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Emergence and transformation of clusters and milieus
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Theoretical box

Emergence and transformation of clusters and milieus

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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.

Large firms and small and SMEs: a complementary role
Javier Alfonso-Gil - Universitad Autonoma de Madrid

Theoretical box

Large firms and small and SMEs: a complementary role

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The canon of the Industrial Revolution is characterized by two basic events: the emerging political system offered greater individual freedom and, consequently, there were new opportunities for individuals to become entrepreneurs and create firms. Initially these firms were small and medium-size (SMEs) but in the 20th century large firms (LFs) began to appear. Although it seemed that LFs would dominate the entrepreneurial world and even lead to a drastic decrease of industrial SMEs, if not their entire disappearance, the data on number of firms, jobs and production tip the scales in favor of SMEs. Is there some reason to be found in the economic system which justifies this dichotomy between LFs and SMEs?

LFs have been driven by the simultaneous effect of a greater tendency to apply knowledge arrived at through R+D and scale economies obtained in production processes by means of necessary and successive capital increases. Although the physical representation of goods produced is by far the most obvious measuring instrument of the economic system, in fact the most decisive factor was also the most elusive aspect of the production process: technological change based on successive increases of knowledge in society. Thus, although capital accumulation is a necessary condition to obtaining long-term economic growth, it is not sufficient in itself. Capital accumulation processes that have not introduced increased knowledge represented by technological change have consistently resulted in persistent decreases in productivity on the part of production units.

How is knowledge acquired? Basically, knowledge is acquired through the constant quest for both new products and new processes. This search obviously requires the use of resources with their corresponding economic cost. If research is carried out within the framework of in-house R+D departments, it is evident that the need for economic resources will multiply and have an immediate effect on the balance sheet. In other words, firms that wish or are able to maintain in-house R+D departments will have to meet increased cost due to the resources dedicated to research and this can only be done by way of higher prices on the market for their new products and processes. Therefore, the task of systematically searching for new, previously unknown, products and processes (the definition of "innovation") implies high costs for firms. These can only be recuperated outside of the competitive market with prices higher than marginal cost which, along with scale outputs, tends to generate large firms (LFs) in oligopolistic markets. Now it's obvious that there are industrial sectors (pharmaceutical, software, biotechnology, etc) where some SMEs are highly knowledge base and innovative but since the charge prices far above the marginal cost and they are a minority in the industrial landscape we can still use the model of LFs as innovators and SMEs as adaptors.

Industrial SMEs, we have observed above, constitute a majority in the system. How and why are they sustained? Firstly, SMEs, in general, do assign resources to R+D although they do not carry out a systematic search for new products and processes and they do not have in-house R+D departments. SMEs improve their productivity by imitating and diffusing technological advances developed in innovating firms by means of resources dedicated to increasing absorptive capacity

(the other form of R+D). For SMEs this type of activity is “as if was innovation”, they carry out R+D to adopt and imitate but not to innovate.

Secondly, SMEs have always tended to group into clusters which guarantees them rapid access to innovations coming from the LFs and minimizes access costs. This is because innovation acts as a public good and also because there are increasing agreements reached with LFs to transfer knowledge at a price. Easy access to knowledge for firms in clusters discourages them from generating costly formal in-house R+D departments whose lack is easily compensated by belonging to a cluster. Moreover, this attitude is reinforced by the knowledge each firm has of the other firms within the cluster. Besides, there is also the potential for increasing returns through specialization in subcomponents of the final product as well as less chance of entrepreneurial failure due to the distribution of total production among a large number of firms.

Finally, SMEs by producing in competitive conditions where there are many other firms turning out the same goods, their price is not a controllable variable but rather one that must be adapted to. If these firms wish to remain in the market, they must be able to offer the best price possible, a price much lower than that of the LFs. SMEs do not innovate because they cannot recuperate the high cost of routine R+D, so they imitate and diffuse at lower prices. On the other hand, diffusing at competitive market prices means the final goods can be purchased by a large number of consumers who would otherwise not have had access to them at higher prices. The cluster's work role is, therefore, essential in increasing demand for new goods and products. Clearly, both, LFs and SMEs tend to form a unity in the industrial construct base in their complementary role.

Geographical agglomerations and the development of local networks
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Theoretical box

Geographical agglomerations and the development of local networks

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The role of the geographical scale for local networks represents a topic which is of special interest in respect of the transferability of established models of networks and cluster promotion to different regions. Geographic agglomerations on the one hand and networking and clusters on the other hand have to be interpreted as interdependent dimensions which change in a co- evolutionary way. The theoretical analysis explores forms and contents of economic interaction in networks which are based on various concepts of agglomeration. The existence of a pure geographical agglomeration (e.g. a city) favours the development of cluster; yet growing networks and clusters also could cause the emergence of a geographical agglomeration as it might have been the case in the Silicon Valley in California.

Geographic agglomeration respectively concentrated versus dispersed location patterns set a framework for economic interaction and (material and immaterial) linkages between economic actors. Existing interpretations of models and forms of geographical agglomeration allow different types of networks and different patterns of behaviour in consequence also different forms of learning, of knowledge sharing and knowledge creation. Firms establish a variety of types of interactions and relationships each of them having different impacts on the knowledge generation and diffusion process. Mariotti and Delbridge (2001) speak of the necessity for firms – in face of knowledge ambiguity, of knowledge related barriers, of tacitness and complexity of knowledge – to engage in the management of a portfolio of ties. Organizations therefore are likely to engage in inter-organizational relations that show a variety of types of ties.

