

# **48<sup>th</sup> JSRSAI CONFERENCE**

**Wakayama, Japan, 8th-10th October, 2011**

## **Regional innovation systems in less developed areas: policy reflections and challenges for Portugal**

(Draft version)

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## **Abstract**

Innovation has moved to the foreground in regional policy in the three last decades. Public policies have been shaped by “best practice models” derived from high-tech areas and successful regions. However, lessons learned from these regions are rarely replicable elsewhere, in particular to territories where actors strategic to the innovation process are less capable and diversified. The regional innovation systems in peripheral regions, and the likelihood of their acting as instruments for territorial competitiveness, have seldom been the subjects of discussion.

The first part of this article examines the concept of regional innovation systems against the background of modern theories of innovation and regional policies. It is argued that the role of localized learning is of strategic importance in the promotion of endogenous regional development. With reference to current research on regional policy, the authors also argue that sustainable regional strength is built on a continuously upgraded knowledge base, rather than on general factor endowment.

The authors then discuss the structural barriers and opportunities to promote regional innovation strategies in the context of the Portuguese political, economic and social reality, pointing out some specificities that need to be addressed in the redesign of public interventions in order to improve regional competitiveness and sustainability.

*Keywords:* regional innovation systems; innovation; innovation policy; peripheral regions; territory; Portugal.

## 1. Introduction

During the last three decades, innovation, understood “in the broad sense to include product, process and organizational innovation in the firm as well as social and institutional innovation at the level of an industry, region and nation” (Morgan, 1997: 492), thus surpassing the strictly classical technological dimension, has become a key focal point on the analysis of territorial dynamics and on modern theories of economic development.

As innovation processes have intrinsically a strong territorial and social matrix, then it must be emphasized the increasingly importance that an enlarged set of factors now assume in the production of knowledge for innovation, namely the informal contacts and the flows of tacit knowledge amongst the different kind of actors, their accepted rules, conventions and cultural patterns (Storper and Scott, 1995), their relational capital and their social capital, on the sense proposed by Putnam (1993: 35): “features of social organization, such as networks, norms and trust that facilitate coordination and co-operation for mutual benefit”. Thus, there has been a shift towards the understanding of the innovation process as a socially constructed mechanism based on the accumulation of knowledge (codified or tacit) through a continuous and interactive learning course (Lawson and Lorenz, 1999; Tura and Harmaakorpi, 2005). Accordingly, Maskell and Malmberg (1999: 20) argue that territorial competitiveness has nowadays, more than ever before, to do “with knowledge creation and with the development of localized capabilities that promote learning processes”.

In this sense, the innovation dynamics is based on resources that are place-specific, this is, “it is a localized, and not a placeless process” (Asheim and Isaksen, 1997: 299), so, regionally based complexes of innovation and production are increasingly the privileged instruments to harness and recreate knowledge and intelligence across the globe (Koschatzky, 2003).

The accumulated knowledge that production systems develop, because they are incorporated in locally based institutions and in a generally non-mobile workforce, tend to perpetuate certain competitive advantages but, although *proximity matters*, what really is important for the upgrading of the competitive edge of localized production systems and resource creation is organizational proximity (Burmeister and Colletis-Wahl, 1997; Kirat and Lung, 1999; Fujita and Krugman, 2004; Carlsson, 2005). It is therefore important to recognize that “knowledge transmission and collective learning

may be fostered by cultural, institutional and geographical proximities often in combination” (Keeble and Wilkinson, 1999: 300).

So, on the last three decades, there has clearly been a change of paradigm on the perception of the relation between industrial dynamics and regional development: long-term regional competitiveness and sustainability has less to do with cost-efficiency and more to do with the ability of firms and institutions to innovate, or, in broader terms, to upgrade their knowledge base (Hallin and Malmberg, 1996).

The theoretical debate about the dialectics innovation-territory remains largely, however, at a abstract and general level, being necessary an important operationalization effort of the main concepts to enrich the empirical research. The implications of this problematic on least favored regions have seldom been analyzed. Usually, the analysis is focused on urban-metropolitan areas on medium to high-tech sectors. The regional innovation systems in peripheral regions, and the likelihood of their acting as instruments for territorial competitiveness, have rarely been the subjects of discussion. On this article we will concentrate upon the Portuguese reality which has its own political, institutional, economic, scientific and regional peculiarities, a reality that is close of the so-called low density territories.

## **2. Innovation and territory: the analytical framework**

In this context, it is argued that the territorial dynamics creates specific interdependences among the actors and between the actors and the institutions that evolve into a peculiar industrial and technological trajectory. Several analytical frameworks share this particular approach, in particular the *Industrial District paradigm*, the *Innovative Milieu conceptual model*, the *Learning Region concept* and the *Regional Innovation Systems approach*. The first two, they both germinated during the 80`s as a theoretical answer to the empirical analyses of some restricted territories whose industrial and spatial dynamics was based on the close links established between small and medium enterprises, production flexibility, entrepreneurship and external agglomeration economies. According to Hallin and Malmberg`s opinion (1996: 332), both models emphasize “the systemic nature of industry; the role of learning and innovation in industrial dynamics; and the spatially embedded character of industrial change.”

The notion of industrial district, a Marshallian view of the process of overall production organization, clearly rooted on the studies about the *Third Italy* and authors like Bagnasco, Garofoli and Becattini, relates to export-based socio-economic firms, usually centered on one industrial branch with a high concentration of horizontally integrated, specialized and autonomous small firms, each one associated to a single phase of production. These small firms work interactively to produce a wide range of differentiated goods that are sold on customer-oriented, fragmented and diverse international markets. The local economies frequently benefit from the information exchange made possible by the growth of localised producer-user networks, consequent upon the flattening of vertical integration within firms (Garmise and Rees, 1997).

