INNOVATION WITHIN A REGIONAL AGRO-FOOD SUPPLY CHAIN - THE PATTERN OF PRODUCTIVE SPECIALIZATION OF THE TAGUS VALLEY

PERFORMANCE DE INOVAÇÃO NA CADEIA DE ABASTECIMENTO AGROALIMENTAR REGIONAL - PADRÃO DE ESPECIALIZAÇÃO PRODUTIVA DO VALE DO TEJO
PERFORMANCE DE INNOVACIÓN EN LA CADENA DE SUMINISTRO AGROALIMENTARIA REGIONAL - EL PATRÓN DE ESPECIALIZACIÓN PRODUCTIVA DEL VALLE DEL TAJO

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ABSTRACT

This paper aims to analyse innovation within a set of economic activities combined in a territorialised agro-food supply chain, which characterizes the pattern of productive specialization of the Tagus Valley. This chain is economically sustained by a combination of entrepreneurial and institutional factors, territorially embedded and determining to some extent an endogenous capacity to innovate. Following a case study methodology, of an interpretative nature, the process of gathering evidence was based on the triangulation of data sources: direct observation; semi-structured interviews of individuals representing the various categories of agents involved and documentary research. These were complemented with an inquiry, subject to statistical analysis, into local business agents. In addition to the identification of a considerable set of deficits of an institutional nature inhibiting innovation, the study also led to the formulation of a number of proposals for better territorial governance which highlight the need to strengthen knowledge transfer to the micro and small companies engaged in agricultural activities. Another contribution lies in the categorisation of an analytical framework for a better understanding of innovation dynamics in any region according to its specificities, including the role of public institutions in this process.
Keywords: innovation performance, innovation network/systems, territorialised agro-food complex, pattern of productive specialization, institutional thickness.

RESUMO

Este trabalho tem como objetivo analisar o desempenho da inovação, num conjunto de atividades económicas - nomeadamente a cadeia de abastecimento agroalimentar regional - que caracterizam o padrão de especialização produtiva do Vale do Tejo. Esta cadeia é economicamente sustentada pela mistura de fatores empresariais e institucionais, territorialmente ancorados, influenciando a capacidade endógena de inovar. O estudo segue uma metodologia de estudo de caso, de natureza interpretativa, tendo o processo de recolha de dados sido baseado na triangulação de fontes de dados: a observação direta; entrevistas semiestruturadas aos indivíduos que representam as diversas categorias de agentes envolvidos; e pesquisa documental. Estas foram complementadas com um inquérito aos atores locais, sujeito a tratamento estatístico. Além da identificação de um conjunto importante de deficits de natureza institucional, inibidores de desempenho da inovação, o estudo permitiu também a identificação de várias propostas para efeitos de governação territorial, destacando a necessidade de reforçar a transferência de conhecimento para as micro e pequenas empresas envolvidas nas atividades agrícolas. Uma outra contribuição reside na categorização de um quadro analítico para uma melhor compreensão da dinâmica

de inovação em qualquer região de acordo com suas especificidades, incluindo o papel das instituições públicas neste processo.

Palavras-chave: performance de inovação, rede/sistemas de inovação, complexo agroalimentar territorializado, padrão de especialização produtiva, espessura institucional.

RESUMEN

El objetivo de este trabajo es analizar los resultados de la innovación, dentro de un conjunto de actividades económicas - Es decir, la cadena de suministro agroalimentaria regional - que caracteriza el patrón de especialización productiva del Valle del Tajo. Dicho complejo está sostenido económicamente por una mezcla de factores empresariales e institucionales, territorialmente integrado y permite determinar en cierta medida su capacidad endógena para innovar. Siguiendo una metodología de estudio de casos, de carácter interpretativo, el proceso de recopilación de pruebas se basa en la triangulación de fuentes de datos: observación directa; entrevistas semiestructuradas a personas que representan a las diferentes categorías de agentes implicados, y la investigación documental. Estos se complementan con una consulta a los agentes de negocios, cuyos datos fueron sometidos a análisis estadístico. Además de la identificación de un importante conjunto de déficits de carácter institucional, los inhibidores de rendimiento de la innovación, el estudio también permitió formular diversas propuestas con el fin de gobernanza territorial, destacando la necesidad de reforzar la transferencia de conocimientos a las micro y pequeñas empresas dedicadas a la actividad agrícola. Otra contribución radica en la categorización de un marco analítico para una mejor comprensión de la dinámica de la innovación en cualquier región en función de sus especificidades, incluido el papel de las instituciones públicas en este proceso.

Palabras clave: performance de innovación, red / sistemas de innovación, complejo agroalimentaria territorializado, patrón de especialización productiva, dimensión institucional.

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INTRODUCTION

The motivation of this research is to reflect on innovation performance and on the territorial innovation systems in non-central regions. So, we intend to identify which actions will facilitate the consolidation of an innovation system in such type of region by favouring international flows of knowledge. As specific goals, firstly, we will evaluate and interpret the innovation behaviour in face of a set of combined clusters of agricultural activities and food industries, denominated as Tagus Valley's Agrofood Complex, and specific corporate and territorial order factors framed by an analysis model, generalizable to other regions - which may not necessarily be rural type. This model combines:

i)   exogenous factors to the agro-food cluster, territorially differentiated (structural, specific to the region; institutional, specific or external to the region);

ii)   endogenous factors to the agro-food cluster.

