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TITLE

The innovation system vs. cluster process: common contributive elements towards regional development

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ABSTRACT

Recent approaches to the study of innovations enhance some similar aspects of the innovation process in knowledge-based economies: (i) the systemic and interrelated nature of innovation and (ii) its geographic and inter-economic activities density of networking.

One perspective is linked to the innovation systems approach at the national, regional and local level. What we know so far is that the most specialized forms of knowledge are becoming a short lived resource, in face of the (increasingly) fast changes that are occurring in the global economy; it's the ability to learn permanently and to adapt to this fast changing scenario that determines the innovative performance of firms, regions and countries. Another approach is to be found in the research on cluster development, where proximity and interrelated technical/technological linkage are the main features to take under consideration.

Although these two approaches operate at slightly different spatial scale of analysis, they both allow the identification of a set of key factors that contribute to understand the way in which institutions and actors, considering the innovation system or the cluster process, participate in the innovation atmosphere and in the economic growth. Nevertheless, both approaches show the same limitation: they tend to focalise into the descriptive and analytical level, disregarding the explanatory level. Local and regional authorities are, mainly, interested in the process of cluster intensification in the local and regional economies context. These features stress out one other controversy level: are the "hard" location factors (the concrete tangible location factors) more important than the "soft" location factors (qualitative, intangible factors) or vice-versa?

This paper aims to explore the current knowledge about this process and to open some fields of future research.

KEY WORDS: innovation system, cluster, knowledge-based economies

TOPIC:
Entrepreneurship, networks and innovation

1. Knowledge-based economies as a conceptual framework

In recent years the learning and the knowledge have been attracting a growing attention as a result of the perception that knowledge-intensive industries are in the core of the economic growth and that the actual society is to enter in a knowledge-driven economy or, even, it's restructuring itself in a new form of knowledge society.

In a knowledge-based economy (KBE), knowledge is the main engine towards economic development.. The promotion of a KBE is one of the national key-strategy, in developed countries and in less developed countries, in the actual world.

Some economists that got the attention to the role of the human knowledge in the economic growth have stated the importance of the knowledge[1] to the development. Solow (1957), in his seminal study, showed that commercial innovation obtained by existent technology is more important than investment in capital. Romer (1990) is one of the so-called new growth economists that consider the knowledge as the basic form of capital and he discusses that the process of knowledge accumulation is the key for the economic growth. This author does consider the knowledge as the third production factor, beside the capital and the land.

The third great world revolution is the transition of the industrial economy to the knowledge society, as putted in Table 1, which is taking place faster than any other before.

Table 1: Essential characteristics of the knowledge society

Attributes	Industrial Paradigm	Knowledge Paradigm
Model of Production	Economy of scale	Flexible
Human Resources	Skilled labour	Versatile and enterprising
Time	Great response times	Real time
Space	Limited and defined	Unlimited and indefinite
Mass	Tangible	Intangible

Normally, the knowledge presents a positive correlation with the GDP *per head*, what implies that the knowledge gap among economies can reflect the difference at the economic level and in the standard of living.

[1] The typology of knowledge can be resumed in: know-what - factual and cultural knowledge obtained from the books and the experience; know-why – scientific and technologic knowledge obtained from investigation; know-who – attends to the professional capacities and capabilities (skills) obtained from experience (learning by doing); know-who – information about who knows what and knows how (learning by interacting).

Houghton and Sheehan (2000) mention as main differences among a KBE and an industrial economy: (i) the information revolution that intensified the knowledge codification and that speeded-up the information transmission; (ii) the emergence of flexible organizations, based on multi-task responsibilities, team work and professional mobility, and that can reach high quality and specialization of the product, with speed and low unit cost of mass production; (iii) crescent demand for knowledge, techniques and learning; formation of hierarchical networking, driven by change and learning; learning organizations that seek connections in order to promote interactive learning among companies and that seek partners and networks to supply complementary goods or services, and that, in the group, allow the formation of systems (or centres) of innovation and economic clusters; (iv) global competition and production; (v) importance of the knowledge society by itself; (iv) complex creation, production and distribution link formation; (vii) industrial concentration opportunity.

It is evident the need of a model that attend to the future age of the information and not the industrial age of the past (Gibson, 1998) and that allows development in the course of a new form of creative destruction (Imparato and Harari, 1997), in the sense of a continuous creation and destruction of the specialized knowledge (fast changes implies fast learning – to learn and to "unlearn" means need for constant competence reconstruction).

OECD (1996a: 7) defined KBE as "economies which are directly based on the production, distribution and use of knowledge and information." Another definition is brought by Petit (2002: 4): "This leads us to define the would-be new growth regime as a set of institutions and organisational principles, superseded by a political convention that could altogether coordinate in a viable way such knowledge based economies where economic actors can obtain information and implement knowledge which significantly alter their strategic capacities."

Among the several existent definitions, a KBE can be understood as an economy in that the production, the distribution and the use of knowledge play the main part in promoting development, in the wealth creation and job creation in all economic sectors. Implicit in this definition it's the fact that isn't just the knowledge-intensive sectors but also the traditional sectors that may need to explore and to use the knowledge.

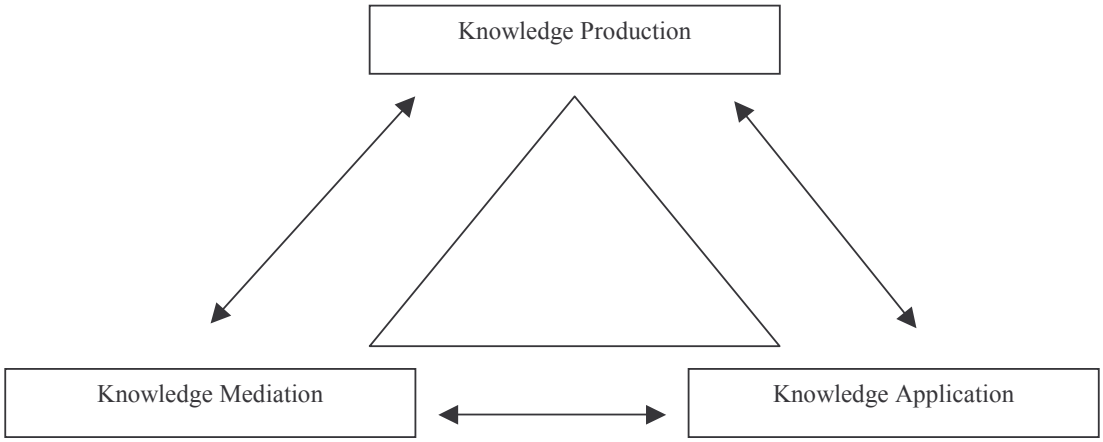
One of the most important conceptual aspects of a KBE is the knowledge process, which implies the linkage among the creation, the distribution and the knowledge use.

Two models can be taken under consideration for that effect, as portrayed in the following figures: in the first case, the process of knowledge is understood as analogue to the case of a good or service; in the second case, interactivity and retroactivity is added to the process (positive feedback).

Figure 1. Linear Model

Source: OECD (2000)

Figure 2. Interactive Model



Source: OECD (2000)

Another conceptual aspect of a KBE is the structure of the economy: main actors, organizations, resources, industries and institutions. Additionally, the spatial aspects of the knowledge are also important, once a fundamental conflict exists (still) among the nature of the knowledge (transnational) and the national space entities. This aspect can be overcome by a network commitment.