Different dimensions of interaction can be observed. There are networking-dimensions of material, supply oriented transactions and networking-dimensions of knowledge sharing. The first belongs to the process of division of labour dealing with the exchange of goods and services, the second with knowledge. The main differences reside in the form of interaction and in the impact of interaction. The spheres of physical interaction (subcontracting relations) considerably differ from the spheres of knowledge intensive respectively R&D-driven interactions. They are different in respect of the involved actors, in the spatial extension and therefore also the significance of geographic agglomeration

The observed network in its regional dimension is dominated by knowledge intensive relations. The qualitative evidence gathered by numerous in-depth interviews in the machinery sector of the region of Styria reveals that the highest number of interactions was reached by pre-competitive R&D knowledge exchange respectively that immaterial dimensions dominate the material ones:. The (industrial) firms do have extensive supplier relations but not so much within the region and within the network. Yet their knowledge oriented relations are to a large degree regionally concentrated. Proximity per se is not sufficient to generate knowledge between firms. The diffusion of knowledge within clusters is

highly selective and strongly dependents of the position of firms within networks and their absorptive capacity.

Clusters are highly differentiated across sectors, regions and countries. There is also no single model of knowledge transmission, also not within clusters. As already foreseen by Marshall variety exists also within clusters – there is much unobserved heterogeneity. Both a theoretical as well as empirical approach to network formation interpreted in a wider context of agglomeration show that approaches to cluster analysis have to avoid universalism – there is not only strong diversity between clusters but also within. This is of special interest in respect of the transferability of policy approaches and measures from one region to another (especially in astern Europe), where industrial structures, institutional thickness etc. is considerably different compared to regions in western Europe.

Knowledge transfer is by no means automatic and proximity per se is not sufficient to generate knowledge between firms. that the forms of organized learning differs remarkably between clusters, that the diffusion of knowledge within clusters is highly selective and strongly dependent of the position of firms within networks and their absorptive capacity.

Special attention will be paid to the evolutionary development of these clusters and their historical background as a co-determining factor in cluster formation. The roles of cluster, networks and geographical agglomeration considerably change more or less co-evolutionary. Different approaches concerning forms, channels and mechanisms of knowledge exchange offer different conclusions for the significance of geographical agglomeration in knowledge exchange. In the Styrian case the main dimensions of economies of agglomeration considerably changed during the last decades. The portfolio of interactions, at long last the meaning of agglomeration for the observed firms cannot be reduced to specific dimensions which merely exists or not.

Determined by firm capabilities and firm behaviour not all dimensions of agglomeration and therefore economies of agglomeration are accessible for all agents. While small and medium sized firms partially gain from economies of agglomeration in the field of basic technologies like material sciences or tool making, large firms concentrated pre-competitive research in the region to gain from economies of agglomeration in the field of Science and R&D. This agglomeration effects still seems to be concentrated around certain clubs of insiders. A considerable share of the investigated firms is not able to participate and gain from economies of agglomeration.

Yet there is a long tradition of pro-active promotion of clusters and networks in the most developed European regions in the meanwhile. Sectoral diversity (therefore low critical mass of actors) and the low absorption capacity hamper the development of and gain from discussed economies of agglomeration by a considerable part of SMEs.

Theoretical box

Geographical and relational proximities in the European Airbus project

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The notion of geographical proximity is prominent in the field of regional studies. Various theoretical concepts including industrial districts and cluster approaches suggest that geographical proximity is crucial to interactive learning and innovative success (see discussion by Oerlemans and Meeus 2005: Do Organizational and Spatial Proximity Impact on Firm Performance? Regional Studies, 39, pp. 89-104). The relevance of geographical proximity to economic success has also become accepted by policy-making organizations, such as the Department of Trade and Industry in the UK (2004: A Practical Guide to Cluster Development, DTI publication).

But several scholars, most notably Torre & Rallet and Boschma, have challenged the significance of geographical proximity, suggesting that other channels for learning might be similarly or more important. Torre & Rallet (2005: Proximity and Localization Regional Studies, 39, pp. 47-59) differentiate between permanent and temporary geographical proximity, and supplement the geographical dimension with a broadly defined concept of organized proximity, which might deliver many benefits traditionally associated with geographical proximity. Boschma (2005: Proximity and Innovation: A Critical Assessment Regional Studies, 39, pp. 61-74) argues that four types of relational proximities coexist with geographical proximity. These are: cognitive, organizational, social and institutional proximity, and might be as or more important than geographical proximity. Boschma's relational proximities show a greater differentiation than Torre & Rallet's organized proximity, but refer to similar facilitators of interaction between stakeholders in innovation. Examples are trust and set communication structures in organizations.

Both from an academic and policy-making point of view it is very important to examine the relevance of the different types of proximity. Academics need to refine their understanding regarding merits and problems of the different theoretical dimensions, to be able to evaluate and refine theory. Policymakers need to know whether their present faith in the benefits of geographical proximity is appropriate, or if policies of regional economic development must be revised to cater for learning and innovation factors associated with other dimensions of proximity.

The present paper by Cooke & Ehret responds to the call by other scholars researching proximity to empirically evaluate the relevance of the different types of proximity. At the same time, the paper seeks to inform policy-making as to what factors matter to learning and innovative success, to help them devising more effective policies of regional economic development. To do so, the paper examines the proximities that manifest within Airbus UK and the international Airbus SAS, during R&D, manufacture, transport and integration of wings for Airbus aircraft.