Secondly, we intend to analyse the intervention of public entities (central and local government, scientific and technological system and vocational training centres) in order to find out whether there is a *local institutional thickness* required to support innovation processes in companies engaged in agricultural activities, food and wine industries established in the region. In this sense, as a first step we sought to assess the presence degree of a set of intangible assets intrinsic to the territory; then, we have made use of some descriptive statistics to measure local milieu's performance in reducing uncertainty inherent to innovation process.

As research method we carried out an interpretative case study, making use of several types of instruments for data gathering. As such, it was applied a survey to companies belonging to the agro-food cluster (producers, producers' organizations, agro-industries and agro-food companies). The inquiry's period took place between November 2010 and March 2011, using a combination of intentional (for heterogeneity and representativeness purposes) and snowball sampling strategy. Direct observation, semi-structured interviews to representatives of local business agents, mayors and Public Administration representatives and analysis of relevant documentation (including firms' databases owned by Statistics Portugal and Departments of Portuguese Government, sectorial legislation from European Community, reports published by regional associations of agricultural entrepreneurs, and opinion articles and interviews published at the specialised press) were also used to get more realistic information about both the abundance of productive activities under analysis and the institutional issues affecting the regional innovation system.

The article is structured in five parts. After the introduction, the second part reflects literature review about the dynamics of regional innovation. The part three synthetises methodological notes. The fourth part presents the case study aiming the identification of the pattern of productive specialization of Tagus Valley, which leads then, we have made use of some descriptive statistics to measure local milieu's performance in reducing uncertainty inherent to innovation process. Finally, in last part the conclusions and implications are discussed, suggesting clues for future research.

1. LITERATURE REVIEW

The dynamics of regional innovation depends of an efficient functioning of regional systems of innovation (Cooke, 2008; Tödtling and Trippl, 2012; Camagni and Cappelo, 2012). The innovation systems approach reflects the territorial dynamics of innovation and seeks to understand the multiple factors that influence the capacity of innovation (Edquist, 2001) in most organizations that involve local productive systems. The conceptualisation of innovation systems by Lundvall (1992) emphasizes the interactive knowledge, the economic interactions, market and non-market relations, and the institutional and social structure to promote innovation dynamics as well as all factors that influence the innovation capacity (Edquist, 1997).

A seminal analysis that has been largely neglected by scholars' community, at least in terms of empirical work, is the conceptualization of Camagni (1991), also inspired by the Evolutionary Theory (Nelson and Winter, 1982; Dosi, 1988), about the roles assigned to the local milieu in reducing uncertainty inherent to innovation process (table 1).

Search	Through the informal exchange of information, the local milieu provides tracing of success stories related to the discovery of new markets and the implementation of new technologies useful to the company, and "memorize" the channels that best disseminating these successful experiences.
Signalling	It signalizes the market in benefit of the image and reputation of local companies, acting as a sort of certifying entity of the quality of goods produced by these companies.
Transcoding	It facilitates collective learning by providing access to privileged information, which is embedded in people and transmitted by personal and organisational proximity. The mechanisms are: a) inter-organizational mobility within the region (but almost interregional immobility) of qualified human resources; b) contacts between customers and suppliers; c) imitation processes and reengineering, spread among local companies of appropriate technologies; d) effects of informal "coffee shop"; e) provision of specialized services within the region.
Selection	It stimulates personal contacts through which are obtained efficiency/effectiveness gains in the circulation of vital information at the level of decision making conducive to innovation; in particular, through the mobility of managers in the local labour market, by imitation, cooperation actions within the framework of associations and industrial and trade organisations and complementary processes of innovation.
Control	Through "face-to-face" ties (belonging to the same family/clan, club, associations), the local environment facilitates the sharing of relevant information in the decision-making process behind the innovation, strengthens the "ties" between the financial sector and the productive system, and promotes a similar "cultural context" among entrepreneurs, managers and other decision makers.
Transformer	It promotes positive externalities appropriable by local companies, particularly important in the spheres of labour market, human capital and education.

Table 1: The functions of the local milieu in reducing the uncertainty in the innovation process (relational synergies of knowledge).
Source: Camagni (1991:121-144).

Such type of milieu may be, as such, determinant to induce external economies of knowledge spillovers' type for small and medium enterprises. Which means that proximity to technical support services, consultancy or integrating consortia with technological centres for the realization of experimental development projects shall reduce costs of transaction and, consequently, accelerate innovation performance at the firm level (Teece, 1988; Scott, 1996; Storper, 1997; Porter, 1990 and 1998a; Torre and Gilly, 2000; Veltz, 2000; Rallet and Torre, 2004; Boschma, 2005).

By contracts of loyalty established between organizations of producers and food industries and large distribution (agro-food companies and hypermarkets), setting standards in quality, quantity, variety and delivery – about to witness an "almost-integration" (Veltz, 2000) with these agents acting as coordinators of a "constellation" of micro and small companies (Piore and Sabel, 1984).

As such, institutional factors and the mobilization of the community and the different regional players to participate in the innovation process plays an important role in order to respond to the specific needs of this community and to promote dynamics of innovation.

In rural areas, the challenge is to manage these dynamic relationships to improve the region's innovation environment (Komninaki, 2015). Komninaki (2015) argues that relative neglect of Regional Innovation Systems interactions limits the fluidity of relationships between actors, particularly in peripheral regions. This may bring the risk of a negative impact in public policy by reducing the territorial capacity of innovation.

In rural regions innovation can take different types, according with Madureira et al. (2013): *1)* product innovation, e.g. agro-tourism and tourism activities rural related to environmental protection; *2)* technological innovations associated with irrigation, to pollution control, waste treatment, processing of agricultural products; *3)* innovation process, such as the cooperation between the various actors involved; *4)* organizational innovations, like deepening of the level of cooperation between local actors; *5)* innovations in attitudes, through a culture of associativism.