There are four approaches that can be made concerning the KBE (Smith, 2002).

There are the ones who believe that the knowledge is, quantitatively, far more important than previously as an input. Drucker (1998: 15) suggests "Knowledge is now becoming the *one* factor of production, sidelining both capital and labour." In the same sense, OECD (1999a: 7) refers that "(…) the role of knowledge (as compared with natural resources, physical capital and low-skill labour) has taken on greater importance."

Then, is possible to consider that the idea that the knowledge is, in some ways, more important as product today than it was before, in the sense that the number of firms and the form of activities based in the transaction of knowledge products are increasing extremely fast.

It also exists the perception that the codified knowledge is more significant as component of a relevant base of economic knowledge.

Finally, there are the ones that discuss that the knowledge economy is sustained in the technological changes of TIC (Technologies of Information and Communication), once the innovation in these aspects modifies the physical embarrassments and the cost of obtaining and spread of the information (to see, for instance, Lundvall and Foray, 1996[2]).

The available data allow verifying that a general tendency doesn't exist in the economies that allow removing the illation that the investment in knowledge has been growing in importance relatively to the physical investment (OECD, 1999a).

The first major impact of the globalisation was to reduce the impact of the location; the more universal the Man becomes, more tribally he acts (Naisbitt, 1998). The growth source in the economy is in the scale reduction, from the big and medium companies to the small and micro ones and, progressively, towards the individual.

This phenomenon is enhancing the importance of the "domestic base" (the unique critical mass of competences, knowledge, suppliers and local institutions that transform certain locations into innovation centres in a specific economic sector), once the global markets and companies annulled the obtaining advantages at the distance, because they all have possibility to do the same.

The probability of a company to have success in a certain sector it's significantly increased by it's location; where it was used to be more important the scale of the company, today it's more important the scale of the cluster, which enhances the specialization (Porter, 1998).

The technologies sweep potential advantages and the residual advantages become more and more important; these residual advantages are essentially linked to the innovation and this should be intended as resulting both from articulation of politics

[2] LUNDVALL, B-A. and FORAY, D. "The knowledge-based economy: from the economics of knowledge to the learning economy" in OECD (1996) *Employment and Growth in the Knowledge-Based Economy*. Paris, OECD.

and coordinated strategies and linked to the adoption of the KBE concept as a prospective model (Guimarães, 1998).

As for the implications of KBE for the organizations, is possible to enhance the fact that it offers business opportunities and performance improvement, but it also involves fast change, uncertainty and turbulence and it puts adjustment problems; for the governments, they should manage the wealth distribution in the KBE in order to accomplish it's social cohesion function; finally, at the international level, the development gap among the countries, in what development and social-economic perspectives is concern, it can be significantly increased if the less developed countries fail in the preparation for a effective participation in the KBE.

OECD has been documenting evidence of a strong relationship between knowledge and economic development and the growing contribution of the knowledge in the economic growth and in the well being of the countries.

The KBE is, in its essence, characterized by five dimensions (adapted from World Bank, 2002):

1. National System of Innovation: innovation and technological change are supported by an effective national system of innovation, a net of institutions (public and private) whose activities and interactions begin, import, modify and diffuse new technologies and practices, in way to allow to add value to the products and services (Gonçalves, 1999).
2. Human resources: the high level education and formation along the professional life become essential goods for an adaptation of the workers to the technological changes and of the companies to the (creation or development) of the innovation capacity.
3. Infrastructure at the information technologies (IT) level: existence of efficient structures at the IT level that allows easiness, speed and low cost in the access to the information; the new IT radicalise by the change in the productive patterns in all of the sectors, in the work organization and in it's own work functional content.
4. Entrepreneurship: the companies are the main knowledge, information and technology users.
5. Institutional environment: they fasten the rules of human and social behaviour.

Table 2. Dimensions of a KBE

Dimension	Intervening Agents	Main function			Temporal Effectiveness
		Production	Distribution	Use	
1.	– Institutes of (R&D), public and private – Universities	☺	☹	😐	Slow
2.	– School	☹	😐	☺	Slow/Fast
3.	– Government – Companies	☹	☺	😐	Slow/Fast
4.	– Companies	😐	☹	☺	Fast
5.	– Government – Society	All	All	All	Slow/Fast

Note that: ☺ = very active, 😐 = active and ☹ = less active

The people should be prepared for the coexistence of their creative, innovative and enterprising capacities with unstable atmospheres of operation, in pair with the speed of the change and of knowledge emergence. The business learning is essential to the companies' strategies, just as the adaptation to the change.

The KBE are, by definition, societies that learn. In fact, the economy of the innovation was always centred in the learning; the technology and the innovation were always had as the main suppliers in the creation and knowledge diffusion.

The generation of knowledge and of innovation implies (Lemos, 1999): the development of scientific and technological trainings and significant efforts in self-learning processes in the productive process (learning by doing), in the commercialisation and in the use (learning by using); the search of technical solutions in institutions of R&D (learning by searching); and in the interaction with external sources (for instance, inputs and equipment suppliers, franchisers, customers, users, universities, …) (learning by interacting).

To become a KBE means more than just to have a trembling "new economy" or "information economy"; in a KBE, all of the sectors become intensive knowledge, and not just the so called high-tech sectors.

In the recent years, the concept of competitiveness has become more complex, has gain real dynamics and the field of business activity has become global, allowing innovative behaviours in three types of innovation systems (Guimarães, 1998):

- Business systems of innovation
- Local systems of innovation
- National systems of innovation.

Our analysis will relapse on the second case, in the following pages. In the local systems of innovation (clusters or industrial districts and regional systems of innovation) the companies learn how to innovate continually (although the innovations are not apparent) through a systematic use of competences generated by cooperation procedures (Mitra, 2000) and interaction.

2. Regional systems of innovation: the implementation of the dialogue between the cognitive and productive spheres

It can be said, in very synthetic terms, that an innovation system understands a certain productive system and its political-institutional involving. In agreement with the perspective transmitted by Lundvall (1992), it is possible to establish the distinction between a strict definition and a wide definition of innovation system: the first would take to include in the concept of innovation system the organizations and the institutions involved in research and exploration activities - such as the departments of R&D, the technological institutes and the universities; on the other hand, in a wide sense, the concept can understand all the parts and aspects of the economic structure and of the institutional structure that "rules" the learning process and, of equal way, the research and exploration activities - the production system, the commercial system, the financial system, the educational and formative system, etc. Has noted by Asheim and Isaksen (1997), the first definition, *strictu sensu*, is inspired by the linear model of innovation, while the most open and including perspective, transmitted by the second perspective, it seems to have conceptually drunk in the interactive model of innovation.

The innovation system concept was first proposed at the national scale level by Lundvall (1992), and it reflects, naturally, the political, administrative and institutional specificities that are more evident among different countries than in national space areas. Its analytical concerns are focused in the relationship among the sectors of dominant activities at the national scale and the effective political-institutional picture of support to the innovation. However, early it was demonstrated that, to deepen the knowledge of the innovation *versus* business and territorial development problem, it turned out imperative to establish a more sharpened focus on: on one side, the analysis of the innovation dynamics that happens in specific economic sectors that demonstrate some homogeneity, in a perspective of study of the horizontal and vertical relationships promoted by certain technological clusters, what

took some authors (Nelson and Rosenberg, 1993; Breschi and Malerba, 1995) to propose the concept of technological system of innovation; on the other hand, the consideration of the differentiated characteristics of the regional economies, the histories of economic success of some European areas based essentially on the strength of a business fabric of small and medium load (for instance, the canonical industrial districts of Third Italy) and, still, the progressive recognition that the community regional politics, factors that, in common, implicated the resource to a new instrument of territorial and economic analysis that it is structured by the concept of regional system of innovation, firstly proposed by Cooke[3], in 1992.