It emerges that permanent geographical proximity is of limited significance for learning and

innovation within Airbus. The company is of an international nature and most knowledge flows between, rather than within, geographically closely delimited regions. Temporary geographical proximity, on the other hand, does play a more important role. This lends support to the theoretical propositions of Torre and Rallet in particular. It also becomes clear that cognitive, and to a lesser extent organizational, social, and institutional proximities matter significantly, and more so than geographical proximity. This is in line with the suggestions of Boschma. The affirmative evaluation of academic theory also yields lessons for policy-making. Organizations such as the DTI should widen their current focus on the support for geographically defined clusters. Policies of regional economic development should also take account of the learning and innovation factors captured by other dimensions of proximity. If interregional knowledge-flows are more important than intraregional ones, public policy is well advised to nurture the relevant, for instance organizational, proximities.

Temporary geographical proximity
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Theoretical box

Temporary geographical proximity

André Torre
INRA Paris

Far from denying the role of space in the implementation of innovation processes, recognizing the existence of moments of temporary geographical proximity helps put in its rightful place the need for face-to-face interactions. Thanks to increasing mobility possibilities, the need for geographical proximity, which is real for certain types of interactions - in particular for services or the sharing of knowledge - can be fulfilled temporarily through travelling, without the interaction leading to the permanent co-localization of the partners.

Firstly, the need for geographical proximity is generally not permanent in innovation and knowledge production activities. It concerns certain phases of the interaction and depends on the firm's or innovation's life cycle. Short or medium-term visits are then sufficient for the partners to exchange - during face-to-face meetings - the information needed for cooperation or for the construction of trust. Thus, permanent co-localization is not necessary even for activities where physical interaction plays an important role in the coordination. This is what we call the need for temporary geographical proximity.

There is no denying that face to face relations remain indispensable for certain types of interactions, in particular to solve problems related to the heterogeneity of reasoning modes or those related to the processes of deliberation and negotiation. However, the intensity of the need for face-to-face relations varies according to the phase of the process. Only two types of situations necessitate face-to-face interactions:
- the launch of innovative projects, in particular in cases where the actors have very different knowledge bases and where the project is not very structured;
- cases of conflict management between innovators, proximity facilitating consultation between the participants regarding the use of communication tools.

These moments of temporary geographical proximity can occur in the context of face-to-face meetings between people involved in the same project. But they are also made possible by organisations whose purpose is precisely to enable people to meet, to exchange information and knowledge. Fares and congresses, for example, enable firms to meet, exchange ideas, and give them an opportunity to develop trust with each other. There is indeed geographical proximity here, but it is organized by institutions that specialise in this type of activities. The same solution to a similar problem is provided by conferences of researchers or of high tech specialists, during which projects or collaborations are conceived, and during which individuals can build trust relationships that can later be developed from a distance. Here again, geographical proximity combines with the effects of organized proximity developed with the help of organisations that specialise in this task.

The recognition of the existence of a temporary geographical proximity based on individuals' mobility has direct implications on the question of clusters, as it calls into question the necessity for firms involved in an interactive research or innovation process to be located in

the same area. Thus, big firms can more easily fulfil the need for geographical proximity by de-localizing part of their staff, including for relatively long periods of time; whereas smaller firms (very small enterprises or small SMEs) are often forced to adopt a permanent co-localization even when they only need temporary geographical proximity. Big firms, group subsidiaries or universities can bypass the constraint of co-localization by sending teams of researchers or doctors for short or prolonged visits to distant research centres for example.

Thus, geographical proximity is not a factor of coordination if it is not activated by organized proximity. In some situations, the latter can even prove sufficient for the establishment of interaction relationships. Could organized proximity alone be sufficient, and function without geographical proximity? Despite the fact that some authors exclusively praise the virtues of clusters, the answer to this question seems to be yes. This is evidenced by situations in which supra-local organized relations occur: multi-unit firms, global networks of firms, national or international professional communities… As it is not geographic in essence, the organization has the ability to "travel through" territories and to cross their frontiers. It is located in space, does not ignore territories, but is neither defined nor limited by them: a multinational firm is a good example of this type of organization. The coordination of these long distance relations rests on the sharing of norms and standards (such as ISO 9000 standards), the existence of formal rules and common representations and on individuals' mobility.

Yet, not only do clusters exist, but their numbers are increasing and more and more policies are implemented to promote their development. What are the reasons for such a success? It is clear that the need for geographical proximity in the coordination of innovation and research activities, and in particular in the exchange of tacit knowledge, cannot alone explain the geographic concentration of actors. The existence of clusters rests on several other factors:

Firstly, economic relations are embedded in social network, and the latter often have strong territorial roots. In this perspective, the existence of localized networks of innovation is less due to the functional need for face to face relations in order to exchange knowledge, than to the fact that cooperation occurs between researchers and engineers belonging to different organizations but originating from the same university or belonging to the same social and family network. Geographical proximity is not so much an economic cause of agglomeration as a social effect of the embeddedness of economic relations in inter-individual relations. Face-to-face interaction between two actors cannot alone generate synergies; the latter can only develop between two individuals who belong to the same network or share common representations. Furthermore, the passage of time and the history of the localized innovation systems are key factors in the success of the local interactive processes;

Secondly, the geographical context of economic interactions is largely conditioned by the role of institutions. And nowadays, geographical proximity appears to be a factor legitimising these institutions (valorisation of the local in itself). Thus, local policies produce geographical proximity institutionally as a privileged mode of economic interactions. The search for synergies between local actors has become the basis for most policies of local development. This is evidenced by the development of technopoles, technological parks or poles of competitiveness created with the financial support of the public authorities, and which often lead to a co-location of actors without necessarily generating significant effects in terms of synergy. Indeed, recent surveys about interfirm cooperations show that in most cases the firms cooperate with organizations that are not located in the same region and that proximity based interactions are relatively rare.

