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Sección ARTÍCULOS

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Regional innovation systems in Portugal: a critical evaluation

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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 urban-metropolitan areas and successful regions. However, lessons learned from these examples are rarely transferable elsewhere. 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. The main objective of the article is precisely to take Portugal as an example to enrich this analysis.

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.

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

JEL Classification: O18; O31; R11; R58.

Keywords: Regional innovation systems; innovation; innovation policy; peripheral regions; territory; Portugal.

Sistemas regionales de innovación en Portugal: una evaluación crítica

RESUMEN: La innovación ha pasado a primer plano en la política regional en las tres últimas décadas. Las políticas públicas han sido diseñadas por los «modelos de mejores prácticas» derivadas de las zonas urbano-metropolitanas de alta tecnología y regiones exitosas. Sin embargo, las lecciones aprendidas de estos ejemplos son

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raramente transferibles a otras partes. Los sistemas regionales de innovación en las regiones periféricas, y la posibilidad de su actuación como instrumentos de competitividad territorial, rara vez han sido objeto de discusión. El objetivo principal del artículo es, precisamente, tener a Portugal como un ejemplo para enriquecer este análisis.
En la primera parte de este artículo se examina el concepto de sistemas de innovación regional en el contexto de las modernas teorías de la innovación y de las políticas regionales. Se argumenta que el papel del aprendizaje localizado es de importancia estratégica en la promoción del desarrollo regional endógeno.
Luego, los autores discuten las barreras estructurales y oportunidades para promover estrategias regionales de innovación en el contexto político, económico y social portugués, y, por último, se señalan algunas especificidades que deben ser abordadas en el rediseño de las intervenciones públicas con el fin de mejorar la competitividad regional y la sostenibilidad.

Clasificación JEL: O18; O31; R11; R58.

Palabras clave: Sistemas regionales de innovación; innovación; política de innovación; regiones periféricas; territorio; 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), has become a key focal point on the analysis of territorial 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. 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).

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 (Kirat and Lung, 1999; Fujita and Krugman, 2004; Carlsson, 2005, Shearmur, 2011).

The theoretical debate about the dialectics innovation-territory remains largely, however, at an abstract and general level, being necessary an important operationalization effort of the main concepts to enrich the empirical research. Usually, the analysis is focused on urban-metropolitan areas and 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 the focus will be concentrated 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

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 approach, in particular the *Industrial District paradigm*, the *Innovative Milieu conceptual model*, the *Learning Region concept* and the *Regional Innovation Systems approach.*

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. 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 is bound together in a social division of labor, in necessary association with a local labor market and innovation, although important, is not strategically pursued, it does not constitute a priority purpose (Becattini, 2002; Morrison, 2008). Storper (1995) accentuates the role of localized *untraded interdependencies* between firms and other institutions in promoting mainly incremental 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 behavioral 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. 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, 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.

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-related paradigm (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 concentrates its appreciations on two focal points (Cooke and Morgan, 1998):

— 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 can be seen as the disposition to collaborate to achieve mutual beneficial ends;
— on the other hand, it emphasizes the growing importance of the formal and informal mechanisms of information and knowledge production and consumption. This last assumption is shared not only by Lundvall (1992) when he states that «knowledge is the most fundamental resource and learning the most important process» and thereby the territory must adopt a context favorable to knowledge creation and continuous learning but also by Ferrão (1997) when he suggests that the concept of learning region reinforces the centrality of the collective learning capability (offensive and defensive) as a key strategy to regional development.

The learning region concept, however, 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. So, the 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 franco-

phone *milieu innovateur*. That is the reason why on Table 1 there is 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). Some authors (Florida, 1995; 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.

A broad definition of an innovation system 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. As 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.

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 suggested by Asheim and Isaksen (1997: 307): «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».

It is 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, *et alii*., 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 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.

The regional innovation system concept presents some features that clearly allow differentiating it from the concepts, even though similar, of the innovative