It seems to us that there is a dialectic in which the productive systems are increasingly confronted with the economic forces game that, in practice, it has been corresponding to an accelerated globalisation movement, of standardization characteristics, and, simultaneously, to a movement of deepening the territory mechanisms, revaluating the regional scale as economic promotion factors.

Since the theory elaborated by Aydalot (1986), founded in different location theories, that as become possible, with some objectivity, to stress out the potential factors, with spatial incidence, of the innovation process:

Table 3. Potential factors of the innovation process

Relative aspects to the local business fabric	Attraction Factors	Synergy Factors
Number of companies	Transport, communications and telecommunications infrastructures	Investigation infrastructures
Industrial structure	Professional formation structure	Consultancy services
External dependence degree	Quality of life	Changes of information inter-companies
Importance of R&D	Venture capital	Human capital

It's interesting to verify that the several vectors that allow to build the notion of regional system of innovation all consist of this conceptual elaboration accomplished by Aydalot (op. *cit.)*; however, it is mandatory here to call the attention to the fact that what's in stake isn't the study of the group of the attraction and location factors of the

[3] The concept of regional system of innovation result, as usual in these matters, of the maturing process of late formulations proposed by other authors: innovation regional potential (Meyer-Krahmer, 1985), regional innovation complex (Stöhr, 1986), innovation networks (Camagni, 1991) and regional technological politics (Rothwell e Dodgson, 1991).

productive activities but the way as they model attending to the social and economic characteristics of the territories and, namely, the connection structure and the operation dynamics between the companies and the support institutions, in what respect to the production of the innovation in their multiple dimensions.

The key word of the concept of regional system of innovation seems to be interaction (networking): among companies, between companies and institutions of the support envelopment, among these own institutions,... . The diversity of configurations of the regional systems of innovation (RSI) depends, in this way, of the institutional support involving and of the specificities of the productive systems structure and, also, of the diversity of articulation forms among these two sub-systems. More than the consideration of the different attraction and business location factors, underlying to the notion of regional system of innovation it is the idea that the induction of more innovative, qualified and competitive business patterns is related to the organizational and institutional arrangements that structure a certain territory in an entity of polycentric coordination. Precisely, the RSI are based on the use of the social organization in order to promote the innovation and the economic development (Thomas, 2000), trying, in that sense, to induce a proper lever effect on the competitive levels of the respective production systems. Those organizational archetypes should also be understood as creation factors of a conducive climate to the innovation and, simultaneously, to the reduction of the inherent risks of that technological-productive option.

As it is inferred, an irreplaceable dimension of the concept of regional system of innovation is relational, not being enough the presence of a set of institutions in the territory so that the specific effects on the economic development become real, being necessary the existence of appropriate strategies on the part of the different social actors to take advantage of the resultants synergies (Almeida, 1994; Santos, 2002). That contact culture and the consequent convergence of cooperative nature behaviours derive of an historical, cultural and economic common background, namely a strong productive integration resulting from the territorial concentration and of the sense of community values belonging and, also, of the share of a regional prospective common picture, that allow the actors to delineate united strategies and to minimize the inherent decisional risks. Imperative it's that the organizational and institutional rearrange that walk "hand in hand" with the notion of regional system of innovation allows a collective productive efficiency (almost relational income) superior to that

that would result of the simple addition of the individual strategies of the social actors (Gilly and Grossetti, 1993). If we remind the different strategic objectives, the different representations and temporalities concerning to the several actors of a certain relationship space, we noticed clearly that the underlying challenge to the concept of regional system of innovation - the one of allowing the emergence of a common rationality and collective learning processes aiming the promotion of the innovation - it is complex and only reachable in medium and long run temporal horizons, once that dynamics seeks to induce, above all, modifications of structural nature with reflexes on the competitive acting of a given regional economy.

That is also the opinion of Autio (1998) that, by adopting a perspective that depreciates the production mechanisms and spread of tacit knowledge, considers that the RSI are constituted by two sub-systems: the knowledge generation and diffusion system, of nature essentially public and including institutions of R&D, teaching and formation institutions, technological centres, technology transfer institutions, etc; and the application and exploration of the knowledge sub-system, that has characteristics predominantly private, constituted fundamentally by companies, vertically and horizontally related, and that form the commercial slope of the RSI. It is assumed that the main feature in the good functioning and acting of the RSI lies in the interface among the sphere (business and institutional) that offers specialized support services to the companies and the business sphere, above all in what it respects local SME, being, in this sense, central objective of this regional development instrument the dynamic adjustment among those two universes, in the perspective of obtaining added levels of business and territorial competitiveness.

Table 4. Indicators of the potential of the RSI

SRI with higher potential	SRI with lesser potential
• Fiscal and financial autonomy • Regional capacity to establish financial partnerships • Self-competences of mediation and promotion • Control and influence on the strategic infrastructures • Universities rooted in the area • Presence of R&D centres • Educational politics and regionalized formation • Regional strategy of innovation	• Tax and financial system without autonomy • Regional incapacity to establish financial partnerships • Limited competences of mediation and promotion • Absence of control and influence on the strategic infrastructures • Universities not rooted in the area • Absence of R&D centres • Standardized educational and formative politics • Casuistical innovation projects

Source: based on Cooke *et alii*, 1998: 1557

In an operative logic, Kirat and Lung (1999) argue that the transformation of the space and the technological proximity in regional system of innovation implies an organization deliberately institutionalised, in other words, that the cohesion of that system is assured by collective action logic and for the share of formal and informal rules of behaviour. If, specially in the case of the industrial districts, that territorial coherence results of the informal mechanisms existence and operation, in which the cooperation among social actors is, first of all, the result of the communion of non formalized collective principles, in the case of the RSI that dynamics results of the conjugated acting either of collective processes based in norms and rules more or less informal and in homogenous cognitive patterns, or of planned creation of formal institutions, such as technological interface centres, R&D centres, formative and educational organisms, financial institutions focussed to support innovative projects of added risk, etc. Therefore, in the RSI, it's aimed the assemblage of functional synergies among the several actors of the scientific, technological and business spheres, which, as it is inferred, crosses the extent of the physical proximity vector broadly, paying more attention to the development of inter-agents cooperation projects, reinforcing the net of connections through territorial mechanisms in the attempt of creating, at a regional scale, clusters (agglomeration economies) that boost the emergence and the growth of technologic based MSE's. As suggested by Gilly and Grossetti (1993), the RSI should be understood as regulation mechanisms of the respective productive systems, allowing to mould the institutions and the individuals behaviour to territorial logics of innovation and of competitive reinforcement by the decrease of the interaction barriers and by the implicit fomentation of a appropriate climate of larger proximities at the technological and economic level. It doesn't matter, for that reason, to set out the problem of the territorial and business development just from the point of view of the institutional thickness but it must be considered also criteria linked to the respective institutional capacity that refer to their performance levels (Bache and George, 1999). One of the important aspects of the RSI approach, in our perspective, is the emphasis putted in the correct definition of the territorial based institutional picture that the different local actors use, creating economic and territorial opportunities and minimizing, simultaneously, the occurrence of a casuistical logic of intervention and of non-coordinated practices.