Finally, with regard to the life of clusters, it is important to remember that the success of

these local agglomerations - even in the absence of strong synergies - can often be explained by traditional economic factors - in which case there are no strong synergies between the different firms located in the agglomeration. The first factor is related to attractiveness based on land prices: the public authorities often maintain the prices of plots at attractive levels in order to attract enterprises or research laboratories, the latter seeing in these low prices an opportunity to set up and function at a reasonable cost. The second factor lies in a series of advantages, such as tax and financial advantages (tax abatements, temporary or permanent tax exemption...) offered by the local authorities in order to attract enterprises and convince them to set up within their zone of activity. The third factor, which cannot be ignored, is related to the New Economic Geography argument concerning the local labour markets. Enterprises naturally seek to locate their activities in proximity of other firms that belong to the same or to related sectors of activity so as to be close to a pool of qualified labour available on the labour market.

The role of tacit knowledge in the process of innovation
Riccardo Cappellin and Luigi Orsenigo - University of Rome "Tor Vergata and University of Brescia

Theoretical box

The role of tacit knowledge in the process of innovation

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The process of knowledge creation, which occurs in clusters specialized in medium-tech sectors, is rather different from that in high-tech industries, which has been extensively studied. Specifically, in this kind of industries the innovation process presents three important characteristics:

- it has an interactive dimension;
- it has a re-combinative character, i.e. it is largely based on the use of (often) already known concepts and elements, the recombination of which leads to original improvements in products and processes;
- it is mainly based on the use, transfer and creation of tacit and local knowledge through informal searching processes.

Cognitive processes, i.e. processes leading to knowledge creation, have a territorial dimension and that is the main factor leading to the spatial agglomeration of innovative activities.

In fact, external stimulus stimulate knowledge creation and innovation, as firms aim to respond to the new emerging needs in their local markets and to solve problems of local users. A low geographical and cognitive distance facilitates the identification of weak signals and promote collaboration between local actors.

Knowledge and innovation are the result of a process of adaptation responding to the search for consistency and integrity when the local or regional environment has to respond to an external challenges.

Innovation requires the search and the integration of complementary resources and capabilities. In the search for a solution to these problems firms initially look for the support of local suppliers. The diversity of metropolitan areas or the specialization of industrial clusters may facilitate the identification of complementary capabilities.

Interactive learning is the key process in knowledge creation. Networks are a form of organization, which facilitates interaction and flows of information and knowledge, and their nodes and links are constrained by the existence of spatial distance.

Knowledge develop according to selected paths, as the specific characteristics of the local selection environment may facilitate the identification of new emerging needs and it may also create obstacles and lead to lock-in effects.

Institutions play an important role in knowledge creation. Local history, common culture, values, norms, visions, trust are the component of the local social capital. These intermediate

institutions decrease the cognitive distance between different actors.

Networks are an appropriate organizational form, when the access to tacit knowledge is crucial as it is in the case of SMEs and of medium-tech sectors. While codified knowledge could be interpreted as a stock or a resource, which can be transferred in the markets, tacit knowledge is linked to action and it can be interpreted a complex set of capabilities, which are localized or idiosyncratic and cannot easily be transferred. In particular, tacit knowledge refers to competencies which explain both how each actor behave and how he interacts with other actors

Tacit knowledge is both the result and a factor in the process of interactive learning. In particular, tacit knowledge plays a key role in the informal process of searching for a solution to local problems, which is particularly important for the innovation adoption within SMEs or medium-tech sectors and which is different from the formal search characterising R&D activities in large firms.

It may be argued that tacit knowledge, while being more difficult to transfer among distant agents, might be easier to be recombined, than codified knowledge. In fact, whether the "codes" inherent in different bodies of codified knowledge are excessively stringent, they can impose univocal interpretations and therefore rigidities in the use and modification of knowledge itself. Moreover, the codes underlying different bodies of codified knowledge can be incompatible with each other. In these cases, recombining the knowledge from different agents, sectors, disciplines and countries can be easier when the tacit component is very strong.

On the other hand tacit knowledge can not be transferred at long distance such as codified knowledge, as it requires personal contacts and a deep reciprocal knowledge. However, in some cases, the lack of geographical proximity may be compensated by adequate organizational or institutional proximity and organizations and institutions allow to transfer tacit knowledge at large distance.

Networks may have different characteristics and they may be distinguished in the following three types, which all have a different cognitive characteristic. Some networks may be defined as 'ecology networks', as they are characterised by strong unintended interactions between various actors and facilitate various forms of un-traded technological interdependencies or spill-over effects as it occurs in geographical agglomerations. Other networks: 'community networks', are based on the sense of identity and common belonging, on the existence of trust relationships and of specialised intermediate institutions ("social capital") and may be defined as places of collective learning where as in "industrial districts" the development of a common production know-how occurs. A third type of network, defined as 'strategy networks' are based on intended relationships and cooperative agreements between firms and other organisations. They imply forms of central coordination, the creation of procedures for the exchange of information, the codification of individual implicit knowledge and the investment in the creation of collective codified knowledge. That is the case of those local clusters and regional innovation systems, which explicitly aim to become a "learning region".