Thus innovation in rural areas may involve (Esparcia, 2003; Brunori et al., 2007; Knickel et al, 2009; Madureira et al, 2013:26-27):

• Economies of scale/specialization: to achieve critical mass, mainly through networks sectoral and regional clusters.

• Economies of scope/diversification: expand the range of products and services through new products and services and through the establishment of cross-sectoral networks and through the interaction between, on the one hand, manufacturers and service providers; on the other, between producers and service providers and consumers.

• Modernization/new technologies: replace obsolete products and processes, improving their quality, flexibility and production capacity, and providing goods and services, reducing costs of production/supply.

• Environment and energy technologies: environmental management, minimizing environmental impacts, improving health and safety, reduced energy costs, new forms of energy supply, renewable energy, biomass plantations, reuse of forest products.

• Organization: improving the efficiency of the organization and work processes.

• Distribution and marketing: enter new markets or increase market share and new channels sales and marketing.

• Communication and knowledge: improving communication and information sharing within the organization or with other companies or institutions, universities and partnerships with laboratories research, local communication and learning networks, specialized knowledge networks.

• Training of the rural population and improve the quality of life partnerships, LEADER[1] local action groups, local development associations, social services, cultural services outreach, training in rural development.

• Development of natural resources, cultural and tourism: protected areas, interpretation centres, nature tourism, bird watching, hunting, fishing, gathering forest products, lodging bed & breakfast, rural tourism, village tourism, heritage recovery, cultural promotion (music, theatre, literature).

• Supporting local products: gastronomy, traditional agricultural products, home products and geographical location, distribution centres, development and demonstration sector horticultural, ecological olive groves, craftwork products.

The agro-food complex of production, according to a literature review synthetized by Oliveira (2013), corresponds to a set of clusters located in the same geographic space - the Tagus Valley, built around the NUTS III Tagus Wetland and Middle Tagus (OECD, 2010) – having at its core the following attributes:

• Presence of a web of market and non-market relationships that extend beyond the corporate sector (due to personal, professional and cultural affinities) illustrated in the diversity and quantity of associative and institutional agents located in the region - suggesting the existence of both 'institutional thickness' and proximity in its multiple ways (Storper, 1997; Kirat and Lung, 1999; Torre and Gilly, 2000; Boschma, 2005).

• This model consists of a set of territorialized agro-food systems, which reflect the rural nature of the 'local millieu' (Oliveira, 2013; Rallet e Torre, 2004; Courlet, 2002; Camagni, 1991 e 1995) - i.e. a predominantly rural region where entrepreneurs share: a system of representations, a technical culture and appropriate resources to assure sustainability of agriculture-related businesses (e.g. food, wine and olive oil industries).

• It is governed by two logics at the level of coordination mechanisms that determine the territorial anchoring of the agro-food supply chain: a) *transactional* (not confining purely to commercial nature); *b) regulational* (going further the pure regulatory logic). These mirrors the change of paradigm in globalized agribusiness, showing that even being a traditional activity (Pavitt, 1984) it has known structural changes in the last decades imposed by important socio-cultural, economic and political transformations (Piore and Sabel, 1984; Veltz, 2000). Such change reflects the progressive adoption of a set of routines geared to

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[1] LEADER ("Liaison Entre Actions de Développement de l'Économie Rurale") is a local development method which allows local actors to develop an area by using its endogenous development potential.

innovation and internationalization through local and extra-local networks (Boyer, 1988; Dosi, 1982; Nelson and Winter, 1982; Teece, 1988; Lundvall, 1988).

2. METHODOLOGICAL NOTES

Based on a case study of interpretative nature (Chua, 1996), since 2009 until 2011 we proceeded to the collection of data relating to the agro-food complex of Tagus Valley through triangulation of sources typically used in this kind of research: *direct observation* (in farms, units of processing, storage and packaging food stuffs and wines, and regulatory and promotional agents); *semi-structured interviews* to individuals representing the various categories of agents involved, alongside the *questionnaire* in the case of business agents; and *documentary research* (legislation on the common organisation of agricultural markets and the recent report of the Portuguese Agricultural Census/2011, among other official documents; selected articles from regional press including interviews to the Portuguese Minister then responsible for agriculture sector and to associative leaders).

Between 2010 and 2011 it was held an inquiry to individual producers, administrators and supervisors of agricultural societies, agro-industrial and agro-food companies, and associative leaders in a total of 112 participants, representing 110 business organisations employing a total of 3736 workers[2]. The response rate was 56.7% of the identified universe, regarding to the most common activities at the light of integrated business accounts system adopted by Statistics Portugal. The sampling method followed the criterion of heterogeneity of business activities existent in the territorialised agro-food complex. The identification of eligible units was done through "snowball" method (Seidman, 1998) in the case of farm producers and food and wine industries. The heterogeneous sample included the totality of the producers' organizations (including cooperatives) in existence at the date of the survey.

The collected data were submitted to descriptive and inferential statistics. The measurement of variables was made according to the method of standardised scores, as proposed in the Community Innovation Survey (Eurostat/European Commission 2006, 2008 and 2010) and in the Regional Innovation Scoreboard 2012 (European Union, 2012), by means of primary data obtained through inquiry – presented in Oliveira (2013).

To improve the interpretation of empirical findings, especially considering the second purpose of this research, it was made use of qualitative data collected through technics above mentioned. The valued added for a better understanding of stakeholders positioning is mirrored in a few proposals for effective policy design and coherence of regional innovation system.