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

	Industrial District	*Innovative Millieu/ Learning Region*	*Regional Innovation System*
Emergence	Spontaneous; as local productive system.	Spontaneous/Induced; as cognitive entity.	Induced; as organizational entity.
Predominant *culture*	Industrial atmosphere.	Entrepreneurial culture.	Scientific and entrepreneurial culture.
Productive system	Industrial; productive specialization; specialization in line with a sectoral division of labor; SMEs; vertically disintegrated.	Industrial and tertiary; diversification of production; large and SMEs; quasi-vertical integration; open.	Industrial and tertiary; diversification of production; large and SMEs; quasi-vertical integration; open.
Reticular structures	Compacts; networks without a strategic centre.	Compacts; networks with leader or pivot enterprises.	Networks with pivot enterprises or institutions.
Dominant forms of learning	By doing, by using, by interacting.	By doing, by interacting, by networking.	By searching, by networking.
Dominant modalities of innovation	Incremental; adaptative; of the product and of the process.	Incremental and radical - *first of its kind*; emphasis on organizational innovations.	Incremental and radical - *first of its kind*; emphasis on organizational innovations.
Growth dynamics	Competition-emulation-cooperation; based on an enlarged social mobilization; socially supported entrepreneurial risk.	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 end the institutional spheres.
Potential risks	Socio-technological lock-in; barriers to the entrance of new players; growth of hierarquization phenomenons.	Technological and relational lock-in; exit barriers.	Technological and relational lock-in; exit barriers: institutional sclerosis.

Source: Santos (2009).

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 hardly found on other models (Moulaert and Sekia, 2003; Asheim, *et alii*., 2011).

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, the analysis is focused 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.

Until two decades ago, 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**.** It is now widely accepted that the promotion of the innovation capability 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.

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.

Corroborating this assertion, Morgan (1997: 501) adds: «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 inter-firm 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 stock 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.

Some authors (Cooke, 1996; Asheim and Isaksen, 1997; Quévit and Van Doren, 1997; Tödtling and Trippl, 2005; Hauser, *et alii*., 2007; Prange, 2008) 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

Since 1986, Portugal has received several financial supports from the European Union, which helped to modernize and invest in certain areas. As innovation is a key factor for the competitiveness of firms and territories, the development of innovation systems has become a major discussion in the country, also as a tool of regional development.

We cannot state that in Portugal existed, or exists, a truly integrated policy for science, technology and innovation. Over the past 30 years there have been various plans and technological foresight exercises which to some extent were the basis of policies affecting R&D and S&T in the process of innovation in enterprises (Laranja, 2009). However, on the whole, the policies implemented, did not accomplish to form a coherent system, being noticeable a lack of coordination between the different sectoral policies that affect this area. In part due the lack of politically autonomous regional bodies, with the exception of Azores and Madeira islands, there is a clear absence of strong regional governance structures, constituting, as Figueiredo (2007) states, *institutional voids* that hamper the deepening and maturing of a more territorially embedded innovation.

Table 2. Overview of multi-level governance of STI policy in Portugal

Regions	*7 Comissões de Coordenação e Desenvolvimento Regional (Regional Development Coordination Commissions) and 2 Autonomous Regions*
Country structure	Unitary country, regions not elected.
Sub-national share of government expenditure, all functions (2009)	13.1%
Definition of regional role in STI	Not defined
Regional role in higher education	Not a regional responsibility.
Formal national-regional coordination bodies	No formal bodies for STI.
Regional consideration in national S&T/Innovation Plan	Technological Plan (2005) promotes regional and bottom-up poles and clusters as well as takes into account regional innovation plans.
Example of national policies with explicit regional dimension	Cluster programmes with inter-ministerial support, including separate version for low-density areas.
Example of coordination tools	Few coordination tools for STI, mainly dialogue and consultation.

Source: OECD (2011).

The recent decades brought to Portugal some benefits from European cohesion policy which imposed national efforts towards innovation in organizations and more investments in R&D. However, despite significant national growth rates in the 1990s as well as a successful attempt to cope with the EMU, the country is lagging behind

EU average with respect to gross production, investment or employment creation (Xavier and Vaz, 2013; Vaz *et alii*, 2013).

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, 2001), the Northern region, including Oporto (Mota Campos, 1997), Vale do Ave (Araújo *et alii*, 2013), the Urban Arch of the Interior Centre of Portugal (an area involving the municipalities of Castelo Branco, Fundão, Covilhã and Belmonte) (Santos, 2002), on different so-called digital regions (Simões, 2008) and on peripheral (Beira Interior Norte) and ultra-peripheral municipalities (of São Miguel and Santa Maria islands, in Azores, Natário *et alii.*, 2011; 2012), have been emphasizing 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 lack of co-operation culture, the individualistic behavior of the firms and their, their human, technological and financial chronic handicaps, namely the predominance of non-qualified labor 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 an erratic innovation policy, 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 3. Portuguese S&T system: main indicators

	R&D expenditure, by sectors of performance (% of GDP, 2010)	*Gross domestic expenditure on R&D by source of funds (% of total GERD Business enterprise sector, 2009)*	*R&D personnel, by sectors of performance Head count (% of the labor force, all sectors, 2010)*	*Employment in high- and medium-high-technology manufacturing sectors (share of total employment, %, 2008)*	*Patent applications to the European Patent Office (number of applications per million inhabitants, 2009)*	*Human resources in science and technology as a share of the total labor force (%, total, 2010)*
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 (2011).