Specifically, four elements are underlined as the real sources of regional development in this paradigm, as Capello (1996: 488) refers: “entrepreneurship, production flexibility, district economies and the presence of some *collective agents* capable of acting as a catalyst for the mobilization of the indigenous potential (a local bank, wholesalers, local industrial associations, some enlightened entrepreneur, etc)”. This localized network of producers are bound together in a social division of labour, in necessary association with a local labour market and innovation, although important, is not strategically pursued, it does not constitute a priority purpose. Storper (1995) accentuates the role of localised *untraded interdependencies* (labour market, local conventions, tacit knowledge collectively held, etc) between firms and other institutions in promoting mainly incremental innovation; diversely, the concept of *Technological District*, as conceived by Rallet and Torre (1995), constitute a variety of industrial district where the external economies lay fundamentally on scientific and technological change and innovation.

Since 1985, the GREMI (Groupe de Recherche Européen sur les Milieux Innovateurs) has also developed a theoretical perspective not only based on the reduction of transaction costs but also on the role of external economies and on the notion of the *Innovative Milieu*, defined as a local milieu which has a certain socio-economic and cultural cohesion founded on common behavioural practices, as well as a technical culture. A *Milieu* is a set of functional interdependences that belong to the same territorial entity. This concept is then intersected with the notion of *Innovation Network* to define an innovative milieu. An innovation network expresses the new context and profile of technological dynamics and change, i.e. the collective and interactive nature of the innovation process (Rallet and Torre, 1995).

Maillat (1998: 124) establishes a useful distinction: “the innovative milieu is not a specific category of localized production system but a cognitive set ... (it) corresponds to a territorialized, outwardly open complex, that is, open to technological and market environment, which incorporates and masters know-how, rules and relational capital”. In this theoretical perspective, innovation is seen as the integration by the milieu of strategic information and resources (Crevoisier, 1996), thus, largely surpassing the narrow definition of innovation as a merely technological domain.

This is really the most interesting feature of the innovative milieu model, its value-added in comparison to the industrial district approach: innovation also encompasses a strong territorial and institutional structure which constitutes an essential instrument on the process of techno-economic creation, as well as an emphasis on the learning behaviors. The fostering of territorial synergies is a key matter of the innovative milieu, by other words, the territory is seen as a cause and a consequence of the actors` strategies and their collective learning processes (Keeble and Wilkinson, 1999).

Another branch of thought on the subject of innovation and territory has more recently (on the 90`s) appeared and may be called the *Learning Region* approach. It mainly has reinforced the organizational-institutional view of the innovative milieu and has also enlarged its scope to the ICT (information, computer and telecommunications)-related paradigm (Asheim, 1996; Asheim and Coenen, 2006). The contemporary economy based on the acquisition of knowledge and know-how have profoundly reduced the cost of storing, handling, transferring and combining information and has also made possible countless different kinds of networking. This model has been developed mainly by Scandinavian authors (Lundvall, Asheim, Isaksen) and two authors of the University of Cardiff in Wales, namely Philip Cooke and Kevin Morgan who concentrate their appreciations on two focal points:

- on the one hand, the reinforcement of the associationist vision: an innovation is highly dependent on information and knowledge; the capacity to innovate implies the necessity to access such invisible factors through networking capacity, which, at its most simplistic level, can be seen as the disposition to collaborate to achieve mutual beneficial ends, a strategy called by Asheim (1996), “learning-by-interacting”;

- on the other hand, it emphasizes the growing importance of the formal and informal mechanisms of information and knowledge production, circulation and consumption; it is now almost a refrain the very often quoted Lundvall`s (1992) statement that “knowledge is the most fundamental resource and learning the most important process”

and thereby the territory must adopt a context favourable to knowledge creation and continuous learning; as Ferrão (1997) suggests, the concept of learning region reinforces the centrality of the collective learning capability (offensive and defensive) as a key strategy to regional development.

In our opinion, however, the learning region concept constitutes clearly a semantic declination of the innovative milieu approach that seems more elaborated and structured. It must be acknowledged that the GREMI and the authors associated to the learning region model, at least during its initial years, have a clear distinctive cleavage line, their mother and main scientific language. The most emblematic GREMI researchers were, at least during its first stages, either french (Aydalot, for instance), or french speaking from Belgium (Quévit) and Switzerland (Maillat, whereas the best known authors of the learning region model were north american (Florida) or welsh (Cooke and Morgan). So, our argument is that, besides accomplishing a semantic declination of the innovative milieu approach, the learning region concept also encompasses a linguistic derivation, a kind of English version of the francophone milieu innovateur. That is the reason why on Table 1 we assume no distinction between these two approaches (Santos, 2009).

Entrepreneurial vitality is nourished in an information-rich environment which gives a strong innovation potential and the need for this information-richness is intensifying as the industrial economy evolves into the information economy (Tura and Harmaarkorpi, 2005). Yet, it is important to make a clear conceptual and processual distinction between information and knowledge, as Simmie (1997a: 7) does: “among other differences, information may be transmitted electronically while knowledge and active understanding reside in the heads of individuals”. In operational terms, this has very different consequences for it is not enough to build up territorially embedded information networks but, fundamentally, it is necessary to use this potential to upgrade the local knowledge levels.