The objective of these assertions claim for the absolute need of questioning *ab initio* the usual answers and the implementation of solutions whose main virtue is to point

out some possible ways concerning mere reinforcement of the regional institutional fabric in the area of strategic business support services and of innovation incentive. More than just creating new institutions, is far more important to understand accurately and globally the territorial architecture, developing a regional prospective picture and a new comprising identity that could be used as a social actors gathering instrument, promoting the decrease of the interaction and transaction costs, generating, cumulatively, synergy effects among the institutional and technological-productive dynamics - the outlines that shape this problem aren't, in essence, much different from those that emphasize the innovative environment means and the intelligent regions.

In short, the essential characteristic of the RSI is the articulation of a certain technological and productive dynamics, which flows from specific organizations strategies that constitute them, with a territorial dynamics that refer to integration strategies of those organizations in the socio-economic regional context. As underlined by Gilly and Grossetti (1993), the RSI bases it's dynamic not only in a pre-existent resources logic of allocation, spread in the geographical space (location theory), but, mainly, in a new resources creation logic through new organizational forms that come from the located cooperation relations.

3. Clusters: the globalization of the places

In the course of the 80's, a growing literature emerged in the course of territorial impacts studies in dispersed places of the industrialized world, the globalisation impact, the integration of the national economies in the world economy and for the growing technological evolution that dictated a new paradigm.

This literature recognized the growing substitution of the previous "fordist accumulation model", based on the dominant presence of big enterprises with a vertical production regime, by a model of flexible accumulation, focused in more decentralized productive forms and less dependents of scale economies formation ("post-fordist model").

This new model has created growth opportunities for countless SME's, either in industrialized areas or in less developed areas, linked to big companies or working in an independent way, operating in market niches or in the big companies markets and whose location is less dependent of the traditional location factors (Sengenberger and Pyke, 1992; Sengenberger *et alli*, 1990; Pyke *et alli*, 1992).

A specific characteristic, common in several countries, it's that SME's are in agglomeration system in certain locals or areas and whose activity has been developed in reticular system of complementarities, interdependence and cooperation. That agglomeration (clusters or industrial districts) they have result in an increase of the collective efficiency, which elapses from the externalities generated by common action, providing a larger firm competitiveness.

In the knowledge and networking era, region becomes preponderant as productive organization and the innovation *locus*, base for the innovation and competition.

From the productive restructuring in Italy[4], some literature allowed the development of the concept, restricted, of industrial district towards the cluster, capable to involve the whole type of business agglomeration, geographically bounded and sector-specialized, independent both of the productive units dimension and the nature of the economic activity.

OECD (1999b) defines cluster as synergic production nets constituted by companies that are strongly interdependent and connected to a chain of production of increased value. The same report also refer that the clusters can comprehend alliances among the companies and the universities, the R&D institutes, the intensive support services of the business activity and the customers.

In the initial perspective of Porter (1990), clusters are productive concentrations of companies that act on a common economic base (therefore, competitors), complementary (that supply components amongst themselves), interrelated (that supply equipments, consultancy or specific services to the main companies) and that interact (they have active and/or multidirectional relations). The argument of Porter (1990), in the analysis of the located competitive advantages, it's that the sectoral economic strength results from the local industries competitiveness and that, in the global world, the economic agents should think globally and act locally. This argument allowed sustaining the location advantage scheme whose vertexes define the elements that are decisive in the atmosphere in which the companies are "born" and where they learn how to compete.

The clusters can be understood as formatted by the following characteristics:

a) a great company or a concentration of companies of similar dimension, with upstream and downstream linkage identification;

[4] Third Italy industrial districts, namely the Emília-Romagna region.

b) sectors that use common suppliers or that supply complementary products or services;
c) companies or institutions that supply specialized qualifications, technologies, information, capital, infrastructures and sectoral associations;
d) public institutions and other regulator organisms that exercise influence on the agglomeration.

The influence of a cluster on the economic productivity and competitiveness levels is supported on three classes:

- Agglomeration economies: advantages and external economies to the individual business, by the cost reduction and productivity gain generated by the economic activities spatial concentration, by the suppliers network that allows an easier access and local supply of inputs, the complementarities and existence of correlated industries;
- Learning by interaction economies: economic gains that rise from lasting linkage with both customers and suppliers creating collective learning that allows improvement of the productive methods, of the quality of the products and of the technological training (innovative "milieu");
- Collective efficiency: combination between the learning by interaction economies, the private cooperation and the public support.

Starting of the existent literature, Albuquerque (2000) describes the existence of three representative types of clusters.

The clusters as regional industrial systems[5], involving combinations between three acting levels: the culture and the local institutions; the industrial structure, in terms of "bonding" among customers, suppliers and competitors and considering the local division of labour; and the corporate organization (inter-companies).

He also considers clusters as RSI[6], focused in technologies associated to productive activities in the machinery, equipment and automobile sectors. A small number of great companies and a great number of SME's form the productive structure. There are also a great number of training, technology transfer, R&D, financing and credit institutions.

[5] See also: Saxenian (1994). *Regional Advantage: culture and competition in Silicon Valley and Route 128*. Cambridge, Mass.: Harvard University.
[6] See also: Cooke e Morgan (1998: 83-113). *The associational economy: firms, regions and innovation*. Oxford: Oxford University.

Finally, the traditional clusters[7], related with traditional industrial sectors (shoes, clothing, ceramic, …).

In face of these representative types of clusters, it is possible to establish a typology, adopting for that effect the criteria used by OECD (1996b) for the industrial sectors classification according to its technological level (in terms of R&D intensity):

- High technology clusters (aerospace, computers, medicines, electrical machines, …);
- Average technology clusters (chemistry, transport material, non-electrical machinery, non-ferrous metals, …);
- Low technology clusters (food, beverage, tobacco, paper, clothing, leather products, petroleum refining, …).

An important paper must be attributed to the local agents (local public institutions, business associations, universities, investigation institutions and companies) as promoters of the competitiveness potential.

From the late considerations, it's possible to extract that the development accomplishment through clusters demand oriented actions in the search for both flexible specialization and collective efficiency, to turn easier the access to credit oriented to the investment (domestic or external), to the strengthen of the productive chain[8] (inputs, capital goods and services), to the identification of market niches, to the formation and training of the labour force, to the invigoration of the dealings with the innovation system (investment in research and technologic development) and to guarantee an institutional atmosphere providing the articulation between business entities and the public institutions. The cluster dynamic is always associated to a high degree of connections among the participant actors; when this assumption happens, it increases the innovative, enterprising and collaborative potential in the scope of the cluster, engendering salutary levels of domestic competition and uplifting the global ambitions.

Also in these ideas it appears the idea of the continuous learning, cooperation and high underlying competition environment implicitly to the cluster concept[9]; some

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[7] See also: Cooke e Morgan (1998: 114-133). *The associational economy: firms, regions and innovation*. Oxford: Oxford University.

[8] There is a fundamental distinction between productive chain and cluster: the productive chain corresponds to a vertical configuration connected to the economy of cost; the cluster is a horizontal configuration that deals with the economy of value.