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 4).

Table 4. S&T indicators by NUTS 2

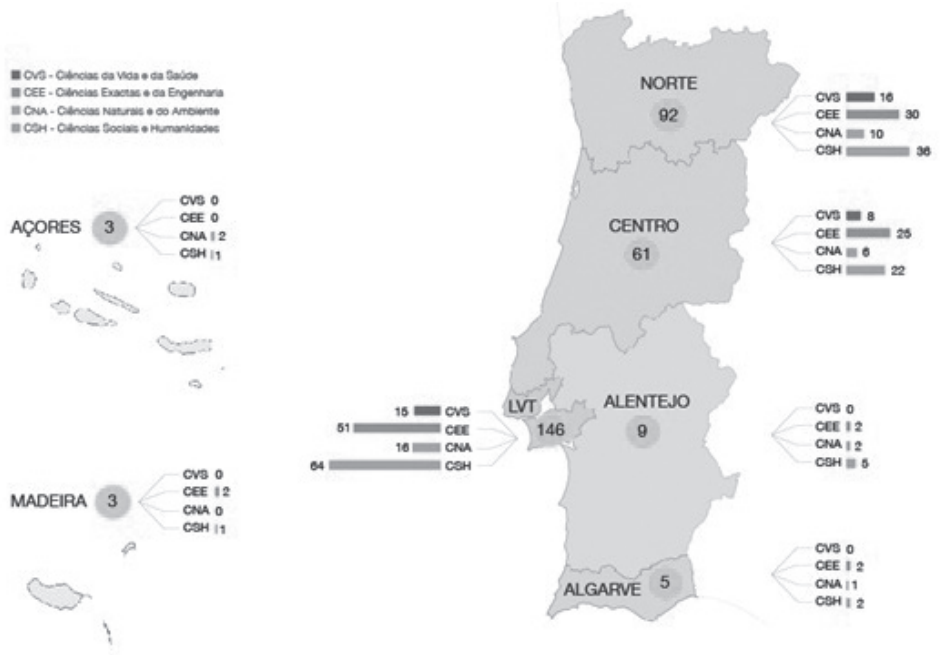
	Human resources in S&T, by NUTS 2 region (% of economically active population, 2010)	*Employment in high-tech sectors, by NUTS 2 region (% of total employment, 2009)*	*Patent applications to the EPO by priority year, by NUTS 2 region (number of applications per million of inhabitants, 2009)*	*Total intramural R&D expenditure, by NUTS 2 region (% of GDP, 2009)*	*Researchers, all sectors, by NUTS 2 regions (% of total employment, 2009)*
Norte	18.4	1.53	9.222	1.42	0.71
Centro	15.7	1.32	5.799	1.28	0.60
Lisboa	33.7	4.18	12.993	2.32	1.77
Alentejo	19.8	2.39	5.52	0.90	0.37
Algarve	21.6	—	5.115	0.45	0.44
Autonomous Region of Azores	17.2	—	2.746	0.79	0.29
Autonomous Region of Madeira	19.3	—	—	0.28	0.20

Source: Eurostat (2011)

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.

It must be added that Portuguese R&D policy, as it 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

Figure 1. Regional distribution of R&D institutions in Portugal



Source: www.fct.pt.

based. The innovation policy, designed and implemented on a national level, has been, 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, under the influence of the universities of Porto, Minho, Aveiro and Coimbra, may constitute a strong facilitation factor for implementing a regional innovation system policy.

The mapping of the localizations of the R&D institutions shows a noteworthy concentration in the more developed and higher density territories, especially in the capital, Lisbon and on the North and Centre regions, specially due to the university effects of Oporto and Minho, on the North Region, and Coimbra and Aveiro, on the Centre Region, while Alentejo, Algarve and the Autonomous Regions of Azores and Madeira show a more fragile R&D institutional fabric.

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 level 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 the recruitment of middle and senior staff among the main sources of competitive advantage of companies.

The reduced entrepreneurial demand for dynamic competitiveness factors is also not unconnected with the predominance of traditional and low-technology industries, low knowledge-intensive and academic qualification deficits of the entrepreneurs, a situation that embodies a fragile demand-pull.

