Benchmarking Innovation in the Valencian Community¹

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Abstract

Benchmarking on innovation policies allows less developed territories to adjust their learning processes along with the experiences of others. There are successful territories in Europe where innovation policies have become key to their development, but there are others where this is not the case, as most Spanish regions. The purpose of this paper is to benchmark the Valencian Innovation System, at three levels of analysis: a) Spanish, b) Mediterranean and c) European regions.

Our results highlight its main strengths and weaknesses, which are indicative of the deficiencies in the Valencian industrial structure and the difficulties involved in absorbing newly qualified, highly-educated people. The Valencian Community shows relative strengths in those aspects related to public funding while its weaknesses are related to private activities. This structural imbalance drives us to categorize the Valencian Innovation System as weak, unarticulated and unbalanced, what makes us question the real existence of a regional innovation system in the Valencian Community.

We consider that support from the regional government should be oriented first towards the definition of some common consensus based targets in which the main actors are involved. Then second, entrepreneurial activities should be fostered, what may link the existing industrial structure to the public research system in the region. Third, a structural change must be promoted in Valencian universities, with greater emphasis on co-operation with regional firms, and knowledge transfer to SMEs so as to increase their competitiveness.

1.- Introduction

Innovation has become one of the main priorities for most European regions. The agreements adopted in the Lisbon and Barcelona Councils are evidence of this

(European Lisbon Council, 2000; European Barcelona Council, 2002). Consequently, innovation policy benchmarking studies constitute one of the main research focuses in the literature (Hassink, 1993; Dou, 2004).

To provide some support to regions in the development of their innovation policies, the EU launched in 1994 the Regional Innovation Strategies (RIS) initiative to promote the definition of R&D and innovation policies at the regional level. Then, the First Action Plan for Innovation in Europe (European Commission, 1996) provided a structure as well as an analytical method for the definition of innovation policies. Based on this, the 'Trend Chart on Innovation in Europe' was a practical tool for the designers and managers of innovation policies, intended to enable a continuous updating and analysis of available information on innovation policies. The results of the First Action Plan and the Trend Chart should enable less favoured territories to learn from good practice and to institute processes oriented to defining and implementing more territorially 'embedded' innovation policies (Georghiou, 1998). This justifies the increasing attention devoted to benchmarking analyses dealing with R&D and innovation in the last years (Hurmenlinna et al., 2002; Luque-Martínez and Muñoz-Leiva, 2005) as a process oriented to drive regions learn from their experiences and from others'.

Within this context it has to be stressed the key role played by the IRE (Innovating Regions in Europe) Network² as a support structure for carrying out benchmarking exercises on innovation policies in European regions. In this sense it has to be added that in December 2006, the Directorate General of Enterprise and Industry launched the PRO INNO³ platform, complementing the IRE Network, aiming at contributing to the development of better innovation policies in Europe, learning from best-practices and transregional cooperation (Perkmann, 2003).

Against this backdrop, the regional dimension has gained in importance, demonstrated by the number of programmes aimed at promoting innovation that have

been implemented in less favoured European regions (Henderson, 2000). The great variety of these actions and the innovation policies developed, illustrate the structural and cultural diversity as well as the main political priorities of each member state (Fernández de Lucio et al., 2003). The literature has associated these differences to the characteristics of the innovation system (Cooke et al., 1997). In addition, a process of devolution of competences to the regions has been taking place in many European countries. As a consequence, regions have become increasingly important sources of innovation and economic growth.

One of the main focuses of research in these areas has been linked to the indicators used to represent and measure innovation (Oslo Manual, 1992, 2005; Frascati Manual, 1994, 2002; Leydesdorff, 2001). In this sense there is an implicit agreement when recognising the existence of deficiencies and lacks in the indicators that allow the measurement of R&D and technological innovation (Godin, 2002, 2003). The European Commission has implemented the Community Innovation Surveys and has introduced a European Innovation Scoreboard [EIS], which includes indicators designed to capture innovative capacity (European Innovation Scoreboard 2002, 2003). This scoreboard enables the progress in Europe in relation to the goals defined in the Lisbon and Barcelona councils to be monitored.