[9] Recently, Porter has revisited his original work in the article *Clusters and The New Economics of Cooperation*, Harvard Business Review, pp. 77-90, Nov.-Dec., 1998. In this article, the concept has

authors refer that the existing interaction and cooperation network should be understood as intern to the companies (Castells, 2001).

The responsibility of the region, in this context, depends on its capacity to focus in activities allowing obtaining effective and dynamic comparative advantages, current of its stock of attributes and of its innovation promotion capacity, in a continuous way. The region should be constituted as flexible and innovative, a territorial space with favourable environment to the attraction of investment and business development and where the support institutions, public and private, exercise an inductor role of that development.

The promotion of clusters, in terms of the local and regional development architecture, is acquiring growing importance, in the sense that its existence offers great potential for the creation of competitive advantages. Even without the public intervention, they result in a set of location advantages, that Nadvi (1997) calls "passive advantages".

Finally, in the essence, the cluster concentrations are only possible through social capital (Putnam, 1996), materialized in the community taking part and in the reciprocity and trust concern, reflecting the level of community civics.

Porter and Putnam glimpsed two faces of the same social phenomena: the governments and the companies are the skeleton and the communities the metabolism of the contemporary development (interaction lies in the social capital and social capital generates interaction).

4. *Clusters and regional systems of innovation: a synoptic review*

The recent literature built around the analytical models that we have previously examined provides an interpretative broad-spectrum portrait of the regional dynamics and it adopts an interaction idea (network paradigm), trying to identify and to understand the cognitive, productive and technological extent that affect the territories nowadays.

Bibliography centred in the cluster and RSI approaches have been putting the emphasis in the importance that the formal and informal mechanisms of production, spread and use of strategic information and of knowledge have towards the competitive acting of those systems. Those relational paradigm based approaches

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pass over the initial entrepreneurial approach and it comprises a wider and complex connections set off features.

present the enormous interest of underlining the deep bond between the economic mechanisms and the extra-economic social forms when there are in stake important processes to the territorial qualification and the competitiveness, as the learning and the innovation processes.

Those approaches, which have been built with base in abundant scientific production, possess today a stabilized theoretical and analytical *corpus*, although it is still possible to point out some ambiguity and fluidity, especially because they didn't create a wide enough autonomy space that it allows distinguishing them amongst themselves with objectivity and rigidity.

Possessing clear industrial logic, the cluster notion is a territorialized set of interrelated companies, of specialized suppliers, of services providers, of companies belonging to related industries and of associated institutions that develop their activities promoting externalities that are echoed positively on the group competitiveness and innovation levels. In the cluster process, the centre of gravity of the dynamics is put upon the established relations along the direct and oblique supply chains. In operative terms, the cluster notion reveals great interest in the strict sense of identifying critical paths for the networks and key-connection consolidation, seeking the creation of more added value and to speed up the transition/development for a KBE.

The idea of RSI is connected to the institutional dimensions order. In fact, the promotion of adjusted institutional architectures to the respective productive system forms, in this model, the true lever of the business and territorial competitiveness, and comprises a marked operative sense that it’s not possible to find in the cluster approach. The concept of RSI assumes, today (and more and more), an eminently instrumental role, frequently associated to the innovation politics, differing by this more operative dimension of other approaches. The first objective of this model is, therefore, the reinforcement of the territorial levels of competitiveness, turning the environment more innovative and the regions more intelligent - in the scope of the classic trade-off between curiosity and utility, the RSI approach hangs sharply to the second alternative.

The possibilities of existence of an innovation system depend essentially on two factors: the space proximity and the technological proximity. The conversion of those two proximity aspects into territorialized innovation system presupposes that they are institutionally structured. In other words, it suits that logics of collective action and

the share of common rules assure the cohesion of a RSI. In certain cases, as the industrial districts, the innovative environments or the intelligent regions, that cohesion emphasizes the domain of the informal institutions, that is, rules and norms that prevail in the local socio-productive culture and that reduce the ambiguity levels in the reciprocal behaviours of the actors. In the other cases, the territory institutionalisation lies in the creation of formal institutions that allude to reorganizations in the *modus faciendi* and in the operative behaviour of a set of political and administrative action - such is the case of the RSI.

Figure 3. Synoptic comparison between cluster and regional system of innovation

	Cluster	**Regional system of Innovation**
Emergence	Spontaneous; starts from the local productive system	Induced; as organizational entity
Predominant climate	Industrial atmosphere	Business and scientific culture
Productive system	Industrial and tertiary; productive specialization in a sense of labour sectoral division; vertically disintegrated or almost-vertical integration; open	Industrial and tertiary; productive specialization in a sense of labour intra-sectoral division; big companies and SME; almost-vertical integration; open
Non-mercantile Relationships among the companies	Informal inter-personal networks of information diffusion; strong horizontal and vertical mobility of labour	Intensity of extra-production connections; importance and diversity of the formalized non-mercantile links (cooperation networks, strategic partnerships, etc.)
Companies connections with the institutional specialized support envelopment	High intensity of contacts; casuistic or strategic	High intensity of contacts; strategic
Connections with the exterior	Strong exposure to the exterior; insert in the international information and knowledge transfer circuits	Strong exposure to the exterior; insert in the international information and knowledge transfer circuits
Network Structures	Compact, with leader-company or with leader-sector	With leader-company or leader-institution (university, technological centre, etc.)
Logic	Of partnership; creation of collective learning mechanisms as a device to the	Of partnership; institutional architecture as lever of the business

	productive base competitive renewal; stimulation of the innovation potential	and territorial competitiveness; stimulation of the innovation potential; statement of a regional strategy of innovation
Dominant forms of knowledge	Tacit and/or codified; global	Codified; global
Dominant forms of learning	By doing, by interacting, by networking	By searching, by networking
Dominant modalities of innovation	Incremental, distinctive and radical - first of its kind; product, process and organizational	Incremental and radical - first of its kind; of the product, process and organizational
Growth dynamics	Competition-cooperation; induced by the activating the information and knowledge diffusion circuits	Crossed fertilization; strongly induced by the institutional scenario of support; dynamic adjustment among the entrepreneurial and institutional spheres; institutional aided business risk
Potential risks	Technological lock-in; increase of the hierarchic business phenomenon; logic of business promotion based on the international labour division	Relational and technological lock-in; exit barriers; institutional sclerosis; nationalization of the cooperation networks

The connection between the cluster and RSI concepts it roots in the understanding of the innovation dynamics of territorially linked processes, trying to analyse its formation and the elements that structure and typify them. Both approaches intend to reach the objective of passing from a comparative advantages paradigm (factorial endowment) to a competitive advantages paradigm (based on the learning and in the knowledge).

The contributions of these two approaches, of complemented characteristics, allowed the development of the literature on regional development dynamics. The existence of specific competences, the cooperation capacity between the actors, the institutional solidarity, the collective learning processes and the higher potential innovation achieved compile fundamental issues of the business and territorial development.