Thus, innovation is fundamentally dictated by the good management of strategic flows of information and knowledge creation and, accordingly, some authors (Cooke, 1996; Morgan, 1997; Cooke *et alii*, 2005; Cooke, 2008) clearly assume that the implementation of territorial embedded regional innovation systems could be of strategic importance to improve the process of systemic innovation and, therefore, regional competitiveness. In a knowledge-intensive region, intelligence and intellectual labour replace physical labour as the fundamental source of value and competitive

advantage (Florida, 1995). Asheim (1996: 395) conceives this problematic on a quite wise and interesting way: “learning regions could have the possibilities of transcending the contradictions between functional and territorial integration through a new, regionalized integration of the traditional, contextual knowledge of industrial districts and the codified knowledge of the global economy within the framework of territoriality embedded regional systems of innovation”.

We argue, like Asheim and Dunford (1997), that territorially based complexes of innovation and production are increasingly the preferred means to recreate knowledge and intelligence all over the world and that creative socio-economic interactions are often played on a regional context.

If we consider a broad definition of an innovation system it involves not only research centers and institutions but also the productive fabric, its institutional and governance basis, its financial structure and its educational and training system. The innovation system articulates all these dimensions, independently of the level of analysis, which allows for a linear inference to the regional level. Such a system can thus be defined as a specific form of organization and regulation of the actors’ interactions throughout the innovation process. Due to the fact that the institutional context of the innovation dynamics is very much conditioned by strong national characteristics (Lundvall, 1992), the concept of innovation system was firstly introduced at the national level but the existence of regional socio-economic and institutional peculiarities influencing the endogenous mechanisms of knowledge incubation, production and diffusion is often better studied and understood at a regional level. As Howells (1996: 6) indicates: “regions within nations can display distinct or idiosyncratic systems of innovation which depart from the national norm and in turn be different from other regions”, so, innovation depends to a large extent on local externalities and knowledge spill-overs and regions differ greatly in their potentials for innovation.

It seems useful, at this stage, to distinguish, analytically and politically, two different types of regional innovation systems, or to be more accurate, a regionalized national innovation system and a conceptually true regional innovation system as Asheim and Isaksen (1997: 307) suggest: “on the one hand, we find innovation systems that are parts of a regionalized national innovation system, i.e. parts of the production structure and the institutional infrastructure located in a region but functionally integrated in, or equivalent to, national (or international) innovation systems, which is based on a top-down, linear model of innovation. On the other hand, we can identify innovation

systems constituted by the parts of the production structure and institutional set-up that is territorially integrated or embedded within a particular region, and built up by a bottom-up, interactive innovation model”.

Non-market, tacit and informal relations, as vehicles to increase the co-operative dimension, constitute a fundamental axis for the promotion of territorially based regional systems of innovation instead of regionalized national innovation systems that can be well exemplified by the technopolitan fever that still prevails in some European countries.

It seems important to examine the innovation dynamics through this bottom-up, territorial methodological angle, as suggested by the innovative milieu and the learning regions conceptual models (Cooke, Etxebarria and Uranga, 1997) instead of following a functional and sectoral approach, so that it can be possible to filter the way the different components of a regional innovation system interact. More specifically, Howells (1996) refers three dimensions that could serve as guide-lines to investigate the structure and evolution of these innovation complexes: the regional style of government, the specialization pattern of the productive fabric and core/periphery differences in industrial structure and innovative performance. Wiig and Wood (1997) enrich this methodological filter when they point out the following elements: the economic and innovative activities, the links both within and beyond the region, the availability of labour, education and training requirements, the technological infrastructure, including links with innovation support organizations and the role of public bodies in providing support for innovation.

More profound and lasting effects of increased competitiveness can only be obtained if innovation becomes systemic in the region, i.e. if it assumes a regional innovation system configuration, promoting the collective capability of interactive learning among the actors (firms, institutions and government agencies) which might positively influence the innovation performance of the regional economy.

**Table 1 – Industrial district, innovative milieu/learning region and regional innovation system: synoptic comparison.**

	<b>Industrial District</b>	<b>Innovative Milieu/Learning Region</b>	<b>Regional Innovation System</b>
<b>Emergence</b>	Spontaneous; as local productive system	Spontaneous/Induced; as cognitive entity	Induced; as organizational entity
<b>Predominant culture</b>	Industrial atmosphere	Entrepreneurial culture	Scientific and entrepreneurial culture
<b>Productive system</b>	Industrial; productive specialization; specialization in line with a sectoral division of labor; SMEs; vertically disintegrated; self-centered	Industrial and tertiary; diversification of production from the standpoint of intra-industry division of labor; large and SMEs; quasi-vertical integration; open	Industrial and tertiary; diversification of production from the standpoint of intra-industry division of labor; large and SMEs; quasi-vertical integration; open
<b>Non-mercantile relations among the firms</b>	High intensity of extra-productive exchanges; informal inter-personal networks of information flows; strong horizontal and vertical mobility of labour	High intensity of extra-productive exchanges; importance and diversity of non-market formal relations (cooperation networks, strategic partnerships, ...)	High intensity of extra-productive exchanges; importance and diversity of non-market formal relations (cooperation networks, strategic partnerships, ...)
<b>Relations of the enterprise with the evolving institutional universe</b>	Low intensity of contacts; casuistic	High intensity of contacts; strategic	High intensity of contacts; strategic
<b>External relations</b>	Opening to the outside world via suppliers and clients	Strong opening to the outside; insertion on the international circuits of information and knowledge transfer	Strong opening to the outside; insertion on the international circuits of information and knowledge transfer
<b>Reticular structures</b>	Compacts; networks without a strategic centre	Compacts; networks with leader enterprises or with pivot enterprises	networks with pivot enterprises or institutions (university, technological centre, ...)
<b>Logics</b>	Communitary; of survival; to avoid that the local/regional economies act as mere spaces of localization of exogenous investments	Of partnership; creation of collective learning mechanisms as vehicles of the competitive renewal of the productive basis; promotion of the innovation potential	Of partnership; institutional architecture as a lever of the entrepreneurial and territorial competitiveness; promotion of the innovation potential; arquitetura institucional como alavanca da competitividade empresarial e territorial; fomento do potencial de inovação; affirmation of a regional innovation strategy
<b>Dominant forms of</b>	Tacit; contextual	Codified; global	Codified; global