Within this framework of analysis, this paper aims at benchmarking the Valencian Innovation System making use of the indicators provided by the EIS, Eurostat and national statistics. In relation to the later, it has to be stressed the paper by Fernández de Lucio et al. (2001) who identify the strengths and weaknesses of the Valencian Innovation System according to the main features of its structure, absorptive capacity and articulation. In our case the analysis will compare the situation of the Valencian Innovation System within Spanish, Mediterranean and European regions. For the Spanish regions, their evolution from 1992 to 2004 is analysed, while within the

different Mediterranean and European regions the analysis is based on the period 1994-2003.

The paper is organized as follows. The first section provides the conceptual framework, the methodology adopted, and the data used in the research. Then section 3 presents the main results obtained in this benchmark and section 4 finally presents the main conclusions achieved as well as some policy recommendations.

2.- Conceptual Framework

From a theoretical point of view, Main defines benchmarking as “the art of finding out, in a perfectly legal and aboveboard way, how others do something better than you do-so you can imitate-and perhaps improve upon-their techniques” (Main, 1992: 102). Benchmarking thus represents a systematic process that allows improving ones key processes by comparing them with the peak performance of the best-in-class (Hurmenlinna et al., 2002). Similarly, according to Dou “Benchmarking could be defined as a system which allows a company and institution or an individual to compare some of their activities with those of the ‘best in class’” (Dou, 2004: 298).

On the other hand, and since we are aiming at benchmarking innovation, innovative capacity could be described as “the ability to produce and commercialize a flow of new-to-the world technologies over the long term” (Furman et al., 2002: 900). In this sense, the literature offers a broad diversity of composite indicators for measuring this capacity (den Hertog et al., 1995; NISTEP, 2001; European Innovation Scoreboard, 2002, 2003; Huggins et al., 2004; Grupp and Moguee, 2004).

To enhance policy learning and contribute to more appropriate policy recommendations (Benz and Furst, 2002) it is common to use examples of ‘best practice’ as blueprints for all regions. Use of general statistics and indicators is aimed at highlighting the main strengths and weaknesses of the regions under study (Fernández de Lucio et al., 2001). These general statistics will enable government

bodies to identify those aspects where regions and countries are lagging behind. That way, they will also observe the innovation policies being defined, implemented and evaluated by their pairs, what definitely can improve their own policy making processes. It is to be hoped that this will enable a focus on those institutional aspects that will have the most direct impact on legal and institutional frameworks allowing more territorially embedded innovation policies to be defined and implemented (Díez, 2002).

As the purpose of this paper is to analyse the relative position of the Valencian Innovation System, this regional benchmarking study will be carried out at three levels of analysis: a) Spanish regions, b) Mediterranean Regions and c) European regions.

First, we have decided to focus on the Valencian Community, because of its structural features. Its regional GDP (81,781.4 Million Euro) represents 9.8% of the whole Spanish income (840,106 MEuro). This ranks fourth among Spanish regions after Catalonia, Madrid and Andalucia, who have been already studied in the literature (Bacaria et al., 2001; Real Heredia, 2001; Riba Vilanova and Leydesdorff, 2001; Albert and Plaza, 2003). Besides, it has some structural characteristics that cannot be found in any other Spanish region. It's most representative sectors (i.e. wood, tiles, ceramics, toy industry, footwear and textiles) are grouped through industrial districts such as the wood one from Benicarlo, the tiles in Castellon, the toys in Elda, the footwear in Elche and the textile from Onteniente. Second, the innovative patterns of firms are not oriented towards R&D activities. On the contrary, firms drive their innovative activities by the acquisition of foreign machinery (INE, 2004). This explains the low-medium technological level of regional firms, which are concentrated on labour intensive sub-sectors, with an alarming lack of companies in high-tech and knowledge-intensive sectors⁴. Third, not only firms are low technology oriented, but what's more, 66.8% of regional firms are constituted by less than 6 employees, while 96.8% are composed by less than 50 employees; only 0.02% of Valencian firms have more than 1000

employees (INE, 2004). Fourth, universities are the main catalyser of regional research activities, but the existing structural imbalance leads the Valencian Innovation System to be fragmented and disoriented due to the lack of co-operation among firms and the research system (Fernández de Lucio et al., 2001).