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[2] The 110 cases that make up the sample observed correspond to the overall rate of participation around 82% among the 135 entities requested to participate in the investigation; the refusal rate was by 4%. Reporting to all the 194 eligible units identified it was not possible to contact 58 agricultural producers, close to 30% of the theoretical sample, within the established period (since June of 2010 until March of 2011).

3. THE PATTERN OF PRODUCTIVE SPECIALIZATION OF TAGUS VALLEY

Consisting of two NUTS 3 statistical region1, *Tagus Wetland* ("Lezíria do Tejo", in Portuguese designation) and *Middle Tagus*, the Tagus Valley territory (contiguous at southwest with the metropolitan area of Lisbon) has a strong rural nature which is shown by its high potential for agriculture and forestry.

When analysing its profile of productive specialization, by applying the location quotients of relevant activities the existence of a spatial agglomeration of agricultural activities can be confirmed (see appendix, Tables A-2 and A-4 (columns 7), almost all values are greater than 1).

3.1 THE INNOVATION BEHAVIOUR IN RELATION TO THE PERFORMANCE OF INSTITUTIONAL FACTORS

Taking into consideration some literature around the territorially differentiated patterns, following the innovation systems approach (Asheim, 2007; Navarro *et al.*, 2008; Capello and Lenzi, 2011; Camagni and Capello, 2012; Natário *et al.*, 2012) it was admitted the chance of a positive association between possible institutional attributes and innovation, measured by partial indexes intended to capture its various dimensions (OECD/Eurostat, 2005) – product, process, organisational, marketing and investment in innovation activities – aggregated then in a simple average (a global index of innovation).

The statistical units considered were companies with headquarters in the Tagus Valley (NUTS 3 Tagus Wetland and Middle Tagus), of any dimension but exercising at least one activity embedded in the agro-food supply chain (divisions 01, 10 or 46 of the Portuguese classification of economic activities, third review, dated from 2008)[3]. The sample surveyed is characterized according to the following table.

Category/Dimension	Microenterprise		Small company		Medium-sized enterprise		Large company		Total
Supplier	1	1,9%	0	0.0%	0	0.0%	0	0.0%	1
Producer	34	63,0%	23	56,1%	5	41,7%	0	0,0%	62
Producer organisation	12	22,2%	4	9,8%	0	0,0%	0	0,0%	16
Agricultural Cooperative	3	5,6%	2	4,9%	0	0,0%	0	0,0%	5
Cooperative winery	1	1,9%	4	9,8%		0,0%		0,0%	5
Agro-Industry	2	3,7%	8	19.5%	4	33,3%	3	100,0%	17
Agro-food company	0	0,0%	0	0,0%	3	25,0%	0	0,0%	3
Producer Association	1	1,9%	0	0.0%	0	0.0%	0	0.0%	1
Total	54	100%	42	100%	12	100%	3	100%	110

Table 2: Composition of the sample by category of agents embedded in supply chain of food and wine, in Tagus Valley.

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[3] Divisions 01 and 10 are listed in tables A-1 and A-3; see Appendix.. Within division 46 (wholesale), it should be considered in particular activities as wholesale of agricultural raw materials and live animals, as well as wholesale of food, beverages and tobacco.

The sample in question is representative of the heterogeneity of the target population, whose size is unknown, in the light of the information collected from the databases existing on the date of the study (2010-2011) made available by public authorities and associations. The head office for 87% of the companies was located in the Tagus Wetland; 47% of companies had less than 20 years of existence (reported to 2011). About 43 percent were exporters, and 25% sold exclusively for the Tagus Valley.

The results obtained for non-parametric correlation tests based on Spearman's Rho (r_s), needed after rejecting the hypothesis of normality of a large majority of the variables included in the empirical research, are presented in the tables 3 and 4. Given that all these correlations are statically significant, with positive estimates, we conclude that the *companies with better conditions in terms of institutional factors specific to the region tend to highlight best innovation-related indexes*.

However, it is worth of notice that the hypothetical beneficial action of vocational training centres in innovation performance (positive correlation between A212 and each of the dimensions of innovation) only shows empirical evidence in terms of process innovation (*p-value* equals 0.007), not being totally clear tests regarding marketing and organizational dimensions (p-values marginally above the critical value of 0.05: 0.059 and 0.055, respectively). So we can infer that the action exerted by those organizations and institutions is positively correlated with the overall performance of innovation - particularly the activities of local government whose correlation coefficient shows the highest value (0.46).

Institutional factor	A211		A212		A213		A214		A215		A216	
Dimension of innovation	r_s	p	r_s	p	r_s	p	r_s	p	r_s	p	r_s	p
Product	0.27	***	0.12	ns	0.22	**	0.37	***	0.18	*	0.11	ns
Process	0.29	***	0.26	***	0.29	***	0.38	***	0.25	***	0.33	***
Organizational	0.38	***	0.18	*	0.27	***	0.24	**	0.23	**	0.31	***
Marketing	0.16	*	0.18	*	0.13	ns	0.35	***	0.20	**	0.27	***
Investment in related activities	0.32	***	0.12	ns	0.15	ns	0.38	***	0.25	***	0.25	***
Global innovation	0.36	***	0.22	**	0.29	***	0.46	***	0.28	***	0.33	***

Table 3: Correlation of innovation with institutional factors specific to the region.