"Territorial Knowledge Management" is a methodology for the governance of learning networks and it indicates six dimensions or levers to promote the innovation capabilities of a regional production system. According to this approach, knowledge policies for SMEs in medium tech sectors may focus on:

- Innovation stimulus: aim to respond to customer needs and to strengthen the integration of the supply chain.
- Accessibility: enhance the low international accessibility, while maintaining an high local accessibility
- Receptivity: invest in education and to expand capability of learning as also relational competencies in the development of cooperation with other actors.
- Identity: enhance the high local embeddedness of economic actors and maintain a strong local identity
- Creativity: Invest not only in R&D but also in developing informal processes of interactive learning and favour an higher diversity of the local actors and insure to the potential innovators the possibility to invest in risky exploratory analysis and in the lengthy process of systematic search of innovation.
- Governance: strengthen intermediate institutions and base policy making on the model of Multi-level governance, rather than on traditional planning or free market approaches.

Institutions have a clear importance in the innovation process, as the creation of institutions and the governance of the knowledge creation process represent key factors for increasing the accessibility and the receptivity of the actors in a cluster as also for the development of their sense of belonging.

Knowledge Value Chain Management in medium-technology SMEs
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Theoretical box

Knowledge Value Chain Management in medium-technology SMEs

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Within strategic management, value chain approaches help identify specific needs as well as organisational strengths and weaknesses at different stages in the process, from procuring raw materials to distributing, selling and maintaining market products and services. Porter's concept of strategic management sees cost leadership and differentiation as the two major strategies to improve competitiveness. Identifying the sources for such successful positioning, however, requires further differentiation. Competitive advantages cannot be understood by looking at a firm as a whole. Indeed, competitive advantage is derived from the several discrete value adding activities both within and outside a firm's performance. For many industrial SMEs in medium-technology sectors, it is their embeddedness within value chain systems with OEM and other suppliers, which defines their competitiveness. Changes of sourcing strategies by OEM strengthening the formation of system suppliers, which integrate different capabilities and functions within the value chain challenges the traditional position of conventional industrial medium-tech SMEs in the value chain.

Strategic management decisions are based on performance assessments of all single activities and the identification of tools required to improve the performance. Cohen and Roussel define four perspectives to measure the strategic performance of single activities: impact on cost reduction, reliability of quality, specificity and individualisation of services, and speed to market with first mover advantages due to innovative capabilities.

These general value chain concepts, however, still refer to innovation as a "black box". This leads to confusion about performance indicators and innovation strategies. Elements of the Lisbon strategy, for example, refer to input indicators like R&D investments instead of looking at systemic linkages and output. Words like 'knowledge' or 'technology transfer' illustrate the cognition of knowledge as something, which can be formally codified and transferred without loss of meaning or context. Concepts like regional, national or sectoral innovation systems stress the importance of systemic linkages between single innovative activities and incentives to enhance innovations. However, even these approaches need a strategic perspective on how these will help define some specific strategic requirements at different stages of the whole innovation process and to structure the complexity of the management task. Therefore, besides the traditional – material – value chain, a knowledge value chain covering the knowledge production process along knowledge generation, examination and exploitation has to be considered.

At the beginning, we have knowledge generation. Knowledge generation is firstly based on processing existing – own or foreign – experiences. This conscious or sub-conscious processing can be defined as learning from existing expertise by combining new elements of existing experiential knowledge pieces or by improving the recognition of existing knowledge. Many innovations in medium-technology sectors are based on technological

paradigms, which started a century ago, but have been improved by engineering expertise and by integrating experiences from other technological disciplines, like material sciences or nature sciences.

The second source of knowledge generation is creativity, which means adding something new to the existing knowledge base. Creative amendments can refer to the use of new materials or procedures in the production process, such as the inclusion of composites into aircraft wing production instead of steel, or to the change of applications to existing products or services, for instance, the use of the Internet as a general means of communication.

The basic challenge in knowledge generation is always combining something new with something existing. While the processing of something existing appears rather easy to manage (depending on the information tools), managing creativity seems to be a more difficult challenge. Knowledge management studies, however, show that even the access to existing knowledge and the absorptive capacity may limit successful processing. For industrial SMEs in medium technology sectors, specific limitations have to be considered. They often lack necessary human capital resources to get into continuous interaction with basic research institutes and researchers from other disciplines. Furthermore, they lack financial capital to develop long-term R&D strategies. On the contrary, the increasing need for interaction with firms, institutes and individuals using different technological paradigms and knowledge bases limit the traditional way of organising interaction for conventional industrial SMEs, which was based on personal and social linkages.

Knowledge examination is the process of assessing and filtering new ideas. Here, the quality of new knowledge, its novelty, applicability, non-intended consequences and prerequisites are investigated. For example, a blueprint for a new aircraft fuselage system has first to be proved on its functionality, then on the compatibility with specific industry and company norms, then on the possibility to receive a patent on it, its ability to fulfil all relevant environmental and safety standards and, finally, to be accepted by the main demander. As a consequence, these processes of assessment create new demands for innovation, as a result of major accidents or failure of existing technologies, for example.

Due to the vanishing boundaries between basic science and product development, processes of knowledge examination are no longer as distinctly separated as in earlier times, when new knowledge had first to be accepted within the scientific community and then turned into commercial and social discussions. Furthermore, knowledge production is no longer spatially concentrated but has to integrate also knowledge from other regions and countries.

Besides language differences, different knowledge (engineering) cultures challenge existing ways of understanding and assessing new knowledge. Most OEM react on this new challenge by implementing a higher level of knowledge formalisation, which is expressed by industry or company norms and technical standards for direct online communication within the value chain. The concurrent engineering approach of Airbus having engineers from different locations and firms simultaneously working on engineering and design tasks online is a typical example for that. For conventional industrial SMEs in medium technology sectors, this requires too high investments into technological infrastructures as well as formalised human capital. As a consequence, they become increasingly dependent on specialised engineering service firms, which provide necessary qualifications, or are threatened to loose contact to the value chain system.