The reason why we have decided to divide our benchmark into three stages, and hence include the Mediterranean and European comparisons, is that with it, we aim at offering a more comprehensive view of the real competitive position of the Valencian Community, not only in Spain, but also on the Mediterranean arch and the whole Europe. Besides, we consider that the existing high degree of heterogeneity among regions as regards innovation will enrich the contribution of this benchmark.

The Spanish 1978 National Constitution (Article 137) asserts that the territorial divisions in Spain are municipalities, provinces and the autonomous communities. In this sense, the corresponding Territorial Units for Statistics [NUTS] adopted by the EU and Eurostat, are the NUTS-II. Hence, we will use the NUTS-II territorial units as the unit of reference for our benchmark.

From a theoretical perspective, we would agree that the Valencian Community, and also most Spanish regions, cannot be considered as 'idyllic' or comprehensive regional innovation systems because of their limited system interactivity and the fact that the learning processes related to innovation in policy making are in the very early stages (Riba Vilanova and Leydesdorff, 2001). So, the regional innovation system's perspective (Cooke et al., 1997) might be considered not to be useful in this context. However, this approach offers a conceptual framework that enables comparison of the relative position of the Valencian Community in innovation: thus we adopt an innovation system's perspective in this paper. Besides, the adoption of this common conceptual framework of analysis allows regional authorities to orient their innovation policies according to a systemic view that may cover the identified needs and weaknesses as well as promote those key strengths.

In spite of the multiple approaches found in the literature in the measurement of the innovative capacity, the European Innovation Scoreboard and the indices/indicators it provides are regarded as the main measures of competitiveness in European regions in terms of innovation⁵. Hence we will also adopt this perspective in our study, adapting the indicators to be used as much as possible to the ones provided by the scoreboard. The scoreboard uses 17 indicators across four categories: human resources for innovation, creation of new knowledge, transmission and application of knowledge, and innovation finance, outputs and markets⁶. The 2002-2003 scoreboard includes seven of the 17 indicators⁷. Thus, the EIS comprises a methodology based on two composite indicators, which rank the most innovative regions. First, the RNSII [Regional National Summary Innovation Index] is a measure of the ranking of regions within their home country; second the REUSII [Regional European Summary Innovation Index] evaluates every region in comparison to the European average. Hence, a composite RRSII [Revealed Regional Summary Innovation Index] is obtained from the unweighted average of RNSII and REUSII. Based on the RNSII composite indicator, some of the leader regions⁸ are above their country average. Hence, it can be concluded that innovative capacity is strongly concentrated in a very few regions in these countries, confirming the existence of 'innovation islands' in Europe (Landabaso, 1997; Claïresse and Muldur, 2001).

Nonetheless, it has to be stressed that despite the great advances done during the last decades in the definition and collection of new R&D and innovation indicators, such as the Oslo and Frascati Manuals, there is still a considerable absence of indicators in this sense (Godin 2002, 2003).

Both in the Spanish and the Mediterranean-European approaches, we want to provide a dynamic perspective that shows how the Valencian Innovation System has evolved in time. In the Spanish benchmark we will use a battery of 9 indicators coming from national statistics that draw near the ones employed by the EIS (Section 3.1). The

next indicators are the ones employed in the Spanish case for the 1992-2004 period: Population with tertiary education (% of 25-34 age class), participation in life-long learning (% of 25-64 age class), activity rate of the population with tertiary education (% of active population), employment in high and medium-high technology manufacturing sectors (% of employed population), employment in high technology services (% of employed population), business R&D expenditures (% of GDP), public R&D expenditures (% of GDP), innovation expenditures (% of GDP) and patent applications to the EPO (per million inhabitants).