<b>knowledge</b>			
<b>Dominant forms of learning</b>	<i>By doing, by using, by interacting</i>	<i>By doing, by interacting, by networking</i>	<i>By searching, by networking</i>
<b>Dominant modalities of innovation</b>	Incremental; adaptative; of the product and of the process	Incremental and radical - <i>first of its kind</i> ; of the product, of the process and organizational	Incremental and radical - <i>first of its kind</i> ; of the product, of the process and organizational
<b>Growth dynamics</b>	Competition-emulation-cooperation; based on an enlarged social mobilization; entrepreneurial risk socially supported	Competition-cooperation; induced by the activation of the information and knowledge flows; entrepreneurial risk institutionally supported	Cross-fertilization; highly induced by the institutional universe; dynamic adjustment between the entrepreneurial and the institutional spheres; entrepreneurial risk institutionally supported
<b>Potential risks</b>	Socio-technological lock-in; barriers to the entrance of new players and to information access; growth of firm hierarchization phenomena; deviant behaviors	Technological and relational lock-in; exit barriers	Technological and relational lock-in; exit barriers; institutional sclerosis

The regional innovation system concept presents, in our perspective, some features that clearly allow differentiating it from the concepts, even though similar, of the innovative milieu and of the learning region, being the industrial district approach largely a founding and more mature path of this analytical trajectory. In fact, the promotion of adjusted institutional architectures to the respective productive fabrics accomplishes, on the regional innovation system approach, the real lever of the territorial and entrepreneurial competitiveness, conferring this paradigm a clear operational dimension we do not find on other paradigms.

### **3. The promotion of systemic regional innovation in the least favored regions of Portugal**

#### **3.1. Innovation and territory on peripheral regions: the core of the discussion**

On this part of the article, we concentrate the analysis on the problems faced by peripheral, least-favored regions in overcoming their comparative disadvantages with

respect to innovation capacities and on the public policies that can be developed to reduce their handicaps. We will base the analysis and discussion on the Portuguese reality.

Until the beginning of this decade, innovation policy in peripheral areas was often simply equated as a supply-side problem, accordingly with the dominant paradigm then accepted of the linear model of innovation. Government policies have usually been designed to support knowledge production, for example through incentives to R&D activities, rather than knowledge utilization (Gregersen and Johnson, 1997). It is now widely accepted that the promotion of the innovation capability in least favoured regions also as to be addressed as a demand-side problem, the constraints to the innovation dynamics being not so much the production of strategic information and knowledge but, instead, its diffusion and appropriation by the regional actors.

Garmise and Rees (1997: 2) underline that: “for the less favored areas of Europe and elsewhere, their relative absence of economic dynamics is rooted in the very limited learning capacities of their innovative systems”. The main focus of public intervention on this ambit now relies on the promotion of interactive learning-oriented processes for the whole of the territorial agents. Networking, design of value-added dialogue platforms and the opening up of new interfaces between innovation support infrastructures and industry, such supply aspects should therefore be fostered, particularly between private and public spheres. Nevertheless, as emphasized above, a systemic approach also implies to take into consideration in a more pro-active way the needs of the main actors of innovation, i.e. firms and, consequently, to adapt the supply of services and their respective structures. In particular, innovation support should meet more intensely the SMEs needs and expectations, thus being more responsive to the composition of the productive fabric. The aim is that this systemic and bottom-up approach favors cooperation and leads to a better regional embeddedness of the system, a particular challenge being the promotion of the endogenous innovative capability of SME-based productive fabric.

This new approach to regional development in peripheral areas tries to redesign the regional innovation architecture, but building upon pre-existent structures and seeking to modify their static, task specific competences into a system of flows and processes based on the network paradigm (Cooke, 1996). Corroborating this assertion, Morgan (1997: 501) concludes: “I would suggest that this is precisely what innovating in the periphery means: working with what exists, however inauspicious, in an effort to break

the traditional institutional inertia in the public and private sectors, fostering interfirm networks which engage in interactive learning, nurturing trust”.

Thus, a regionally differentiated strategy becomes fundamental to make better use of such specific territorial resources, like, for instance, the existing knowledge base that should serve as a base-line for new trajectories of upgrading and diversification or the existing technology transfer system that should be improved with respect to the specific needs of small- and medium-sized lower-tech firms, for they need know-how which often is not offered by traditional technology transfer institutions. Considerable attention must be paid to the profile of the regional production fabric because it conditions all the techno-organizational changes and may determine different development trajectories.

Some authors (Storper and Scott, 1995; Asheim and Isaksen, 1997; Quévit and Van Doren, 1997; Tödtling and Trippel, 2005; Hauser *et alii*, 2007) are consequently underlining regional policy approaches that are context-sensitive, production-systems oriented rather than firm-oriented and focusing on the continuous structural adaptation of the regional institutional and economic set.