Caption: A211 - scientific and technological base within the region; A212 - vocational training centres (idem); A213 - local partnerships with sectorial agents; A214 - local Government performance; A215 - cooperation of financial institutions located in the region; A216 - local labour market. ***/**/* significant at the level of 1%/5%/10%; ns - not significant.

The variance proportions of innovation that are explained by the institutional conditions specific to the region are between 4.0% (on the relation between marketing innovation and the indicator of the degree of financial institutions' cooperation within the region) and 22.1% (linking the global innovation with the institutional factors performance).

Considering the extra regional institutional factors, following table 4 it is noted the existence of statistically significant correlations in all dimensions of innovation and, also, in the global indicator

of innovation with almost all these factors. There are, nevertheless, two exceptions: *i)* there is no significant evidence that the performance in marketing innovation is positively correlated with the importance attached by the companies to the extra regional scientific and technological basis; *ii)* nor that the better provision of external vocational training centres (A222) if associated with increased investment in innovation activities.

Institutional Factor	A221		A222		A223		A224		A225	
Dimension of innovation	r_s	p	r_s	p	r_s	p	r_s	p	r_s	p
Product	+0.28	***	+0.14	ns	+0.26	***	+0.36	***	0.21	**
Process	+0.30	***	+0.27	***	+0.30	***	+0.23	**	0.28	***
Organizational	+0.33	***	+0.20	**	+0.30	***	+0.22	**	0.25	***
Marketing	+0.13	ns	+0.22	**	+0.23	**	+0.49	***	0.25	***
Investment in related activities	+0.28	***	+0.16	*	+0.19	**	+0.42	***	0.30	***
Global innovation	+0.33	***	+0.26	***	+0.35	***	+0.44	***	0.32	***

Table 4: Correlation of innovation with institutional factors external to the region.

Caption: A221 - scientific and technological base outside the region; A222 - vocational training centres (idem); A223 - partnerships with sectorial agents from outside the region; A224 - Performance of public administration (central Government). A225 - cooperation of financial institutions located outside the region. ***/**/* significant at the level of 1%/5%/10%; ns - not significant.

All significant correlations are positive, showing a high probability of *companies with better institutional conditions (in terms of external resources) achieve better performance in innovation*, despite the exceptions mentioned in the preceding paragraph. The variance proportions of innovation that are explained by institutional conditions external to the region are situated between 3.6% (investment in innovation-related activities in relation to the degree of performance as business partners of business agents linked to agro-food business value system, located outside the region) and 26.0% (the global innovation index related with performance of institutional factors outside the region).

Thus it is evident how relevant is for boosting rural innovation the support provided by institutional stakeholders in access to knowledge, leading to the assessment of the role exercised by the higher education sector (OECD, 2002), either external or specific to the region of interest, so as to better understand the pattern of innovation in the territorialised agro-food complex.

3.2 INSTITUTIONAL THICKNESS

Then it took place a second phase of research, dedicated to the evaluation by business agents about the performance of national and local government and public schools and R&D centres as responsible not only for managing the main instruments for territorial cohesion development (including *Rural Development Program* and the *Compete Program - collective strategies for local efficiency* within the National Strategic Reference Framework 2007-2013 implemented by Portuguese Govern); but also for the production and dissemination of knowledge (codified and tacit) and technology transfer to productive system.

Thus, reading 'scores' for variables A211 to A214 (identified in table 3) according to a qualitative scale of ordinal type based on quartiles after indexing (too modest, modest, good, excellent) it was found that, in general, the activities developed by all of these entities were valued as modest (see Appendix, table A-5).

Still, it is to register the recognition for about half of the respondents regarding the adoption of a set of measures implemented by public institutions considered as relevant to improve not only the transfer of knowledge and performance in business innovation, but also the notoriety of regional products at national and international markets. Such measures were: vocational training (54.5%), organising local events to promote regional products (52.7%); reduction of bureaucracy (49.1%); promotion of the region's products abroad (48.2%).

It should be noted that subjective appreciation is notoriously more favourable among exporting companies (47 of a total of 110 surveyed). For these, public measures that received a positive percentage balance of opinions (making use of a multi-choice scheme for answering to the questionnaire) were as follows:

- Reduction of bureaucracy (+ 25.5 percentage points/pp.);

- Access to market information and new regulations (+ 23.4 pp);

- Public funding for innovation activities, including the qualification of specialised personnel (+ 17.0 pp);

- Organisation of local events of promotion of regional products (+ 17.0 pp);

- Vocational training in the region (+ 14.9 pp);

- Promotion of the region's products abroad (+ 6.4 pp).

The remaining 63 enterprises (negotiating only in the domestic market) revealed an opinion frankly more unfavourable in relation to the role exercised by public in the decade under consideration, highlighting just three measures with a positive balance: vocational training in the region (+ 25.4 pp); organisation of local events of promotion of regional products (+ 12.7 pp); reduction of bureaucracy (+ 3.2 pp).

These results suggest that overall performance of entities under evaluation will have been instrumental in reducing transaction costs and uncertainty in innovation activities that supported the internationalisation of companies surveyed.

Despite of some testimonies favourable to the action of higher education institutions and R&D centres, mostly located outside the region, the fact is that a majority (54.5%) of respondents to the questionnaire refused to recognise these entities as partners – being mostly the same in the public domain.

Such results indicate the existence of gaps in connection between education and R&D sectors and firms in its large majority; locking the dynamics of organizational learning and innovation in the region, causing a lack of appropriate human capital particularly in micro and small enterprises

(which invested the least in training and/or recruitment of agronomists and technicians skilled in agricultural activities, throughout the decade of 2000).