5. The cluster and the regional systems of innovation as instruments of territorial development - the peripheral regions with structural problems of development

As known, the present innovation policy, enhancing the adaptation urgency to the different territorial idiosyncrasies, comes more and more nearer to the typical approach of the modern regional politics that enhance the collective learning processes and the institutional innovation instead of aiming, almost exclusively, to provide the basic infrastructures stock (Henderson and Morgan, 1999) and the attraction of international erratic investment[10], attacking the causes and not, as traditionally, the symptoms of the structural delay of territorial spaces - actually, the problem of the development issue is contested, widely, by combating the innovation deficit that is usual in the peripheral and structurally weakened regions[11]. In other words, it's possible to state that the innovation politics is becoming more and more important in its regional facet and that the modern regional politics involves, also, a dimension tied to the innovation dynamics incentive in a way that, in the operative level and, even, at the relevant conceptual framework level, there is clear closeness (and even of coalition) tendency among these two politics of economic animation that value the so called development software, choosing the cognitive, organizational and institutional intangible aspects as priority axes of intervention (Landabaso, 1997; Maillat, 1998; Sanchez, 2000; Santos, 2003).

Both the innovation politics and the modern regional politics have evolved towards the resolution of the socio-economic development problems, paying a particular attention to the demand-side problems (Gregersen and Johnson, 1997), putting special emphasis in the SME's technological and organizational requests[12]. Let's recalled that the European Commission (1996) included this more territorialized and demand

[10] The modern innovation politic doesn't deny, as one of its instruments of competitive potential promotion of a territory, the appeal to the attraction of selective forms of exogenous investment, in order to collect entrepreneurial projects or sectors that, that, by its technologic *apport*, may represent an additional feature in the qualification of the regional productive system (Pires *et alli*, 2000), in the sense of deepening or developing the specialization patterns.

[11] That convergence of politics is in line with the increasing empirical evidence that shows that regional development divergence mainly result from the productive territorial structures differences at both productivity and competitiveness levels in which innovation is a critical factor, although not the only one.

[12] The understanding that the encouragement to innovation in more underdeveloped peripheral areas couldn't just be taken in the supply side, as motivated the DG XVI of the European Commission to put in action a set of instruments, from 1994 forward, like the Regional Technologic Plans (in eight european regions, including the Norte region in Portugal), renamed, after 1996, as Regional Innovation Strategies that, basically, aimed at creating the foundations of a dialogue and innovation culture, starting from an enlarged mobilization (bottom-up) of the actors' different competences and from the entrepreneurial demand outline diagnosis in the technologic and organizational fields.

dynamics motivational philosophy in its “Green Book on Innovation”, recognizing the important role that renewing the competitiveness promoters' factors based in innovation can carry out in SME’s, once they are the ones who form the central economic structure of the peripheral and less developed regions. Indeed one of the objectives of the European Commission (1999) lies in the decrease of the technological and innovative gap between the European regions. Aware of the technological activities of innovative base concentration in the “ten innovation islands” (Great London, Rotterdam/Amsterdam, Ile of France/Paris, Ruhr, Frankfurt, Stuttgart, Munich, Lyon, Torino and Milan), that embody, today, about 80% of the expenses and cooperation activities in R&D in Europe (op. *cit.),* the European Commission has been reinforcing its support to the innovative potential development in less developed regions.

The bottom line is the understanding that the obstacles to the innovation dynamics in peripheral regions are, usually, less associated with the production of strategic information and knowledge and more related to the processes that refrain its diffusion and appropriation by the regional actors (Santos, 2000); in this sense, it’s fundamental to provide mechanisms that help altering these conditioning structural blockades to the absorption and use of strategic support information to the innovation. This new generation of politics as evolved to try to answer to that large number of companies that aren’t aware of the requirement of basing their competitive strategies on innovation as a demarcation factor in the markets in face of a scenery of crescent (and exacerbated) global competition. They are centred, strategically, on SME’s less worried with the innovation factors, trying to promote a group of technological and organizational externalities susceptible of assimilation for those companies, starting from, in an approach from below, the potentialities and lacks diagnosis of the own regional productive structure. In that sense, privileged instruments, like the implementation of technological auditors' networks, the diffusion of technologies adapted to the traditional specialization sectors in the peripheral regions, the regionalization of the academic investigation politics, are used, aiming to answer to the competitiveness challenge of the local productive fabric, the development of horizontal networks of business cooperation, etc.

Henderson and Morgan (1999), that call this new generation of regional politic of “regional experimentalism” (semantically valuing the exploratory and learning-by-experimenting dimensions), understand it as an instrument of social capital creation

amongst the several actors involved, starting from the establishment of permanent exchange of ideas channels, the search for common projects that may lead to trust and reciprocity bows reinforcement, the increasing interaction between the public and private spheres, the conception of institutions with intermediation functions (namely in the transfer of relevant information and knowledge field and in the innovative companies' incubation), the promotion of a network of business support strategic services mainly focused in the real needs of the productive fabric, etc… - as stated by Maillat (1998), that strategy is an attempt of playing with the proximity effect and of territorially associating industrial know-how and tertiary know-how.

It's necessary to have a clear notion that the innovation politics, as putted as before, is no longer an attempt, more or less casuistic, of promoting and using the technology transfer channels, but it seeks, mainly, the stimulation of the regional environment. What, basically, is in stake is to know if these less successful and dynamic regions (that, in general, possess a low qualified innovative and competitive productive base at the international scale and a little dense and articulated institutional infrastructure) gather the necessary conditions allowing a positive evolution of these processes of social and cognitive capital level uplifting.

Note that the analytical framing that evolves from this problem is what it was enunciated by the clusters and RSI models: in terms of socio-economic animation, the prime success territories are those who are characterized by the firms and institutions capacity in assuming learning dynamics voluntarily - in the products, in the process and in the organizational structures - and who adapt to the pressure induced by the constant competition (Henderson, 2000). The tone of political intervention must, in consonance, pass from the company level to the own environment level, since it is assumed that it is precisely the innovative environment, and not necessarily each firm taken individually, that it is responsible for the regional innovation dynamics. This model has implicit the recognition of the externalities importance in the innovation and diffusion process, what seems indicative enough to undertake the public intervention, without what the firms, especially the SME's, couldn't develop a significant innovation effort.

The major objectives of the innovation politics based in the clusters and RSI approach are, in the essential, the ones of removing the systemic and market flaws that rend inoperative the full and articulate operation of the business and institutional universe

and it's consequent competitive upgrading. Basically, those approaches try to identify and overcome three fundamental types of flaws (Proinov, 2002):

- inadequacy or inefficacy in the public goods provision;
- flaws in the coordination between the actors;
- gaps in the connection to the great world networks of information and strategic knowledge flow.

If the approach centred in the cluster analysis puts the tone in the creation of competitive advantages based on mechanisms rooted in the deepen of the inter-business specialization and of the labour division, the model of the RSI refer to the emphasis in the institutional reply to the seek for specialized support services to the productive activity and to the proper adjustment of the interfaces between the actors that are part of the innovation system. They are, as argued previously, analytical models with complementary visions on the regional development problem.

In that sense, in the extent of the Regional Science, those approaches, although with different aims in several aspects, present a clear advantage of offering a way of thought the economy and of organizing the business and territorial development efforts that allow objectively overcome some of the limitations of the more orthodox sectoral and canonical approaches. In general, they possess the operative advantage of allowing a better apprehension of the sense of the changes in the competition picture at the global scale, of the role of the knowledge based innovation creation systems and of the main factors that are underlying the renewal of the competitive advantages. Those approaches allow to raise the bases to analyze and to build the foundations that should sustain the dialogic affiliation between the business and institutional universes, and between the private and public spheres, bringing to life partnerships of increased value that can improve the social networking and to put it to the service of shared objectives of competitiveness promotion.