### **3.2. The Portuguese context**

Some research studies conducted in different areas of Portugal, such as the Península of Setúbal (Almeida, 1994), the district of Aveiro (CEC, 1997), Alcanena (Nicolau, 1999; 2001), the Northern region, including Oporto (Mota Campos, 1997), the Urban Arch of the Interior Centre of Portugal (an area involving the municipalities of Castelo Branco, Fundão, Covilhã and Belmonte) (Santos, 2002) and on different digital regions (Simões, 2008) emphasized the very fragile basis of interactiveness among the regional innovation actors, a situation that refrains profoundly the capacity to foster a regionally based innovation system. All those studies stressed the individualistic behavior of the firms and their lack of co-operation culture, their human, technological and financial chronic handicaps, namely the predominance of non-qualified labour pools, the absence of science-based industries, the lack of investments in R&D and other intangible factors, the low density and quality of the innovation infrastructures and the thin institutional basis, and not a situation of *institutional thickness* (Amin and Thrift, 1994),

these are all key constraints for the accomplishment of a broad process of regional innovation.

### 3.2.1. A highly concentrated national innovation system

The Portuguese scientific and technological system is relatively weak in comparative terms and scale of the OECD countries. The proportion of R&D expenditure in GDP in 2009 was only 1.66%, the expenditure being accomplished mostly by universities and other public research institutions (51.9%). The industry has been increasing its role very rapidly, although this is limited to a participation in a narrow field of technological activities, the bulk of R&D expenditures at this level being concentrated in a small number of sectors and companies.

**Table 2 – Portuguese S&T system: main indicators.**

	Research and development expenditure, by sectors of performance (% of GDP, 2009)	Gross domestic expenditure on R&D (GERD) by source of funds (% of total GERD Business enterprise sector, 2008)	Research and development personnel, by sectors of performance Head count (% of the labour force, all sectors, 2009)	Employment in high- and medium-high-technology manufacturing sectors (Share of total employment, %, 2007)	Patent applications to the European Patent Office (EPO) (number of applications per million inhabitants, 2008)	Human resources in science and technology as a share of labour force - Total (% , total)
Portugal	1.66	48.1	0.94	3.45	13.59	23.5
EU 27	2.01	54.7	1.07	6.69	119.5	40.1

Source: Eurostat (2010)

There is a large number of research institutions, some of them with a good scientific reputation and staffed with highly qualified researchers, nevertheless, the processes of technology transfer to industry are still inadequate, although this situation tends to improve recently due to policies oriented towards the creation of transfer mechanisms, the pressure on public institutions to self-finance their activities and the increased technological awareness of industry.

It is worth adding that along these characteristics, the national S&T system is geographically very unbalanced, since there is a phenomenon of excessive concentration in the metropolitan areas, with a particular focus on the Lisbon region

(Table 3). The Lisbon region is responsible for nearly half of the total public and private expenditure in R&D and about the same proportion of the total human resources dedicated to these activities.

**Table 3 – S&T indicators by NUTS 2.**

	Human resources in science and technology (HRST), by NUTS 2 region (% of economically active population, 2009)	Employment in high-tech sectors (high-tech manufacturing and high-tech knowledge-intensive services), by NUTS 2 region (% of total employment, 2008)	Patent applications to the EPO by priority year, by NUTS 2 region (number of applications per million of inhabitants, 2007)	Total intramural R&D expenditure (GERD), by NUTS 2 region (% of GDP, 2008)	Researchers, all sectors, by NUTS 2 regions (% of total employment, 2008)
Norte	18.4	1.53	4.626	1.22	0.58
Centro	15.7	1.32	3.634	1.22	0.58
Lisboa	33.7	4.18	8.249	2.26	1.46
Alentejo	19.8	2.39	1.308	0.90	0.46
Algarve	21.6	-	4.745	0.37	0.44

Source: Eurostat (2010)

It must be added that Portuguese R&D policy, as is centrally defined and implemented, is specially targeted to the preparation of the economic fabric to the globalization process although, paradoxically, in overall terms, is not very market-oriented. Being mainly directed at national level, this policy reinforces vertical hierarchical linkages and centralization, instead of promoting a regionally based innovation dynamics. In Portugal, there is no regional innovation policies formulated in a regional basis and there is neither an innovation regional policy, territorially based. The innovation policy, designed and implemented on a national level, is, in fact, promoting increasing disparities among the Portuguese regions, due to a logic that is based on what we could call the dictatorship of a real and qualified entrepreneurial demand that favors particularly the most dynamic regions of Lisbon and Oporto.

Nevertheless, it should also be noticed that the spatial distribution of the S&T organizations (public laboratories, research centers, ...), under the influence of the universities of Porto, Minho (Braga and Guimarães), Aveiro and Coimbra, is a strong facilitation factor for implementing a regional innovation system policy. The mapping of the localizations and of the research locus of these interfaces between University and

industry shows a significant concentration in the more developed and higher density territories of North and Centre regions and should constitute an asset on the formulation of regional innovation strategies.

### **3.2.2. The mismatch between the knowledge production sphere and the economic sphere**

One of the traits that best characterizes the regional innovation system is undoubtedly a marked separation between the sphere of knowledge production, namely the S&T system, and the productive sphere. The S&T infrastructure, specially the academia, has been living according to a logic that does not intercept the real demands of the productive universe – they have not been talking the same language. It is no wonder that this situation is deeply installed and is quite difficult to alter: the large majority of the small and medium entrepreneurs possess no more than the basic education and this S&T infrastructure seems too far away from their needs and expectations. On the other hand, most companies do not have qualified human resources to enable them to assimilate these cognitive resources and gain competitive advantage. This should put, in our point of view, the recruitment of middle and senior staff among the main sources of competitive advantage of companies.

The reduced entrepreneurial demand for dynamic competitiveness factors (product engineering, process and organizational design, marketing, quality, ...) is also not unconnected with the predominance of traditional and low-technology industries, low knowledge-intensive, a situation that embodies a fragile demand-pull. The factors underlying the dynamics of innovation that has been diagnosed are basically those that are transmitted via the market vertically along the value chain, resulting often of informal contacts with customers and suppliers. In fact, it appears that the importance attached to institutional channels is quite small.