In turn, the Mediterranean-European analysis (Section 3.2) covers the 1994-2003 period by means of the next 10 indicators obtained by Eurostat: Population with tertiary education (% of 25-64 age class), participation in life-long learning (% of 25-64 age class), employment in high and medium-high technology manufacturing sector (% of total employment), employment in low and medium-low technology manufacturing sector (% of total employment), employment in knowledge-intensive high-technology services (% of total employment), business enterprise sector R&D expenditure (% of GDP), government sector R&D expenditure (% of GDP), higher education sector R&D expenditure (% of GDP), patent applications to the EPO (per million labour force) and high-tech patent applications to the EPO (per million labour force)⁹.

3.- Results

The Valencian Community is one of the peripheral Spanish regions, located on the Mediterranean coast, with a total area of about 23,000 square kilometres, 4.6% of the country. Its population is around 4.5 million inhabitants, which is 10.5% of the total Spanish population. In 2004 its regional GDP per capita was approximately 17,000 Euros, similar to the Spanish average. Its productive structure is mainly constituted by family-owned small firms or small and medium sized enterprises (SMEs) in traditional manufacturing sectors (i.e. shoes, ceramics, furniture, textile, tiles, toys, etc.), none of

which are knowledge intensive sectors. Hence, the innovation intensity of the region is low. For 2004, the activity rate relates to about 59% of the population, and the unemployment rate 11% of the active population. In 2004 R&D expenditure in the region was 0.95% of regional GDP, of which only 35% was attributable to the business sector (INE, 2004), which indicates the small role of firms in relation to public government institutions.

3.1.- The Valencian Community in Spain

In this section, we describe the position of the Valencian Innovation System relative to Spanish regions for the 1992-2004 period. As stated above, 9 indicators are used in this national benchmarking process. To sum up all the information obtained in the period under study, a comparison between the values for the Valencian Community, the Spanish average, and the leader region(s) is performed for each indicator.

[Table 1 here]

In terms of population with tertiary education the results show that the Basque Country has the highest percentage of highly-educated people, with values above 50% in 2001. Navarra, Madrid and Aragon follow with very similar values (about 48%). Extremadura, Balearic Islands and Canary Islands are the lowest ranked regions, with 25% of their populations having tertiary education. In terms of degree of convergence with the Spanish average the values are around 80%, while with respect to the leader region, the values are around 75%.

As regards the participation in life-long learning Navarra and the Valencian Community are the best performers with very similar values among them (around

6.5%) and showing substantial differences with the other regions. On the other side of the coin are La Rioja, Catalonia and Cantabria with values close to 2%.

Catalonia shows the best results (86.8% in 2004) for the activity rate of highly educated people, with Aragon, Balearic Islands, Galicia and the Basque Country close to this level. The Valencian Community is in an intermediate position (82% in 2004), close to the national average (99.75% in 2004) and the leader region (94.5%); Asturias is the lowest ranked (76% employment rate). The Valencian Community is shown to have experienced negative growth over the 12 years from 1992 to 2003, showing some increase in 2004; its position in the ranking has gone down since 1992 when it was third to 11th in 2001 and finally 6th in 2004.

With respect to employment in high and medium-high technology manufacturing sectors, Navarra, with 12% of employment in 2001 and 10.5% in 2004, ranks highest, followed by Aragon, Catalonia and the Basque Country with values around 9-10%. However, in absolute values, Catalonia alone contributes about 30% of the total employment in Spain in these sectors. In the Valencian Community, which ranks 10th, average growth has been negative, decreasing from 4.1% in 1995 to 3.5% in 2004.

For employment rates in high technology services the Valencian Community (1.7% in 2004) is lagging behind and close to the shoddier performing regions such as Balearic Islands, Castilla La Mancha, Castilla León and La Rioja. On the other hand, the Community of Madrid, with 5.8% employment in high technology services in 2004 ranks highest contributing with 40% of total employment in high technology services in Spain. In spite of the period does not allow to conclude any improvement or retreat, it can be seen that the employment rate in Valencia is only around 27% of the leader region and 67% of the national average.

In order to alleviate the weaknesses in the high-tech manufacturing and services sectors, the Valencian economy should focus on emerging sectors that could generate new technologically advanced and knowledge intensive jobs. In addition to

the attempts being made by most Valencian universities in the form of entrepreneurial programmes and science parks, other efforts designed to promote entrepreneurial activities will be needed. In this respect, the Valencian Business Innovation Centres might play a leading role.