Knowledge exploitation is the actual application of a new idea, which includes

commercialisation and diffusion. The more radical an innovation is the more important it is to change the cognitive perspective of customers on needs and solutions to fill the needs. Consequently, innovators must have a perspective on potential demanders, their (hidden) needs and channels to reach them. This requires combinations of cognitive leadership, integrative knowledge, marketing and distribution expertise, and communication skills. In times of international markets, these capabilities have to cope with wide spread diversified cultures and institutional, as well as social, systems. Many conventional industrial SMEs are used to receive their orders and accordingly the requirements for new products and processes from their main customers (the OEM). The OEM, however, increasingly use outsourcing towards system suppliers in non-strategic segments to get new insights on specific new solutions. This means that conventional SMEs have to show a higher level of initiative to develop their own ideas on innovative adjustments to prevent downgrading within the value chain systems. Such new initiatives, however, require investments in human capital and R&D cooperation as well as funding for prototypes and regulatory approvals.

Based on these theoretical and empirical observations, three important messages to the European Commission and regional policy-makers seem to be worth further discussion:

- the relevance of formal public regulation to obtain international competitiveness of domestic firms: here, clear and transparent rules are as important as support for SMEs to overcome costs and administrative requirements for the regulatory process;
- the importance of access of SMEs to formal and informal knowledge bases to rise within international value chains: here, support for SMEs to adjust their ways of interaction, which was used to social and personal links, towards formalised ways of knowledge exchange needs to be supported;
- the need for strategic support for conventional and knowledge-intensified firms to overcome barriers to grow within knowledge value chains: here, a differentiated approach considering the specific needs of different types of SMEs have to considered.

Social capital and clustering
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Theoretical box

Social capital and clustering

Stanislaw Walukiewicz
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Until now there is no one commonly accepted definition of social capital, although the concept of social capital, which refers to features of social organizations, such as networking, norms and trust, that facilitate coordination and cooperation for mutual benefit, has found rising albeit grudging acceptance within the economic profession in recent years. Like other sociological concepts, its amorphous nature initially elicited deep scepticism from mainstream economists, who questioned the validity of classifying social interactions as a form of capital. An increasing number of economists now acknowledge that social capital shares at least some similarities with financial, physical and human capital in its intertemporal dimension and its ability to generate a stream of future benefits. These benefits include information sharing and the matching of people to economic opportunities, mutual aid and insurance, as well as effective collective actions.

We use systems research principles to weigh the amount of social capital in an industrial/service company, research institution, university, consulting firm, sports club, professional organization, etc. As a by-product we demonstrate how such principles can be used to contribute to better understanding of social capital, as a complex phenomenon in new economy. We present two new models for an analysis of social capital of a firm.

We define social capital as a resource that is composed of formal and/or informal relationships among workers, teams, organizational units, etc. within a firm, as well as its so-called organizational culture, viewed as a pool of formal/informal rules, principles, behaviour standards of people, procedures, etc. It is one of four forms of the entire capital of an analysed firm. The other three forms are: financial capital, physical capital and human capital.

The above partition of the entire capital of a typical firm into four forms is a base for the accounting model for an analysis of social capital, in which we claim that the market value of an analysed firm equals the sum of the value of its financial, physical, human and social capital calculated or estimated for any moment from the past, the present and the future of a firm. The market value of a firm is understood in one of two ways: either as the value defined via a stock exchange or as the value established as a result of the negations between a seller and a buyer.

Using the accounting model we claim that in one-man company the value of its social capital equals zero, i.e. there is no social capital, since it takes at least two staff members, two organizational units, etc. to build any relationship in a firm. We use the accounting model to analyze social capital of a university and a sports club. In the first example we demonstrate that it is useful to consider a multi-stuff organization as a set of a particular number of one man companies, each with corresponding human capital.

We introduce the concept of the virtual production line and demonstrate that it can be considered as a natural development (phase) of the well-known (classical) production (assembly) line concept, realized in practice for the first time by Henry Ford. We define the classical production line as a partition of a complex production/service process into a fixed number of simple operations (jobs) done by simple workers on a line (belt). In the case of many classical production/service lines manned by people or robots, we agreed for the purpose of our analysis, to join them into one production/service line, which is called the classical production line. We observed that the partition of a process into jobs is fixed for a time and does not allow any self-organization, i.e. the workers on the line cannot change the organization of the process.

We consider a virtual production line as a hypothetical belt, where we have a number of experts (teams of experts), scientists, specialists, etc. with their laptops, computers, data bases, etc., connected via the Internet or any ICT networks, solving a more or less accurately defined problem of our firm during a creative process. The experts combine their human capital, mostly their tacit knowledge with the codified knowledge to solve in a creative process a problem which may be at the beginning not well defined and described in a murky way, but due to their efforts (self organization), it became to be more and more clear-cut.

So, we define the virtual production line as a division into more or less precisely described tasks (jobs) of a complex, perhaps not so well-defined problem-solving process (creative process), combined with modern ICT. The division of labour into tasks as well as the number of tasks may be changed during the creative process by experts (team of experts) involved in the process. Such a modification is called self-organization of virtual production line. Obviously, self-organization may recur over the creative process. We observe that on the virtual production line we have, in general a division of labour, not a partition of it, as it is in the case of the classical production line. We also note that unlike the classical production line, the virtual one is not a division of labour alone but combination of labour division with modern ICT and self-organization.