The existing technology transfer system needs to be improved with respect to the specific needs of small and medium-sized lower tech firms that, usually, account for the vast majority of the regional productive universe (in some regions, up to 99% of the enterprises belong to this dimensional group). They have a specific kind of demand that needs to become explicit so that the innovation support infrastructures can comply with their requirements: most SMEs usually need know-how which is often below the

scientific and technological levels of universities, technological centers or other public or private innovation support institutions. These needs are not only technology-related but also organizational, and besides there is a lack of institutions and services in market-oriented activities like market-monitoring, export and internationalization. It must also be emphasized that non innovative SMEs, that is the larger part of the Portuguese productive fabric, are seldom taken as a priority and a primary target by those innovation support infrastructures.

As mentioned above, the reality of demand-pull factors of innovation is quite modest. Three programming periods of the co-funded EU assistance, already involving competitiveness and innovation goals, produced practically no organizational learning results in targeted Objective 1 territories (Figueiredo, 2007). The centralized architecture of the Portuguese innovation system did not succeed in establishing a common culture of proximity to firms. The locus of organizational learning is nowhere. The succession of governments produced unstable pattern of decision-making and of strategizing including the Agency for Development and Innovation (AdI), which in principle would be the decisive factor of continuity

In an attempt to close the gap between university and industry a number of interface institutions, such as the AdI, an innovation relay centre promoted under the framework of the STRIDE Program), were created in a context of central government initiatives. The objective of these institutions is to serve as intermediaries between the universities/research laboratories and the industrial fabric, and hence to encourage the diffusion of the technologies being developed, namely through co-operative projects, contract research and technical support. However, the majority of these institutions that provide support to innovation and entrepreneurship belong to the national innovation system which happens to be a vertical and highly hierarchical structure that prevents the promotion of horizontal co-operative behaviors among the regional actors and the full exploitation of local synergies.

### **3.2.3. A narrow concept of innovation**

According to the referred studies, innovations predominantly follow prevailing technological trajectories, based on already existing knowledge and being on their majority of the incremental type. Basically, companies are bound by market pressures,

to take a competitive position that passes mainly by the systematic and gradual renewal production processes (gradual and partial automation of production lines, etc..) with the aim, in the first instance, to increasing productivity, improving delivery times (quick response) and reducing the need for labor. Following *fordist* strategies, they rely on scale and volume: that is the reason why other critical modalities of innovation are insufficiently treated, little attention being paid to the intangible dimensions of innovation, such as organizational or commercial. This seems a consequence of a predominance of a very restrictive notion of innovation among the vast majority of Portuguese entrepreneurs as they confuse modernization strategies based on the renewal of physical capital goods with innovation.

Although some new conditions in terms of industrial and R&D policies led a number of Portuguese firms to try to improve their technological level and their capacity to adapt to a changing environment, namely adopting a more innovative posture, the Portuguese industrial pattern, is still vertebrate by non-skilled manpower intensive sectors with a low qualified workforce, and manufacturing low technology and low quality products, the dominant sectors being the traditional *filières* of textiles, footwear and wood/furniture. This is the overall picture but there are also excellent examples of traditional firms on all those sectors that have successfully accomplished competitive restructuring processes.

So, there is an increased awareness about the need to change the basis for the competitive advantage of Portuguese less favored regions. On one hand, a vast majority of the research capabilities still lacks interaction with firms and the intensity of technological start-up's is still low. On the other hand, research capabilities oriented towards the incorporation of knowledge in the valorization of endogenous resources are incipient, not well targeted and with no continuous interaction with the less developed and low density territories of the two most dynamic regions of Lisbon and Oporto.

In a convergent way, we argue, based on the analysis of the Portuguese Digital Cities and Regions Program (Simões, 2008; Simões and Santos, 2008), that the recent revival of interest in the “digital” in Portugal has been constructed around a rather narrow set of empirical and theoretical issues concerning mainly to technological innovation, neglecting other strategic political areas, such as the politics of governance and social innovation, the role of democracy and citizenship in city-regions politics, and tensions around social reproduction and sustainability across the city-regions.

### **3.2.4. A deficit of regionally rooted innovation networks**

In general, too, the business partners along the value chain are not located in these territorial spaces and, consequently, the dynamics of innovation is not regionally rooted. Moreover, a large share of the regional business community, including the vast number of SMEs that vertebrate the regional economies, remain unaware of the mechanisms of information transfer and knowledge in place, not being part of the local/regional innovation systems, either because they are practically non-existent at a regional level either because the national innovation system is too far away from the real needs of this wide range of companies. Technical knowledge is socialized on the basis of informal locally-based networks, in which information circulates and is shared. The firms' partners along the value chain are usually not in the regions and the innovation dynamics is not regionally embedded. This seems true for large firms and the most dynamic group of SMEs, for the vast majority of the productive fabric seldom establishes other links outside the commercial partners of suppliers and clients.

So, besides their dimensional handicap, as the vast majority of the Portuguese enterprises are small to medium-sizes, the true critical bottleneck is their isolation, not to be connected to the information and knowledge flows, to the global world, the so-called loneliness syndrome.

In fact, the different studies that have been developed about this subject have obtained empirical results showing that geographical proximity is not enough to promote any territorial innovation dynamic and the inquired firms prove to have a somehow anonymous relationship with their respective territorial setting.