Next we move to analyse the expenditures performed by the business sector in R&D [BERD]. The foremost regions are the Community of Madrid and the Basque Country, which both display increasing values above 1%. Catalonia and Navarra, with very similar values are ranked next. Despite the efforts being made by Valencian firms, (0.15% in 1992, 0.33% in 2004), these are growing at a slow pace such that it is not realistic to talk of any degree of convergence despite some positive trend can be observed. This low growth can be explained by the sectoral distribution of Valencian firms. As already stated, most of them are SMEs mainly oriented to traditional sectors (Fernández de Lucio et al., 2001; Molina-Morales et al., 2002) where competitive advantage is mainly based on price, and there is little involvement in R&D activities which are mainly developed by universities and public research centres.

Thus, regional authorities must be realistic in acknowledging that the increase in Valencian BERD is still at a very low level, and that there is an urgent need to modify the regional business structure to include more technologically advanced sectors. On the other hand, in terms of public R&D expenditure, although the Community of Madrid maintains its lead (0.76% in 2004) – mainly due to the ‘capital effect’ - the relative position of the Valencian Community (0.4% in 1992 and 0.62% in 2004) is significantly improved (ranked 6th in 1992 and 3rd in 2004). That way, the Valencian region, which represented 40% of the leader region in 1992 (88% with the national average), had in 2004 a convergence rate above 80% (121% with Spain).

These two last indicators show that those regions with higher rates of public R&D expenditure at the beginning of the period, such as the Community of Madrid, Navarra and Aragon, have changed their focus to BERD. This raises the question of to

what extent it is necessary to increase public R&D spending in a region and the real effectiveness that public R&D may have on its own territory (Cohen and Levinthal, 1990; Todt et al, 2007). Is it really worth increasing the public investments in R&D activities orienting them towards high technology sectors if the existing business sector (industrial structure) cannot absorb the advances made by them?

Innovation expenditures are illustrative of the efforts made to introduce successful products in the market. The period analysed is 1994-2000, but it should be kept in mind that the data are not homogeneous. Between 1994 and 1996 there were no changes in the number of sectors included in the innovation survey in Spain. However, from 1998 on new sectors, such as 'Telecommunication Services', began to be incorporated (and were included in 2000). Thus, these results should be interpreted with a degree of caution, as growth reflects not only increasing commitment in the Spanish economy to innovative activities, but also the inclusion of new sectors. Aragon is far above all the regions and the national average. The Valencian Community, in spite of the efforts done (average growth rate over the last ten years is 4%), cannot be said to be converging with the leader region and the national average. As already stated, in 2000 most regions show a noticeable increase in their innovation expenses. Therefore, it would be interesting to look at the evolution of this indicator in order to clarify whether the observed growth continues at the same rates, or is a consequence of the increased number of sectors.

Finally, according to the results obtained as regards the patent applications to the European Patent Office [EPO] it can be concluded that the Spanish tradition in patenting is very poor, with many regions showing nil growth (Canary Islands, Cantabria, Extremadura, Castilla La Mancha). Trends in the Valencian Community with respect to the Spanish average and the leader regions (Catalonia and Navarra) are quite uniform (about 100% with Spain and 45% with the leader regions respectively). However, there is a large gap between the leader regions and the rest. In this sense

the Valencian Community ranks 7th after regions such as Navarra, Basque Country, Community of Madrid and Aragon. It has to be emphasized the case of La Rioja, where from 2000 onwards a noticeable increase has been observed with more than 23 patents (per million inhabitants).

As seen, the Valencian competitiveness should be improved through promotion of employment in high technology manufacturing industries and services. This will require universities to play a major role, not only by developing R&D and teaching activities in technologically advanced sectors, but by integrating the knowledge developed in the region and reducing the brain drain effect of highly trained graduates from Valencian universities migrating to other regions such as Catalonia and the Community of Madrid. Increased employment in these high technology sectors, which would contribute to a more knowledge dependent economic structure, would also entail higher levels of business R&D expenditure and innovation capacity in the region.