Facing the evidenced facts, two important needs arise. One relates to the in-depth analysis of the reasons that explain this weak organizational proximity between knowledge production/transfer centres and respective users (particularly smaller companies), revealing "*institutional fineness*" (Amin and Thrift, 1994). Another is to identify what actions in terms of collective efficiency could improve the effectiveness of regional innovation system to overcome this lack of proximity.

Thus a new stage of statistical analysis comes up, which purpose is to identify which routines and procedures that are missing so as to trigger a greater dynamism in knowledge spillovers taken at local and extra-local levels, in coherence with the construct for each function of local milieu (table 1). The rationale is as follows: if companies (surveyed) are proactive in access to knowledge they should get a permanent learning from establishing interactions with their business partners (bearing in mind the limited rationality of economic agents and their differentiated ability to process information and so generate innovations).

The measurement of those functions, as detailed in table A-8, was made using a simple arithmetic average of the variables presented in table 3 along with a few more variables to capture specific corporate attributes (described in table A-7). One should notice that once again all elementary variables were previously indexed and then were calculated the respective statistics, allowing an harmonized reading based in quartiles about each function performance. Results for descriptive statistics are shown in tables 5 and 6, exhibiting a low performance for search, signalling, selection and transformation functions; and a medium performance for transcoding and controlling functions.

Statistics		Search	Signalling	Transcoding
N	Valid cases	110	110	110
Average		32.29	34.47	41.13
Median		31.95	32.80	40.26
Std.- deviation		17.30	11,26	12.75
I.C.$_{95\%}$ (μ)		(29.04 ; 35.54)	(32.36 ; 36.59)	(38.73 ; 43.52)
Minimum		3.45	9.52	11.37
Maximum		86.32	69.05	81.04
Performance				

Table 5: Measures of central tendency and location for indexes relating to
the functions of the local milieu.

Statistics		*Selection*	*Controlling*	*Transformation*
N	Valid cases	109	109	109
	Missing	1	1	1
Average		35,11	49,90	37,57
Median		33,33	49,60	37,44
Std.- deviation		19,28	11,10	12,81
I.C.$_{95\%}$ (μ)		(31.49 ; 38.73)	(47.81 ; 51.98)	(35.17 ; 39.98)
Minimum		,00	25,99	12,87
Maximum		86,75	74,11	73,48
Performance				

Table 6: Measures of central tendency and location for indexes relating to the functions of the local milieu (conclusion).

Caption:

81 - 100	"very high"	
61 - 80	"high"	
41 - 60	"medium"	
21 - 40	"low"	
0 - 20	"very low"	
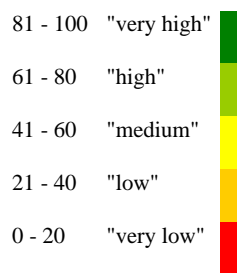
3.3 DISCUSSION

The qualitative assessment of performance for each of them, jointly with the analysis of the data collected through qualitative techniques described in methodological notes (with emphasis on interviews to local business actors[4], mayors and Public Administration representatives), allow withdrawing the following conclusions regarding the research question addressed to collective efficiency' actions:

- Strengthen the link between the associative entities and respective affiliates, towards greater cooperation and awareness of producers for ongoing changes in markets and technologies, with the collaboration of higher education institutions and research centres (through systematic training and experimental development). This shall lead to efficient technological choices and effective management decisions in an uncertain environment (like a tracking mechanism).

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[4] During the research period, between 2010 and 2012, there were about 25 interviews to managers of LEADER Local Action Groups, as well Producers' Organizations recognized by Portuguese State as beneficiaries of Common Agricultural Policy subsidies and European funds for rural development.

- Foster integration of the value chain through intensification of actions for promotion of regional products (wine, olive oil, vegetable crops, livestock and the horse), signalling expanding international markets - such as Brazil, Russia, China, the Australian continent and the countries of Eastern Europe (in particular the Baltic Sea region). This action must also involve regulators agents, acting collectively in a proactive way not only with the large producers but also with producer organisations. Otherwise they still be judge by the majority of farmers and industrial agents as mere extensions of the Central Administration.

- Promote greater institutional and cultural proximity (Boschma, 2005) among agents involved in agro-food complex (bringing together the efforts of entrepreneurs and managers, researchers/teachers and politicians with sectorial responsibilities) via open discussion forums, reducing information asymmetries existing in the market. This action might serve to revitalize the National Fair of Agriculture, annual event that has taken place for more than half a century in Santarem being an excellent meeting point for economic and institutional actors linked to agriculture and food industries. With such an action would not only be enhanced that symbol of rural culture in the region but above all the urgent debate regarding to the unbalanced share of economic value generated within the regional agro-food complex.

- Massive announcement by business and associations of producer organisations (PO) regarding through realization of geographically decentralized seminars regarding operational plans for agribusiness using communication systems that support the transmission of image and voice in real time (digital technologies). This action may enable producers to anticipate and adjust in a timely manner their offer in competitive markets – a critical issue in the face of rapid and intense changes in the external environment (not controllable, dynamic and uncertain).

- Effective coordination that is expected by the PO implies also, face-to-face communications and regular technical visits to farms in order to monitor the evolution of cultures according to the standards set in those plans, contributing for the homogenization of the product quality and predictability of supply. The deepening of this interaction strengthens the upstream value creation and integration of supply chain - improving the ability of local business agents to exert 'control function'.