It has very low expression of the existence of cooperation networks strongly rooted territorially, promoting innovative projects, which is, as we know, the essential distinguishing feature of the presence of an innovative environment. Similarly, it is not institutionalized what might be called a collective learning process, since although there exists an entrepreneurial culture based on empirical knowledge accumulated over generations, companies and institutional actors ultimately follow individualistic paths that do not enrich cognitively the local and regional environments in which they operate. It is not regionally established what might be called a true culture of contact, this situation encompassing a vacuum and a relational deficit that is a major obstacle to the establishment of cooperative relations that are vital for the competitiveness of enterprises and obtain collective gains.

Regional innovation systems in Portugal are thus, in practice, non-existent or, not being so pessimistic, embryonic. We have the pieces of the game but we are not playing – we do have entrepreneurial and institutional actors, we have institutional thickness in this field but we lack a strategy and dynamics.

### **3.3. Policy implications**

It seems that the base-line for Portuguese least favored regions is very low in terms of their innovative capabilities and potential, in their pre-conditions to follow up a traditional innovation-led regional development trajectory. So, unlike the nucleus of the discussion that on the scope of the GREMI and of the learning region approach is centered on the functioning of innovative regions, the debate for Portuguese regional development purposes must be arguably centered on the promotion of the necessary conditions that must be fulfilled to initiate a learning and innovative process (Ferrão, 1997 and 2002; Simões, 2003; Simões and Santos, 2008).

The low performance of the Portuguese regional innovation systems is mainly due to problems of interaction between players (organizations). Universities and other higher education organizations, R&D and technology centers, development and technology agencies, inter-faces between universities and firms, entrepreneurial associations, leading firms, venture capital and the different platforms available for fostering entrepreneurial start-up's tend to develop a low level of interaction. We may say that the absence of market-oriented players of the brokers type explains part of the problem. We would have in this case an organizational failure due to difficulties in the social division of roles and responsibilities. But in our view there are institutional and governance problems as well (Simões and Santos, 2008). There is a diversified set of rules of the game that, on one hand, tend to inhibit the cooperative pattern of behavior between the players and, on the other hand, to disseminate within organizations patterns of behavior contrary to innovation.

This situation prevents the creation of an economy based on networking, and this seems to be the key-issue of territorial development in this Portuguese periphery. We believe that the promotion of the so-called social capital should, as far as possible, anticipate the implementation of policies aiming at enhancing the technological and organizational

potential of a given region – to conjugate these two intervention dimensions seems unquestionably to be the greatest challenge of a territorial innovation policy.

We have seen that innovation is, above all, the resultant of a learning process that needs know-how accumulation, technical qualifications, interaction and experience. This learning dynamics depends as much of supply-side actors as of demand-side actors. Nevertheless, it seems that, at the enterprise level, the efforts of public support should focus on the local SMEs of mostly traditional sectors that haven't yet understood the need to innovate - in this sense the regionally based innovation policy in least favored areas must have, as Quévit and Van Doren (1997) point out, a pedagogical dimension.

A clear operational objective, thus, should be the increasing of the capability and of the competence of the public administration to interact with an enlarged set of actors of the innovation process, to deepen its awareness concerning the demands of the firms and to build up broker organizations that could: “assist firms in analyzing their situations ... and define their particular needs in relation to the innovation process” (Asheim and Isaksen, 1997: 321).

An important operational axis of the whole innovation policy should lie on the organizational capabilities of the networks of relationship that can become a crucial determinant of the entire institutional architecture of the regional innovation system. It should be an important aim to involve SMEs as much as possible on all the ongoing, evolving process, to make sure that their long term needs are duly taken into consideration.

Anyway, SMEs usually face particular problems that hamper their effective participation on the innovative dynamics, such as a difficult access to information, lack of qualified labour force, financial and administrative constraints, etc. It is undeniable, at least in the Portuguese context, that this dimensional group of enterprises may require specific assistance and there is a need for additional empirical evidence of the capacities of the different categories of SMEs so that a more pragmatic appreciation of this sector will be gained which will be essential to formulate targeted policy-measures aimed at stimulating greater SME participation, a *sine qua non* condition for the achievement of a systemic innovation process on a territorial basis. It seems important to promote consistent efforts to strengthen the technology absorption capacity of SMEs which may involve facilitating the processes of learning and accumulating knowledge and strengthening skills in the firms. The regional innovation support services that now only serve a minimal part of the firms' universe, and therefore aren't promoting innovation in

the regions as efficiently as they should, must be able to answer not only the specific demands of traditional innovators but rather to be concentrated on the promotion of a co-operation culture and interaction amongst the elements of the territorial innovation architecture.

The studies that we have mentioned demonstrated clearly that the weaknesses of those Portuguese regional innovation systems are the result of either a political and institutional dependency of central administration or the unwillingness of the regional actors to increase the coordination roles in order to introduce rationality in what is now a set of incoherent actions. In Portugal, at a regional level, it can be said that many of the elements that can constitute the core of an orthodox regional innovation system already exist, such as universities, technological centers, interface institutions, training centers, industrial associations, etc. Nevertheless, because of a lack of a co-operation culture and an absence of networking structure, the different agents act on the basis of a set of individual strategies developed internally by each sector, which constitute the major limitation of the regional institutional fabric. In other words, we may say that the present architecture of the Portuguese innovation system is unable to generate market-oriented and interactive organizational learning and knowledge.

Some authors (CEC, 1997: 15) argue that these Portuguese weaknesses “can only be overcome if inter- and intra-regional co-operative relations were reinforced and if regional institutions can improve their ability to create and diffuse technology, as well as to improve their capacity to adapt national innovation policies to the local context”. It seems clear that the fundamental policy imperative in Portuguese less favored regions is to strengthen these network relationships which leverage the innovative capability of the firms. New dialogue channels among entrepreneurial and institutional actors are urgently needed – more formal or more informal, these arenas for the creation of relational capital are absolutely vital steps in order to, from a bottom-up perspective, generate pivotal institutions and assume common strategies of action.