3.2.- The Valencian Community in Europe and the Mediterranean Arch

In this section we study the relative position of the Valencian region in the European and Mediterranean areas¹⁰. The analysis will focus on comparing the relative position of the Valencian Community and its degree of convergence with regard to the leader region(s) in the 10 indicators used.

[Table 2 here]

For population with tertiary education, the Valencian Community ranks 29th in 1999 and 24th in 2004 among European regions. These values are in line with the EU average (close to 90%) despite in comparison with the leader region for this indicator (Île de France in France) the Valencian Community just represents 25% in 2004. Thus, the region is in an advanced position within Europe, with 83% of European regions in a

worse position, and 16% ranking higher. In the Mediterranean area the Valencian Community ranks quite high (5th position), with 53% of the value of the leader region (Catalonia in Spain). Therefore, although the percentage of the population with tertiary education is quite high when compared to those observed in the Mediterranean area, within a European perspective this is not the case.

For lifelong learning the Valencian Community stands 27th among European regions for the analysed years. The region represents 15% of the leader regions (South East and London). Its relative position is similar to the one observed in the previous indicator, with 15% of the regions ranking higher and 85% lower. This trend is also reflected in the Mediterranean benchmark, where the values for the Valencian region correspond to about 70% of the level of Lombardia (Italy), leader region for this indicator. In this sense, the region ranks third among the regions that constitute the Mediterranean arch (2nd in 1999 with Andalucia as leader region), being 92% of them positioned behind the Valencian one. These results confirm the predictions already made in the national context.

Employment in high and medium-high technology manufacturing sectors in the Valencian Community just represents 4% of the whole employed population, making the region rank very low in Europe, with 17% of the values observed for the leader regions (Franche-Comté in France and Stuttgart in Germany). 75% of the regions in Europe perform better than the Valencian and only 25% lag behind. In the Mediterranean area the Valencian Community is well below the leader region (Piemonte in Italy), which has 14% of its employed population involved in these sectors. The region is in 15th position among Mediterranean regions, being 40% of them above this level.

In an opposite direction to the results attained for the previous indicator, the Valencian economy ranks really high concerning the employment in low and medium low technology manufacturing sectors, what confirms the conclusions determined for

the Spanish benchmark. About 20% of the employed population is involved in these sectors. Within European regions the Valencian Community was 2nd in 1999 and 10th in 2003, representing about 84% of the leader region in 1999 - La Rioja (Spain) – and 69% of Norte (Portugal), leader region in 2003. Consequently, 95% of European regions show lower levels of employment in these low technology oriented sectors. The trend is similar for the Mediterranean arch, where Veneto (Italy) is the leader region with 25% of its employed population participating in these low added value activities.

The orientation towards low technology sectors of the region under analysis is once more reinforced by the results observed for employment in knowledge-intensive high-technology services. Stockholm (Sweden) acts as the most competitive region in Europe in this sense with more than 8% of the employed population, being Lazio (Italy) the leader region in the Mediterranean arch with 5% of the employed population. In both cases the Valencian Community ranks dramatically low with just 17% of European regions in a lower position in 2003.

These previous indicators regarding the employment in high and low technology sectors highlight the most remarkable weaknesses of the Valencian Innovation System, and consequently those where the public administration should make the strongest efforts. This endorses the need to promote the creation of new technology based industries and the employment in high technology sectors.

The business expenditure in R&D activities in the Valencian Community illustrates the already observed deficiencies in the structure of the private sector. In 2003 this indicator was 0.29%, what represents about 4% of the value observed in the European leader region (Braunschweig in Germany). In the Mediterranean area, Midi-Pyrénées (France) is the leader region with superior values to 2%. This demonstrates the low levels of business investment in R&D activities in the Mediterranean area in relation to Europe.

Regarding government R&D expenditure, the Valencian Community (0.1% in 2003) is in 78th position among European regions, with 6% of that of the leader region (Flevoland in the Netherlands – 1.5% in 2003). The trend is similar in the Mediterranean area, where the studied region ranked 13th in 2003, representing 10% of the values for the leader region (Lazio in Italy). The latter is complemented by the R&D expenditures executed by the higher education sector. In this sense the Valencian Community ranks in some advanced positions both in Europe and the Mediterranean area. In 2004 the region performed 55th in Europe (10th in the Mediterranean), representing 26% (64%) of the leader region Övre Norrland in Sweden (Dytiki Ellada in Greece).