- Reinforce the cognitive basis of PO through advanced training of agronomists at their service in the field of experimental development, fulfilling the needs of micro and small producers in terms of 'stock' of knowledge. This action might encourage the implementation of best practices in the area of environmental sustainability and the upgrading of cultivation techniques and livestock production, with marginal benefits accrued to the producer, and particularly to society, by mitigating the risk of loss of biodiversity associated with intensive farming practices and improving the quality of foodstuffs, with lower human health risks.

- Permanent support to farms by engineers and technicians employed at PO. It is still evident the human capital gap, demanding to incorporate technical staff, with experience

in experimental development, endowed with not only scientific but also organizational skills and communication to interact with producers. It is therefore advisable to strengthen the formal knowledge in the areas of management and marketing, in parallel with the accumulation of tacit knowledge, fertilized by more regular contacts with R&D centres and postgraduate education which will help to offset the "skills gap" (Camagni, 1991).

• Underpinning of tax incentives for companies that reinvest profits in experimental development through projects in partnership with PO and with R&D units based in the region, in line with the scientific patronage. This might help to internalize market failures inherent to 'spillovers' of knowledge originated in the scientific and technological system administered by the govern; specifically under the technology transfer programmes (Pavitt, 2005). This measure could trigger effects of symbiotic nature (namely in what concerns to PhDs and MScs applied research), and may constitute an important source of autonomous funding for the polytechnics established in the region (Santarem and Tomar) – endowing the regional innovation system with upgraded human resources (Tödtling and Trippl, 2012; Natário *et al.*, 2010).

FINAL CONCLUSIONS

This study seeks to evaluate and interpret innovation performance, within a set of economic activities - namely the regional agro-food supply chain - that characterize the pattern of productive specialization of Tagus Valley, under the hypothesis of several determinant factors, of entrepreneurial and/or territorial nature, framed by an analysis model extensible to other regions.

Given the results, it is concluded that the standard of innovation that predominates in the territory would be, in the logic of Camagni and Capello (2012), a *smart and creative diversification area*, characterized by some internal innovation capacity, high degree of local competences, suggesting that the not negligible innovation activities carried out in the area mainly rely upon tacit knowledge embedded into human capital. Moreover, the regional agro-food complex is strongly endowed with characteristics such as creativity and attractiveness that help to absorb knowledge and to adapt it to local innovation needs. However, by opposite the conditions of Camagni and Capello (2012), the region doesn't present a low degree of local applied knowledge.

The strengthening of local institutional thickness, through the intensification of relations between higher education institutions, is crucial for a widely accessible knowledge base and thus fostering innovation processes, filling the gaps between companies in terms of R&D. Shortening the detachment between universities/polytechnics and the agribusiness units demands the provision of knowledge intensive services (including training and consulting provided by the higher education institutions and R&D centres), as well as financing courses on the part of companies. This organizational proximity will be the backbone to step toward the needs fulfilment of those, into a path of better regional innovation performance.

In terms of policy making, in short becomes critical:

- Strengthen the linkage between the productive sphere and the scientific and technological system in order to enhance the transfer of knowledge for micro and small enterprises, particularly in agricultural activities.

- Intensify the coordinated collective actions through local institutions for the promotion of products originating in the territory.

- Sensitize young people for multiple career opportunities in activities directly or indirectly linked to the agro-food business of the Tagus Valley.

In particular, micro and small enterprises must be compromised with the strategic requisite of increasing respective human capital endowment in order to improve their capacity to absorb technological knowledge, consequently intensifying interactive learning by means of intentional spillovers (specialized consulting and trainee, postgraduate courses and participation in scientific workshops in Portugal and abroad).

As a final remark, this paper allows to develop the analysis of innovation in rural territories according to its specificities including the role of public institutions in this process. The conclusions remit to important proposals related with public policies and territorial governance. In this sense, future research shall be centred in role of external networks of knowledge on an international scale, realise what may be done, how and to what extent, considering that higher education sector have a pivotal function of linking different regional systems of innovation, crossing borders beyond the strictly European economic area by means of digital technologies.

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APPENDIX

Table A-1: List of agricultural activities (agriculture, animal production and related service activities) – Portuguese classification of economic activities/rev.3.

Section A	Agriculture, animal production, hunting, forestry and fishing
Division 01	Agriculture, animal production, hunting and related service activities
Group 011	*Temporary crops*
Group 012	*Permanent crops*
Group 013	*Vegetative propagation material culture*
Group 014	*Animal production*
Group 015	*Agriculture and animal production combined*
Group 016	*Services activities related to agriculture and animal production*

Source: INE (2007). Note: This classification is largely coincident with NACE Rev.2 from Eurostat.

Table A-2: Location quotients by groups of agricultural activities in the Tagus Valley vis-à-vis the Mainland Portugal (year of 2009).

Grouping of municipalities (NUTS III)		Tagus Wetland		Middle Tagus		Tagus Valley	
Group code (CAE Rev.3)	1)	2)	3)	4)	5)	6)	7)
011	1,11%	4,95%	4,45	0,81%	0,73	2,94%	2,64
012	0,62%	0,85%	1,37	0,22%	0,36	0,54%	0,87
013	0,02%	0,04%	2,06	0,01%	0,48	0,03%	1,33
014	0,53%	1,75%	3,2	0,75%	1,41	1,26%	2,37
015	0,88%	2,05%	2,32	0,35%	0,40	1,22%	1,39
016	0,30%	0,48%	1,60	0,36%	1,20	0,42%	1,41
Total	3,47%	10,11%	2,92	2,50%	0,72	6,41%	1,85

Caption:
Relative weight per group in the universe of establishments in the Mainland Portugal;
Relative weight per group in the universe of establishments in the Tagus Wetland;
Location quotient by group of activities (Tagus Wetland);
Relative weight per group in the universe of establishments of the Middle Tagus;
Location quotient by group of activities (Middle Tagus);
Relative weight per group in the universe of establishments of Tagus Valley;
Location quotient by group of activities (Tagus Valley).
Source: calculations performed based on data provided by the Office of Strategy and Planning, the Ministry of labour and Social Security (April, 2011).