The virtual production line forms the essence of the managerial model for an analysis of social capital. We conclude such an analysis with three observations: In the first, we note that without modern ICT, the value of social capital of the firm is negligible. This is true, inasmuch as we note that social capital became a subject of serious studies only in 90's when we began to be able to send information, data, etc. to virtually every corner of the world at almost zero cost. So, the information proximity is of a key importance for the virtual production line.

The second conclusion consists in observation that the history of improvement/development of the classical production line delineates directions for research on the virtual production line. In fact, the second is a natural development (phase) of the first one. We note that the virtual production line is an instrument (a transition belt) experts use to combine codified knowledge with their tacit knowledge, competence, experience etc., to produce improvements in products, services, technology and management, and contribute to the stocks of knowledge, both codified and tacit. Otherwise stated, it is a device on which social capital of the firm is making money (financial capital), using human capital of its experts and its physical capital (computers with software, data bases, communication networks, patents, licenses, books, etc.), acquired with a view to creative process.

Finally, in the third observation we argue that in new economy a big organisation combines the classical production line with the virtual production line. In fact, generally speaking, such

a business runs a number of classical production/service lines, turning out goods and/or services, and a number of virtual production lines, as different problems may be solved there at the same time. A virtual production line makes innovations and improvements, viewed in a very broad sense as change for the better on a 'here and now' basis, accepted by the market. Since for a vast majority of SME`s, creating the virtual production line is practically impossible, they turn attention to clusters where alongside research institutions, universities, etc. they build a virtual production line to solve problems faced by respective clusters. So a given cluster can considered as the virtual production line and clustering, the process of cluster formation may be described as a design of the virtual production line. This is the essence of the innovative industry in new economy.

Knowledge networks and their evolutionary-institutional character
Michael Steiner and Michael Plodder -Joanneum Research, Graz

Theoretical box

Knowledge networks and their evolutionary-institutional character

Michael Steiner and Michael Plodder
Joanneum Research, Graz

Cluster policy should be legitimized from an institutional perspective. Despite legitimate recent criticisms concerning the theoretical foundation, the empirical validity and the policy implications of the cluster concept the concept has to be taken as a unifying approach for important elements for the changing character of the innovation process. The legitimization of clusters significantly changed from a predominantly material linkage and agglomeration based concept to an institution that supports knowledge generation and the sharing of knowledge.

Despite the basic institutional character there is a strong diversity of clusters both in form and content. In the context of evolutionary and institutional economics arguments are developed that emphasize the specific character of clusters as a form of governance enabling the generation and diffusion of knowledge within and between networks. As institutions they are co-evolving with new technologies and reveal both internal and external variety. In a globalized world of freely moving capital and increasingly freely moving people, it is only social capital that remains tied to specific locations. Thus, the "knowledge-based economy" is characterized by the hyper-mobility of information partly also of knowledge and the local character of social capital as a fore-condition for knowledge generation. What does this mean for the institutional setting of knowledge networks in an internationalized framework? What is the relative importance of local versus international knowledge exchange? The relationships between the firms become more complex, risky and require to be redesigned in a long-term perspective. This has compelled firms to devise new organizational forms and contractual arrangements, which may be capable to manage these new and more complex relationships. There is evident progress in the conceptualization of contents and forms of knowledge exchange and learning within networks.

Governance structures are never deterministic – cluster analysis has to avoid being "oversocialized". Within clusters there is ample room for human agency. One of the basic elements of an evolutionary approach is the creative function of the market as also expressed by innovative behaviour supported by clusters. Yet clusters do have a tendency for exclusivity – part of the goals of networks is to create some kind of knowledge monopolizing market of proximate firms and related support institutions.

As an evolutionary institution clusters are also exemplars of the relationship between economic organization and economic development. One important aspect of this perspective is that institutions like clusters are not automatically there but that they are the result of an evolving process shaped by policy activities and entrepreneurial behaviour responding to new challenges. This implies a changing character of institutions in support of knowledge creation and sharing – clusters as a form of "social technology" are co-evolving with new physical technologies and are therefore in a constant need to change themselves. Institutions are

themselves shaped by economic behaviour and hence subject to change. Since there is definitely room for agency there is ongoing interaction between the agents and the clusters which is a driving force for the adaptation of clusters. So there is in-built endogenity in the development of clusters: their institutional forms are exogenous in the short-run (so setting the framework for economic relationships and development), but become themselves endogenous over the longer run. The changing character of clusters – in forms of organisation, in the kind and mechanism of knowledge sharing, in their geographical reach – becomes a challenge for further research.

If clusters are a certain institutional response to a historically given logic of production then clusters themselves have to undergo change. As long as economic growth is to be understood as an evolutionary process the nature and dynamics of the organization of production, the role and change of institutions and technology and technological advance has to be specified.

The governance of interactive learning networks

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Theoretical box

The governance of interactive learning networks

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The diffusion of knowledge and the process of innovation creation in a cluster depends on the "institutional thickness" of the innovation system to be considered.

Information flows through an interactive process and new knowledge is created through the combination of existing information and knowledge within learning processes, which involve groups of individuals, call for the development of links, networks and social and cultural institutions and conventions among different actors. Thus the co-ordination of this interaction process represents a key policy field.

Learning proceeds according to an evolutionary and adaptive processes, both dynamically (in time) and spatially (through regional diversification and integration). Innovation is the result of decisions of the various interacting agents not based on the principle of substantive rationality, but rather on that of procedural rationality. No complete sequence of decisions can be preordained. To achieve coordination, organizations need to learn rapidly Thus, a good design of the organization procedures involving the interaction of the various actors is crucial.