In terms of patent applications to the EPO, in 2003 the Valencian Community ranked 130th in Europe and 15th in the Mediterranean arch. These measures just represent 4% of the leader region in Europe (Stuttgart in Germany) and 13% of the Mediterranean leader region (Emilia-Romagna in Italy). Thus, just 25% of European regions (60% Mediterranean regions) perform lower than the Valencian Community. This indicator shows the severe weakness in the Mediterranean arch in relation to patent applications compared to Europe. These values are in line with those observed for the high-tech patent applications to the EPO where Noord-Brabant (Netherlands) and Provence-Alpes-Côte d'Azur –PACA- (France) lead respectively. The Valencian Community just represents 2% of the value observed in 2004 for Noord-Brabant and 9% of the one for PACA. In this sense, a noticeable increase is observed in the performance of the Valencian region from 2002 to 2003, jumping from the 125th position in Europe in 2002 to the 97th in 2003 (19th in the Mediterranean in 2002 and 13th in 2003). Hence, these patent related measures have to be analysed with some caution since strong differences are observed from year to year¹¹.

4.- Conclusions and recommendations

Great cultural, social and economic diversities can be found in Europe. One of the core aspects of economic growth is technological progress, which is triggered by innovation. There are successful territories in Europe where innovation is becoming the key to development, but there are others where this is not the case, as most Spanish regions.

Within this framework, benchmarking studies on innovation policies constitute a major focus in the literature. Benchmarking allows improving ones key processes by comparing them with the peak performance of the best-in-class. The results of these studies are allowing the less developed territories to adjust their learning processes to draw on the experiences of other territories, and to establish processes oriented to defining and implementing more efficient and regionally 'embedded' innovation policies. The Regional Innovation Strategies (RIS) initiative developed in many European regions is a clear example of this orientation.

In this context the concept of innovative capacity has emerged in the literature in relation to benchmarking exercises, including a very diverse set of methodologies and composite indices. However, the literature agrees in the recognition of the existence of deficiencies and lacks in the indicators that allow the measurement of R&D and technological innovation.

As the purpose of this paper is to analyse the relative position of the Valencian Innovation System, the regional benchmarking study has been carried out at three levels of analysis: a) Spanish regions, b) Mediterranean Regions and c) European regions. These three stages aim at offering a more comprehensive view of the real competitive position of the Valencian Community, not only in Spain, but on the whole Europe.

In general terms, the results of our benchmarking highlight the main strengths and weaknesses of the Valencian Innovation System, from which some policy

recommendations can be derived. The Valencian Community shows relative strengths in those aspects related to public funding (i.e. tertiary education, lifelong learning, public R&D expenditures) while its weaknesses are indicated by those measures related to private activities (i.e. employment in medium-high and high technology manufacturing and services sectors, private R&D expenditures, patent applications). The low employment rates in those high technology sectors are indicative on the one hand of the deficiencies in the Valencian industrial structure, based on traditional hand-made sectors such as ceramics, shoes, furniture, toy industry, tiles, etc., and the difficulties involved in absorbing newly qualified, highly-educated people on the other.

These aspects are strongly related to the role of universities. Universities and public research organizations are without doubt the major actors in R&D activities in the region. However, does it really make sense to have an inclusive public research system if the existing industrial structure cannot absorb its advances, graduates, researchers and applications?

This structural imbalance shown by the Valencian Innovation System can be characterized by the next three adjectives: weak, unarticulated and unbalanced. On the one hand, it is weak due to its low technology orientation. It is unarticulated due to the lack of co-operation among the diverse actors that constitute an innovation system. Finally, it is unbalanced due to the fact that the advances made by (in this case) the public research system cannot be exploited by the business sector. These conclusions drive us to wonder in a critical way about the real existence of a regional innovation system in the Valencian Community.