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 conform to their requirements: most SMEs usually need know-how which is often below the scientific and technological levels of universities or other public or private innovation support institutions. Non innovative SMEs, that is the larger part of the productive fabric, are seldom taken as a priority target by those innovation support infrastructures.

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 highly centralized architecture of the Portuguese innovation system did not achieved in establishing a culture of proximity among entrepreneurial and institutional actors.

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. Nevertheless, the majority of these institutions that supply support to innovation and entrepreneurship belong to the national innovation system which has a vertical and highly hierarchical design that inhibits the promotion of horizontal co-operative behaviors among the regional actors and the full exploitation of regional 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 renewal production processes (gradual and partial automation of production lines, etc.) with the aim to increase productivity, improve delivery times (quick response) and reduce 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. 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.

In a convergent way, it is argued, 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. The 34 projects of the Digital Cities and Regions Program covered 287 of the 308 municipalities in the country, with a total investment of over EUR 200 million. It was a powerful tool for mobilizing local actors for the Information Society, as it involved e-government solutions for local administrations, the strengthening of the competitiveness conditions for SMEs and a wide range of services centered on citizens, such as health, social security, education and culture. In a slightly different register, some authors even suggest the necessity to redefine the referential framework to identify and promote innovation, namely in what concerns the models of knowledge production and transfer and the role of collaboration networks for the innovation spreading, in order to capture the so-called «hidden innovation» (Madureira *et alii.*, 2012 and 2013).

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 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 informa-

tion 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 - «geographical proximity is not the critical dimension of the firms' performance» (Araújo *et alii.*, 2013: 200). Another 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.

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. Regional innovation systems in Portugal are thus, in practice, non-existent or, not being so pessimistic, embryonic. The pieces of the game exist but Portugal is not playing —there are entrepreneurial and institutional actors, there is institutional thickness (Amin and Thrift, 1994) in this field but there is a lack of a strategy and of a collective 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).

A collective learning dynamics

The low performance of the Portuguese regional innovation systems is mainly due to problems of interaction between regional actors. Entrepreneurial and institutional regional actors tend to maintain low levels of interaction.

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 obstructs the creation of an economy based on networking, and this seems to be a critical issue of territorial development in Portugal. 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 one of the greatest challenges of a territorial innovation policy in Portugal (Conceição and Heitor, 2003). An innovation strategy based on a catching-up learning process seems to trace good development trajectory for these territories.

A priority target

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. 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.

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 in order to formulate targeted policy-measures aimed at stimulating greater SME participation, a *sine qua non* condition for the achievement of a systemic innovation process. It seems important to develop knowledge providers and/or link the firms to external knowledge sources and to promote consistent efforts to reinforce the technology absorption capacity of SMEs (Evangelista *et alii.*, 2002; Santos, 2003; Cooke, 2007; Laranja, 2009; Expósito-Langa *et alii.*, 2010; Miguélez *et alii.*, 2011) —a *glocalisation* dynamics supported by networking inside the regions and beyond. Public intervention should be closer to SMEs.

A regional agenda

As it was argued, the weaknesses of the Portuguese regional innovation systems are the result of either a political and institutional reliance 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. Nevertheless, the different agents act on the basis of a set of individual strategies developed internally by each sector.

Some authors (CEC, 1997: 15) suggest 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».

Anyway, in Portugal it must be taken into consideration that some specific institutions (e.g. technological centers, ...), 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.

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; Kyrgiafini and Sefertzi, 2003; Kautonen and Sotorauta, 2005; Capó-Vicedo *et alii.*, 2011), 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.

A regional leadership

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. 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. The foremost dimension in building a successful regional innovation system lies in leadership, and this work is absolutely vital to make some innovative agents assume a a mobilizing and strategic leadership. So, a multi-level governance architecture is urgently needed in order to create rationality and synergies among the innovative entrepreneurial and institutional actors.

Besides, more comprehensible and continuous political stimulus is needed to support the expansion of this innovative territorial dynamics, so that these embryonic regional innovation systems can develop and succeed.

A final point to be made is that policies for regional innovation systems demand an in-depth study of the regional economies and this rigorous work, including the role of strategic planning and regional foresight, is also still to be done in Portugal

4. Conclusion

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 in Portuguese least favored areas**.** Due to the fact that in Portugal there is neither a consistent regionalized innovation policy nor an innovation regional policy, territorially based**,** the problematic of long-term regional competitiveness has become 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**.**

It was 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 interaction 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 immaterial assets.

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.

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