Since economic systems are complex and evolving, the main problem is that of organization or coordination, i.e., how to guarantee that the various involved actors will adopt a coherent behaviour, so that they can jointly attain the desired aggregate result without dissipating resources. Institutions allow to save the limited cognitive capacity of individuals and organizations and facilitate the process of reciprocal integration. Their role is that to create new routines or baseline, which insure the adaptability of connections between actors.

The multiplication of players and layers of negotiation – international, national, and local – demands a different model of government, called "multilevel governance", based on organisational structures of interaction and partnership. Governance is the challenge of steering and positioning complex organizations. These can be committees, research groups, firms, networks, clusters, communities, regions and international agencies.

Governance is made by complex policy networks. The expression governance is used with respect to decision making systems, where the decisions are not taken according to the traditional hierarchical processes by a public authority ("government"), but rather through open forms of collaboration between a plurality of public and non public actors, which may differ between the various specific areas of policy and between the various levels of government.

Multilevel governance is based on forms of horizontal and vertical negotiation between the

various stakeholders, where the exercise of a hierarchical control is one of the components and it differs from the traditional free market approach, which thrusts automatic or non intentional mechanisms of interaction and, while advocating higher competition, leads to mergers and acquisition and greater concentration and various conflicts of interest. The governance model increasingly characterizes modern complex societies, where actors become increasingly different and interaction should be based on an higher division of tasks between the actors, in order to exploit complementarities.

Economic development is stimulated in those territories with highly evolved, complex and flexible institutional systems where a multilevel governance as a coordination mechanism is essential to assure cohesion, mutual comprehension and harmony between different agents

Territorial Knowledge Management (TKM) represents a new perspective to regional innovation policy. While traditional innovation policies mainly focus on financing the individual firms and providing financial incentives to R&D investments, the TKM framework indicates the need to promote the various factors which determine willingness and capabilities of firms in investing in an innovation strategy and facilitate the interactive learning processes among the different local stakeholders leading to innovation. In particular, according to the TKM, an interactive learning process involving various local actors is promoted by actions working on six different levers: the existence of an external stimulus, the level of accessibility between actors, their receptivity to external relationships, the building of a local identity, the enhancement of creativity, the capability to govern the innovation networks.

The study of the aeronautical cluster in the Campania region has allowed to identify some problems of the governance of innovation networks and weaknesses, which are shared also by other less developed regions.This cluster has a rather long history, which goes back to the beginning of the XX century and represents one of the few high-tech industrial clusters existing in the Objective 1 regions of the European Union. It is composed by approximately sixty specialized firms and research centres and by various large national enterprises, working for the major international firms in the sector.

Innovation seems to develop mainly due to an adaptive process of the firms, responding to the constraints determined by the external requirements of the clients and to the availability of external financing of R&D by public institutions, rather than being the result of a deliberate strategy aiming to exploit external opportunities and to face the emerging threats of the globalization process.

Most of the different stakeholders often do not share a common identity and interpretation of the needs of the cluster and that explain the difficulties to reach a consensus view on a common strategic perspective, as it would be required to form a critical mass of human and financial resources and infrastructures needed in important technological innovations.

The existence of relationships and the effectiveness of the joint initiatives seem to be related to informal and personal social ties rather than to the existence of a formal network having a certain degree of institutional thickness.

In the local context there are some invisible barriers, such as the scarce mutual knowledge, the problems of communication and the difference of language between the different actors, due to the difference of the system of values, fields of competence and adopted technologies, especially between the large companies and the SMEs and also between the industrial firms and the non industrial private and public organizations.

The circulation of information in the network of local actors is characterized by asymmetries between these actors, when some stakeholders do not allow full access to information to all actors, intentionally or due to deficiencies in their communication strategies. Such asymmetries result in distorted decisions and undermine consensus, hence discouraging participation.

SMEs, as well as some intermediate institutions, above all financial ones, have a much weaker role, if any, in participating and influencing the multilevel governance process within the regional innovation system

Thus, the governance model adopted in the Campania aeronautic cluster has still a rather hierarchical nature and, although knowledge is no longer concentrated in the hands of a few privileged subjects, some local actors seem not to have equally benefited from advantages deriving from the participative and cooperative process or to have been cut off from these advantages.

The adoption of the TKM framework in Campania region and other less developed regions indicates:

- lack in consistency of the interactive learning process,
- weakness, and in some cases, absence of the intermediate institutions to influence and stimulate the decision-making,
- insufficient level of coordination among stakeholders,
- the absence of a strong catalyst of the governance process, able to promote, mediate, and represent the common interests,
- regional policy and EU regional support are mainly linked to short tem budgetary constraints and targets, on the contrary innovation policy requires a long-term perspective.

Thus, to increase the strength of the network and to produce new knowledge for the cooperative innovation among sectoral/local and regional systems, stimulating, at meantime, the transnational partnership between agencies of innovation and transfer, suggested policy guidelines are:

- the strengthening of partnerships between public and private structures, assuring more cooperation and continuous relations in the production, transmission, diffusion and use of knowledge and information,
- to understand the mechanisms of participation to the network by small stakeholders, strengthening their involvement both in the decision-making process and in the optimisation of the production cycle,
- to consolidate the long-term evolution of the strategic approaches of the different stakeholders and to reciprocally recognize it such as a source of competitive advantage,
- to enhance interactive learning processes and the organization of joint innovation projects between the local actors,
- to promote a greater international integration.