Table A-3: List of agro-food industries (Portuguese classification of economic activities/rev.3.).

Group	Designation
101	Animal slaughter, preparation and storage of meat and meat products
103	Preparation and storage of fruits and vegetables
104	Production of animal and vegetable oils and fats
105	Dairy industry
106	Processing of cereals and legumes; manufacture of starches, and starches related products
107	Manufacture of bakery products and other flour-based products
108	Manufacture of other food products
109	Manufacturing of feeding stuffs

Source: INE (2007).

Table A-4: Location quotient of agro-food industries in Tagus Valley (year of 2009).

Grouping of municipalities (NUTS III)	Tagus Wetland			Middle Tagus		Tagus Valley	
Group code (CAE Rev.3)	1)	2)	3)	4)	5)	6)	7)
101	0,13%	0,15%	1,17	0,16%	1,24	0,15%	1,20
103	0,04%	0,15%	4,01	0,07%	1,82	0,11%	2,94
104	0,04%	0,06%	1,50	0,17%	3,98	0,12%	2,70
105	0,07%	0,06%	0,91	0,06%	0,81	0,06%	0,86
106	0,03%	0,11%	4,02	0,07%	2,55	0,09%	3,31
107	1,45%	1,68%	1,16	1,66%	1,14	1,67%	1,15
108	0,09%	0,11%	1,22	0,09%	1,04	0,10%	1,13
109	0,03%	0,15%	4,83	0,05%	1,46	0,10%	3,20
Set of groups	1,9%	2,47%	1,32	2,32%	1,23	2,40%	1,28

Caption:
Relative weight per group in the universe of establishments in the Mainland Portugal;
Relative weight per group in the universe of establishments in the Tagus Wetland;
Location quotient by group of activities (Tagus Wetland);
Relative weight per group in the universe of establishments of the Middle Tagus;
Location quotient by group of activities (Middle Tagus);
Relative weight per group in the universe of establishments of Tagus Valley;
Location quotient by group of activities (Tagus Valley).
Source: calculations performed based on data provided by the Office of Strategy and
Planning, the Ministry of labour and Social Security (April, 2011).

Table A-5: Statistics of central tendency and dispersion for the territorial nature factors.

Factors / Dimensions	Average	Median	s.d.	X_{min}	$X_{máx}$
Local scientific and technological Base (A211)	27.12	16.67	23.85	0.00	91.67
Local vocational training centres (A212)	35.91	25.00	33.78	0.00	100.0
Local partnerships with agents of the sector (A213)	35.03	30.00	22.97	0.00	96.67
Performance of local government (A214)	30.51	33.33	18.64	0.00	66.67
Region-specific institutional factors (A21)	36.40	35.09	16.31	6.02	74.86
External scientific and technological Base (A221)	26.52	20.83	23.95	0.00	91.67
External vocational training centres (A222)	28.86	25.00	28.17	0.00	100.0
External partnerships with industry agents (A223)	32.61	30.00	22.92	0.00	96.67
Performance of Public Administration (A224)	24.21	22.73	17.81	0.00	90.91

Table A-6: Statistics of central tendency and dispersion for the corporate nature factors.

Factors	Average	Median	s.d.	X_{min}	$X_{máx}$
Degree of competition within the cluster (B11)	60.00	57.14	14.84	28.57	100
Social/relational Capital (B12)	57.64	60.00	17.92	20.00	100
Interaction (B13)	29.25	27.59	17.57	0.00	86.21
Reserve of tacit knowledge (B14)	48.86	50.00	20.43	0.00	100
Local entrepreneurship (B15)	47.50	50.00	22.19	0.00	100
External to company but industry-specific (B1)	48.65	48.17	10.72	25.33	87.53
Market monitoring (B21)	50.00	50.00	38.31	0.00	100
Participation in knowledge transfer networks (B22)	36.49	35.71	15.16	14.29	92.86
Endowment of human capital (B23)	42.17	46.15	23.48	0.00	84.62
Internationalization (B24)	12.73	0.00	18.61	0.00	83.33
Company-specific (B2)	35.35	34.16	16.91	5.36	79.35

Table A-7: Attributes of the clustered Agro-food supply chain of the Tagus Valley.

Specific to Agro-food supply chain	Degree of regional competition within the Agro-food supply chain, vis-à-vis the rest of the country (B11)
	Social/relational capital (B12)
	Interaction (B13)
	Reserve of tacit knowledge (B14)
	Local entrepreneurship (B15)
Specific to firms	Market benchmarking (B21)
	Participation in knowledge transfer networks (B22)
	Endowment in human capital (B23)
	Internationalization (B24)

Table A-8: Elementary variables applied in measurement of functions of the local environment.

Function	Elementary variables
Search	A213, B13
Signalling	A214, B11, B24
Transcoding	A213, B12, B13, B23
Selection	B21, B23, B24
Control	A111, A112, A213, A215, B12, B22
Transformer	A113, A114, A211, A212, A213, B13, B14, B15

Caption: A111 – accessibility, A112 – connectivity, A113 – localization economies, A114
– local labour endowment. The remaining variables are identified in tables 3, 4 and A-7.