Proceeding in this reasoning line, we defend that, agreeing with the opinion of Pires *et alii* (2000) that the innovation politics should have as fundamental mission to promote the competitiveness of the productive system, in a context of economic relations globalization and of acquisition of capacity of innovating competitive advantages resultant. In this sense, the innovation politics deals, above all in peripheral and depressed economies, with the double challenge of competing, on one side, for the upgrading of the companies competitive profile and of the most representative sectors

of the different effective industrialization models in those territories and, on the other hand, for contributing to the emergence of new vectors of productive specialization, trying linkages to new more demanding activities of technological inputs but also providing an effective accumulation of technical knowledge (Mota Campos and Silva, 1996).

Recurrently, one of the handicaps that arise from the peripheral regions is tied with the fact that its technological outline is characterized by a system of C&T in which the public sector (universities, laboratories) is overrepresented considering the effort developed by the private sector. This situation carts consequences about the orientation of the investigation activities that are carried out that, guided by internal academic logic, are more oriented for upstream phases, in the sense of its concentration in fundamental and applied investigation modalities, driving away from the market requirements (Koschatzky and Sternberg, 2000; Santos, 2002).

The public politics of regional potential of innovation promotion have, also here, a privileged space of action, trying to endow those territories of mechanisms that encourage endogenous activities of R&D by the economic actors, what has usually been implicating the establishment of proximity platforms between the academic and business spheres and the progressive internalization of the investigation function by the more structured regional business environment. We are talking of promoting the investigation function regionalization, allowing the region to gain a more economic profile and redirecting it in the sense of the adjustment to the business demand dynamics.

The tone putted in the industrial reordering of traditional sectors is, above all in peripheral regions with fragile economic structures, one of the main challenges that the innovation politics must set out. In this case, it's mandatory to consider the creation of mechanisms that lead to the external information of the technological, organizational and companies' market needs, a lot of times located in traditional and low-tech sectors, leaving from that referential base-line to draft the main lines of intervention and centring on the firms the politic instruments. In fact, one of the main problems that turns fundamental to overcome lies in the fact that these depressed territorial spaces are affected by very limited learning capacities are the real cause of its economic "anaemia" and, in that sense, the main focus of public intervention should be based on the promotion of collective learning and institutional reorganization enlarged dynamics, inclusive and interactive.

One of the aspects that seems also absolutely indispensable lies in the reinforcement of the capacities and competences of the public administration to adapt its *modus faciendi* to this new action picture that lies more in the catalysis and in the fertilization of the innovation potential of the several territorial actors, forecasting a formulation of public politics that pay special attention to the construction of politics in collaboration with the business and institutional fabric, more than a construction of politics for the collaboration (Saucer *et alii*, 2000).

To work with the endowment of local resources, to break with the institutional and business inertias, promotion of networks of inter-business cooperation, actors involvement (Morgan, 1997): we believe that this is, today, the great challenge that the innovation politics face as a fundamental factor of sustained promotion of the business and territorial development levels in peripheral regions.

6. Concluding remarks

Although these two approaches operate at slightly different spatial scale of analysis, they both allow the identification of a set of key factors that contribute to understand the way in which institutions and actors, considering the innovation system or the cluster process, participate in the innovation atmosphere and in the economic growth.

Nevertheless, there is a problem concerning public administration, specially in peripheral regions: local and regional authorities are, mainly, interested in the process of cluster intensification in the local and regional economies context, meaning that the physical investment is still very important to the less developed regions.

This feature stresses out one other controversy: are the "hard" location factors (the physical tangible location factors) more important than the "soft" location factors (qualitative, intangible factors) or vice-versa?

The process of entrepreneurial dislocation that we've been noticing in Portugal point out that the first ones are still important; although, due to the fact that those kinds of companies invest, basically, in the productive function, is possible to dig out that the main impact is the resulting unemployment.

As important as the cluster intensification is the creation of synergies and cooperation between the actors; that is in fact a great challenge that peripheral regions must face in order to "survive" in the competitive world. Although the efforts made by EU in order to promote innovation, only now the innovation concern as become a part of the political agenda, with all the negative impacts of that late perception.

Bibliography

ALBUQUERQUE, E. M. (2000). *Análise da performance produtiva e tecnológica dos clusters industriais na economia brasileira.* UFRJ/IE, Research Project "Arranjos e Sistemas Produtivos Locais e as Novas Políticas de desenvolvimento Industrial e Tecnológico", Nota técnica 28/00 (preliminary version), Rio de Janeiro. Obtained in the Internet in http://www.ie.ufrj.br/redesist/.

ALMEIDA, A. J. S. (1994). *Sistema Regional de Inovação e Competitividade Industrial – o Caso da Península de setúbal*, MsC dissertation. Lisbon: ISCTE.

ASHEIM, B. and ISAKSEN, A. (1997). "Location, agglomeration and innovation: towards regional innovation systems in Norway", *European Planning Studies*, 5 (3), pp. 299-330.

AUTIO, Erkko (1998). "Evaluation of RTD in regional systems of innovation", European Planning Studies, 6 (2), pp. 131-140.

AYDALOT, P. (ed.) (1986). *Millieu Innovateur en Europe.* Paris: GREMI.

BACHE, I. and GEORGE, S. (1999). "Explaining variations in regional empowerment through UE structural policy: the case of United Kingdom", communication presented to the International Conference of the Regional Studies Association - *Regional Potentials in an Integrating Europe*. Bilbao: Universidad del Pays Basco, September.

BRESCHI, S. and MALERBA, F. (1995). "Sectoral innovation systems", communication presented at the conference *Systems of Innovation Research Network*. Söderköping, September.

CAMAGNI, R. (1991). "Local milieu, uncertainty and innovation networks" in Camagni, R. (ed.), *Innovation Networks, Spatial Perspectives.* London: Belhaven Press-GREMI.

CASTELLS, M. (2001). *The Internet Galaxy: Reflections on the Internet, Business and Society.* Oxford: Oxford University Press.

CLARK, J. and GUY, K. (1998). "Innovation and competitiveness: a review", *Technology Analysis & Strategic Management*, 10 (3), pp. 363-395.

EUROPEAN COMMISSION (1996). *Green Paper on Innovation.* Luxembourg: CE.

EUROPEAN COMMISSION (1999). *Sexto Relatório Periódico relativo à Situação Socioeconómica e ao Desenvolvimento das Regiões da União Europeia.* Luxembourg: CE.

COOKE, P. (1992). “Regional innovation systems: competitive regulation in the new Europe”, *Geoforum*, 23, pp. 365-382.

COOKE, P., URANGA, M. abd ETXEBARRIA, G. (1998). “Regional systems of innovation: an evolutionary perspective”, *Environment and Planning A*, 30, pp. 1563-1584.

DRUCKER, P. (1998). “From capitalism to knowledge society” in NEEF, D. (ed., 1998). *The Knowledge Economy*. Woburn MA: Butterworth.

GIBSON, R. (ed., 1998). *Repensar o futuro.* Lisbon: Presença.

GILLY, J.-P. and GROSSETTI, M. (1993). “Organisations, individus et territoires. Le cas des systèmes locaux d` innovation”, *Révue d` Économie Régionale et Urbaine*, 3, pp. 449-468.

