 2004). In the last twenty years Taiwan has become the third largest producer of computers in the world (after the U.S. and Japan), no doubt due to the manufacture of products with brands from foreign firms that produce computers. Yet, the most important factors of the success of the computer cluster (situated North of Taipei and where approximately 1,200 firms are located) are, on the one hand, that local firms have improved their capacity for the design of products (improved knowledge) and logistics, to which must be added the changes in organization of production with a growing externalization (offshore production) in continental China.

Thus, the spatial forms of organization of production experience continuous transformations, seeking the most efficient forms of production in such a way that the new forms are added to the previous ones and so form multiple spaces of development. This is a self-organizing process led by the most innovative firms of the cluster that react to the changing needs and market competition through responses that modify the cluster network (Best, 1990). Saxenian (1994) adds that when competition is based on continuous innovation, as in the case of computer and semi-conductor industries,



leading firm strategy is focused towards the constant interaction of new products and applications in new markets. The internationalization of local firms does not necessarily imply that the local firm's interaction is reduced when new businesses are created and new firms are reliant on local externalities for their growth, as in the case of Rochester.

In the whole process, the behaviour of the other forces that determine the development processes is very important. Innovations condition the internal organization of firms and the spatial organization of production. The introduction of new products and new methods of production require new forms of internal organization of the firms for reasons of efficiency. An example is the automobile industry since the time of Ford's introduction of the assembly line in the early XX century, to subcontracting and externalization of parts of the productive process to suppliers grouped in industrial parks. On the other hand, the application of new technologies allows divide the productive process in parts, the productive specialization of the firms and the re-engineering of the design of the final products' productive system, whether it is the case of an industrial districts or of an industrial complex around the large firms. Finally, local learning and innovation, and local firm's interaction evolve thanks to global competition. The search for production efficiency stimulates new location strategies that favour cluster transformation, especially in the case of innovative firms.

A territory's urban development conditions, in turn, its own production organization, since cities are the preferred location place for industrial and service firms, for the clusters and for the local productive systems in general; cities supply the resources, as well as the goods and services, required for making them more competitive. The city is the space in which industrial and services investments are made, in which firm networks are established and in which meeting points for the firm network are located, which is why its size and urban characteristics, and its position in the urban system determine the configuration of the local firm network.

The city is the place in which innovations are produced (Feldman and Audresch, 1999, point out that a 96% of innovations in the U.S. were made in metropolitan areas with only a 30% of the population of the country), where technical knowledge is disseminated. This is why firms that share the same scientific base tend to group together in certain cities. The attraction of these intangible assets in cities stimulates the formation and development of firm clusters, and the specialization of firms in industrial activities and individual services. From this point of view, the system of cities thus

becomes the territorial side of the spatial organization of production. It is, therefore, in the cities where the emergence of localization and urbanization economies and of cost reduction in firms takes place.

Finally, the institutional development of the territory where the firms carry out their work and where the clusters are established, determines the type of organization of production of the productive system (Putman, 1993). The cities and regions where new forms or organization of production have emerged, and in which they have been progressively imbedded, are territories where trust and reciprocity between individuals and the organizations stimulate cooperation as well as economic exchange. The economic activity, and thus, the forms of organization of production are immersed in a set of social, cultural and political structures that can either favour or hinder the economic dynamic. The rules of the game, in other words, the formal and informal institutions, change as society, the firms and the citizens make demands, that will permit them improve their well being.

When strong ties are established between the population and the firms, trust among the organizations is generated, and this favours the exchange of products and information and spreads knowledge among the local plants and firms. This reduces transaction costs and stimulates the capacity for creation and diffusion of technical knowledge. When strategic agreements between firms are reached, the mechanisms that lead to scale economies in the production and commercialization of goods and services, to scope economies through the differentiation of production, and finally to cost reduction in production through greater innovation capacity emerge. In a productive system where globalization is the rule, where clusters form part of the entire value chain, the appearance of new rules facilitates the ties between firms and between clusters, as shown by the growing amount of international standards and behaviour codes (environmental, quality control, technical capacity, labour conditions, ethical and social norms) that have surged spontaneously as the networks and clusters organize themselves on the global level (Humphrey and Schmitz, 2004). However, though globalization conditions change in the institutions, the specific characteristics of the territory are still key, since they maintain and regulate the mechanisms of organization of production (Messner, 2004).

## **7. Final comments**

One of the characteristic features of the economic dynamic today is the shaping of a diverse productive space, located in a singular group of cities and regions of developed and developing countries. The development of the productive forces is speeding up both the productive diversity and the diversity of the forms of spatial organization of production: industrial districts, industrial complexes, clusters or innovative milieus and firm networks.

The paper argues that spatial organization of production is not a new phenomenon, but rather a very old process, whose origins go back to before the industrial revolution in the XVIII century. The introduction of innovations in the productive system, the integration of the markets and the firms' quest for economic efficiency explain the change in firm strategies, and thus, its forms of organization and its investment and location decisions.

Thus, in each of the important technological revolutions of past centuries (the industrial revolution, the electrical revolution and the informational revolution) new forms of spatial organization of production emerged. Their constant transformations, stimulated by the forces of economic development, have given rise to the variety of models we can see today. It can therefore be said that spatial organization of production is a phenomenon associated with the economic development of cities and regions and with the organization and location strategies of the firms. It has, therefore, an economic logic.

The paper points out that cluster evolution is a self-organizing process, as a result of the firms search for improved economic efficiency. Innovative firms define their spatial strategies in answer to the challenges posed by the markets, and so, introduce location and organization strategies in order to deal with changes in the demand and increased competition in the markets. Today's spatial and production organization models guarantee the firms the attainment of internal and external scale economies and the reduction of production and management costs; and so, favour investment returns.

Yet, the decisions of the remaining actors that form part of the firm cluster are also important in the spatial organization of production. The organizations devoted to the development of innovations and knowledge, the representatives of the public administrations and other public and private organizations, as well as leaders of opinion in general, of the cities and regions, contribute directly or indirectly with their

initiatives towards private and public investment decisions and this helps improve the resources and the attraction of cities and regions.

It is precisely the local initiatives that influence development (diffusion of innovation, urban development, and institutional change) that, as previously mentioned, condition the firms' investment and localization decisions. Nevertheless, the diversity in forms of spatial organization of production and the dynamic each have requires specific policies and actions for each locality. The promotion of clusters and firm networks, the attraction of outstanding projects, the support to technological institutes and scientific parks, the stimulus of initiatives for sustainable urban development, the design and implementation of strategic plans and community actions, are only some of the answers on behalf of the local communities to the challenge of globalization.

The new development policies attempt to make cities and regions more competitive territories, and make them more attractive for the investment and location of firms. Thus, the economic strategies and policies of cities and regions tend to converge with the spatial strategies and policies of firms. The combined effect of the actions of the territories and firms, stimulates economic development processes and transform the geography of production.

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## **EMERGENCE AND TRANSFORMATION OF CLUSTERS AND MILIEUS IN THE DEVELOPMENT PROCESSES**

### **ABSTRACT**

The paper presents an interpretation of the factors that explain the emergence of clusters and firm agglomeration, and the mechanisms through which they develop and change. The discussion takes place from the perspective of economic development. It argues that spatial organization of production is a phenomenon associated with the economic dynamic of cities and regions, as well as with the organization and location strategies of firms. It maintains that the development forces such as diffusion of innovation, urban development and institutional change are factors that condition the strategic decisions of firms, and so, the spatial organization of production.

**Key word:** clusters, milieus, networks, globalization, cities, endogenous development.