Anyway, in Portugal it must be taken into consideration that some specific institutions (e.g. technological centers, industrial associations, ...), that nowadays vertebrate less favored regions, are privileged actors that are able to play a stronger role on the creation, the dissemination and, mainly, the adoption of new forms of knowledge establishing new and vital bridges between the globally codified knowledge and tacit knowledge locally available. We, therefore, argue that this bottom-up approach, whose strategy implies to deepen the networking among the regional actors, is essential to

promote successfully the upgrading of the Portuguese regional innovation profile. But to implement the regional innovation systems as a policy tool we need powerful catalysers of the strategy. These catalysers should be selected among the national innovation system players which are closer to firms, knowing better their needs and being more receptive to market-oriented incentives and less risk-averse. Among the several organizations evolving in the national innovation system, the interfaces between University and industry are non-profit research organizations which have in general higher levels of proximity, credit and involvement with firms.

On this context, a simplistic approach, based on the linear model of innovation, should also be avoided, not over-investing in university science projects, assuming that this would automatically feed through into the industrial environment (Henderson and Cooke, 1999; Kautonen and Sotarauta, 2005), although, at the same time, it should be expected that Portuguese higher education institutions that are located on less developed areas of the country can exteriorize all their potentialities and adopt a behavior that surpasses the sphere of mere instruments of the educational system. The existence of knowledge providers is not, nevertheless, a sufficient condition for a successful regional innovation process. The systemic approach to innovation underlines the importance of interaction and collaboration between knowledge providers and the business sector. Regional policy makers should therefore try to set up networks between research universities and firms, and also try to integrate the local/regional public sector in the innovation process.

Public intervention should be closer to SMEs, thus reinforcing the territorial dimension of innovation. As problems to recruit qualified personnel seem to hamper the regional innovation systems in many small and medium-sized regions, special measures may be needed to facilitate the recruitment of qualified personnel. The viability of these embryonic regional innovation systems must not rest on external constraints but on local capabilities and resource creation processes in which the role of SMEs and very small firms seems pivotal in the context of Portuguese less favored regions.

It seems clear that for regional innovation policies to be meaningful the regions in question must already have either one or several clusters of SMEs or one or several larger leading companies surrounded by clusters of suppliers and/or customers. On the other hand, since most small and medium-sized regions do not have public research institutions, developing strong links to research infrastructures in other regions are of paramount importance. It is needed urgently that several locus of organizational

learning must be created to counterbalance the intensive process of internationalization of the national scientific and technological system determined by government priorities. These locus should absolutely involve demand pull concrete innovation needs which are located in firms and in the different regional territories, although sharing in some cases a global perspective of the market. It is rather a complementary agenda and surely a crucial opportunity to avoid the detachment of the national scientific and technological system from the regional productive structures. The spatial distribution of R&D centers and of inter-faces university-industry combined with the entrepreneurial and productive culture prevailing in each of the Portuguese regions should be understood as targeted locus for implementing regional innovation strategies.

The philosophy of the planning approach has, consequently, to change radically (Morgan, 1997): the question isn't any longer of planning *for* the regional community (firms and institutions) but, instead, of planning *with* them and, besides, due to the fact that it involves mainly changing social and institutional inertias, results should only be apprehended on a medium to long-term basis. We are not talking about the simple re-equipment and technological upgrading of firms, we are dealing with a whole set of incremental changes on the behavioral patterns of regional actors, each one of them with its specific logics and rationalities. The regional innovation system approach aims at least with engaging with the right targets, namely the institutionalized inertia which characterizes so many less favored regions. Definitely, a territorial innovation policy does not consist of casuistic attempts of technology transfer but on the stimulation of the whole regional milieu. In this way, a regional innovation system can be seen as an instrument of establishing a learning framework for all partners involved in the construction of the socio-economic trajectory of the territory. This really seems to be the challenge for almost all the Portuguese regions and a critical assessment must be done to the implementation of ready-made recipes.

## **5. Conclusion**

The subject of innovation is nowadays central to modern theories of regional development; innovation, broadly defined to include not only product or process

upgrading but principally organizational and institutional rearrangements, is vital for regions to obtain competitive advantages.

An understanding of the mechanisms and of the extent in which innovation is assessed as an interactive and systemic process constitutes a means to study in depth the structure and performance of regional innovation in least favored areas (Landabaso, 2002; Rosenfeld, 2002).

We have seen that the current architecture of the national innovation system has been unable to generate market-oriented and interactive organizational learning and knowledge. And besides, due to the fact that in Portugal there is neither a consistent regionalized innovation policy nor an innovation regional policy, territorially based (Santos, 2003), the problematic of long-term regional competitiveness is becoming a critical issue, mainly now that the rhythm of structural change imposed by the global economy is dictating new patterns of regional behavior and competition. That is why, arguably, the promotion of territorially embedded regional innovation systems in Portugal seems a fundamental and coherent strategy to face contemporary regional development challenges, as long-term regional competitiveness and sustainability has less to do with cost-efficiency and more to do with the ability of firms and institutions to innovate, i.e. to improve their knowledge base (Cooke, 2007).

Finally, it is argued that special attention should be paid to the design of the intervention policy, trying to avoid the classical functional top-down and supply-side approach, the classical repertoire of some innovation policies; innovation-led regional policies must basically address the questions of enhancing the territorial capabilities to foster interactiveness among the regional actors, of engaging the actors in processes of collective learning and of producing strategic knowledge or, more synthetically, to increase the stock of social capital in the Portuguese least favored regions, territories where there is a clear deficit of these invisible assets.

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