GONÇALVES, F. (1999). “A transição da Economia Industrial para a Economia do Conhecimento” in GODINHO, M. ad CARAÇA, J. *O Futuro Tecnológico. Perspectivas para a Inovação em Portugal*. Oeiras: Celta.

GREGERSEN, B. and JOHNSON, B. (1997), “Learning economies, innovation systems and European Integration”, *Regional Studies*, 31 (5), 479-490.

GUIMARÃES, R. (1998). *Política Industrial e Tecnológica e Sistemas de Inovação*. Oeiras: Celta.

HENDERSON, D. (2000). “EU regional innovation strategies: regional experimentalism in practice”, *European Urban and Regional Studies*, 7 (4), 347-358.

HENDERSON, D. and MORGAN, K. (1999). *Regions as Laboratories: the Rise of Regional Experimentalism in Europe*, Cardiff: Cardiff University.

HOUGHTON, J. and SHEEHAN, P. (2000). “How to keep abreast of the new economy”, *Professional Engineering*, 13 (22), pp. 38-39.

IMPARATO, N. and HARARI, O. (1997). *A grande virada. Inovação e Escolha Estratégia em uma Era de Transição*. Rio de Janeiro: Campus.

KIRAT, T. and LUNG, Y. (1999). “Innovation and proximity. Territories as *loci* of collective learning processes”, *European Urban and Regional Studies*, 6 (1), pp. 27-38.

KOSCHATZKY, K. and STERNBERG, R. (2000). “R&D cooperation in innovation systems – some lessons from the European Innovation Survey (ERIS)”, *European Planning Studies*, 8 (4), pp. 487-502.

LANDABASO, M. (1997). "The promotion of innovation in regional policy: proposals for a regional innovation strategy", *Entrepreneurship & Regional Development*, 9, pp. 1-24.

LEMOS, C. (1999). "Inovação na Era do Conhecimento" in LASTRES, H. and ALBAGLI, S. *Informação e Globalização na Era do Conhecimento*. Rio de Janeiro: Campus.

LUNDVALL, B.-A (ed.) (1992). *National Systems of Innovation. Towards a Theory of Innovation and Interactive Learning*, London: Pinter.

MAILLAT, D. (1998). "Innovative milieux and the new generations of regional policies", *Entrepreneurship & Regional Development,* 10 (1), pp. 1-16.

MEYER-KRAHMER, F. (1985). "Innovation behaviour and regional indigenous potential", *Regional Studies*, 19, pp. 523-534.

MITRA, J. (2000). "Making connections: Innovation and collective learning in small businesses", *Education & Training*, 42, pp. 228-237.

MORGAN, K. (1997). "The learning region: institutions, innovation and regional development", *Regional Studies*, 31 (5), pp. 491-503.

MOTA CAMPOS, M. I. e SILVA, M. (1996). "Política de inovação em regiões industriais atrasadas", communication presented at the *IV Encontro Nacional da APDR*, Covilhã: UBI.

NADVI, K. (1997). *The Cutting Edge: Collective Efficiency and International Competitiveness in Pakistan*. DP 360. Brighton: Institute of Development Studies.

NAISBITT, J. (1998). "Dos Estados para as Redes" in GIBSON, R. (ed.). *Repensar o futuro*. Lisbon: Presença.

NELSON, R. and ROSENBERG, N. (1993). "Technical innovation and national systems", Nelson, R. (ed.), *National Innovation Systems*, New York: Oxford University Press, pp. 3-21.

OCDE (1999a). *The Knowledge Based Economy: a set of facts and figures*. Paris: OCDE/GD.

OECD (1996b). *Technology and industrial performance*. Paris: OECD.

OECD (1996a). *The Knowledge Based Economy*. Paris: OCDE/GD.

OECD (1999a). *Boosting Innovation: the Cluster approach*. Paris: OECD.

OECD (2000). *Knowledge Management in the Learning Society*. Paris: OECD.

PETIT, P. (2002). *Accountability in knowledge based economies: A regulationist view on institutional changes in a Post Fordist Era*. EAEPE Conference, November, Aix-en-Provence.

PIRES, A., RODRIGUES, C., CASTRO, E. and ESTEVES, C. (2000), *Construção de uma Estratégia de Inovação para a Região Centro*, Aveiro: CEIDET-UA.

PORTER, M. (1990). *The competitive advantage of Nations*. New York: The Free Press.

PORTER, M. (1998). "Criar as vantagens futuras" in GIBSON, R. (ed.). *Repensar o futuro*. Lisbon: Presença.

PROINOV (2002). *Clusters e Política de Inovação*, Lisbon: PCM.

PUTNAM, R. (1996). *Comunidade e democracia – A experiência da Itália moderna*. Rio de Janeiro: Fundação Getúlio Vargas.

PYKE *et alli* (1992). *Industrial Districts and Inter-Firm Cooperation in Italy*. Geneva: Institute for Labour Studies, ILO.

ROMER, P. (1990). "Endogenous technological change", *Journal of Political Economy*, 98, S71-S102.

ROTHWELL, R. and DODGSON, M. (1991). "Regional technology policies", in Brotchie, J., Batty, M., Hall, P. and Newton, P. (eds.), *Cities of the 21st Century*, Harlow: Longman, pp.45-55.

SANCHEZ, P. (2000). "The design of a European Innovation Policy: issues and problems", communication presented in the seminar *Innovation and Diffusion in the Portuguese Economy*, Lisbon: CISEP.

SANTOS, D. (2002). *Dinâmicas Territoriais de Inovação no Arco Urbano do Centro Interior*, PhD Dissertation, Aveiro: University of Aveiro.

SANTOS, D. (2000). "Innovation and territory: which strategies to promote regional innovation systems in Portugal?", *European Urban and Regional Studies*, 7 (2), pp. 147-156.

SANTOS, Domingos (2003). "Política de inovação: filiação histórica e relação com as políticas de desenvolvimento territorial", *Estudos Regionais*, 3, pp. 25-40.

SEGENBERGER *et alli* (1990). *The Re-Emergence of Small Enterprises – Industrial Restructuring in Industrialised Countries*. Geneva: Institute for Labour Studies, ILO.

SEGENBERGER, W. and PYKE, F. (Eds.) (1992). *Industrial Districts and Local Economic Regeneration*. Geneva: Institute for Labour Studies, ILO.

SMITH, K. (2002). *What is the 'Knowledge Economy'? Knowledge Intensity and Distributed Knowledge Bases*. Institute for New Technologies, Discussion Paper Series n.º 2002-6. Maastricht: The UN University.

SOLOW, R. (1957). "Technical change and the aggregate production function", *Review of Economics and Statistics*, 39, pp. 312-320. Obtained in the Internet in http://merlin.fae.ua.es/fidel/docencia/TechChan/SoloREyS.pdf.

STÖHR, W. (1986). "Territorial Innovation Complexes", *in* Aydalot, Ph. (ed.), *Milieux Innovateurs en Europe*. Paris: GREMI.

THOMAS, Kevin (2000). "Creating regional cultures of innovation? The regional innovation strategies in England and Scotland", *Regional Studies*, 34 (2), pp. 190-198.

WORLD BANK (2002). *Building Knowledge Economies: Opportunities and Challenges for EU Accession Countries*. Final Report of the Knowledge Economy Forum. Paris: World Bank.