But, why should there be such a structural imbalance? In fact, universities and firms in Valencia constitute the two sides of a coin. Most European regions are in agreement that the research and business spheres must become more integrated and collaborative. This applies particularly to the Valencian Community. However, due to the traditional character of SMEs (microfirms) it is almost impossible to get them to

recognise the advantages of cooperating with the research environment. This lack of interaction constitutes one of the main weaknesses, compromising the future development of the Valencian Innovation System.

We consider that support from the Valencian regional government and the local institutions should be towards the definition of some common regional targets by consensus based processes in which the main regional actors are involved. Without this common view of the regional economy the innovation system cannot be oriented. Then second, entrepreneurial activities should be fostered, what may link the existing industrial structure to the public research system in the region. This orientation may involve an increase in the employment and the investments in R&D activities made by high technology oriented sectors. As a consequence, a complete renovation in the strategic orientation of sectors such as furniture, ceramics, tiles, toys and shoes, could be achieved. Third, a similar structural change must be promoted in Valencian universities, accompanied by greater emphasis on co-operation with regional firms, and knowledge transfer to SMEs so as to increase their competitiveness. It is imperative that the Valencian Community achieves these objectives if it is to continue the accomplished growth and not to lose ground in relation to other European regions.

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Notes

¹ This paper is the outcome of a project funded by the 'Alto Consejo Consultivo en I+D de la Generalitat Valenciana'. Jon Mikel Zabala-Iturriagagoitia would like to acknowledge the help of the Department of Education, Universities and Research of the Basque Country, in the form of funding for the Programme for the Researchers Formation. We are indebted to Cynthia Little for her help with the language-editing of the text.

² <http://www.innovating-regions.org/>

³ <http://www.proinno-europe.eu>

⁴ The high-tech firms only represent 8% of regional industrial gross added value, while the low-tech firms represent 65% of regional industrial gross added value (INE, 2004).

⁵ The EIS (2002: 12) states that "40 per cent of the variation in per capita regional income can be explained by differences in innovative performance" (RRSII).

⁶ Human resources for innovation (5 indicators): New S&E graduates (% of 20-29 age class), Population with tertiary education (% of 25-64 age class), Participation in life-long learning (% of 25-64 age class), Employment in medium-high and high-tech manufacturing (% of total workforce), Employment in high-tech services (% of total workforce). Creation of knowledge (4 indicators): Public R&D expenditures (% of GDP), Business expenditure on R&D (% of GDP), EPO high-tech patent applications (per million population), USPTO high-tech patent applications (per million population). Transmission and application of knowledge (3 indicators): SMEs innovating in house (% of manufacturing SMEs), Manufacturing SMEs involved in innovation co-operation, Innovation expenditures (% of total manufacturing turnover). Innovation finance, outputs and markets (6 indicators): High-tech venture capital investment (% of GDP), New capital raised on stock markets (% of GDP), New to market products (% of sales by manufacturing firms), Home internet access (% of all households), ICT expenditures (% of GDP), % of manufacturing value-added from high-technology.

⁷ The seven indicators that constitute the EIS indices for 2002 and 2003 are: Population with tertiary education, Participation in life-long learning, Employment in medium-high and high-tech manufacturing, Employment in high-tech services, Public R&D expenditures, Business expenditure on R&D, EPO high-tech patent applications.

⁸ As far as the RNSII composite indicator is concerned, the leader regions in each European Country are: Wien (Austria); Bruxelles (Belgium); Bayern (Germany); Attiki (Greece); Comunidad de Madrid (Spain); Ile de France (France); Uusimaa (Finland); Southern & Eastern (Ireland); Lombardia (Italy); Noord Brabant (Netherlands); Lisboa E Vale Do Tejo (Portugal); Stockholm (Sweden); Eastern (UK). In all cases, the same regions have the leadership in both 2002 and 2003.

⁹ The leader regions for each (Mediterranean/European) indicator are: Population with tertiary education (Catalonia/ Île de France); Participation in life-long learning (Andalucia- Lombardia/South East-London); Employment in High and medium high technology manufacturing sector (Piemonte/ Franche-Comté-Stuttgart); Employment in low and medium low technology manufacturing sector (Valencian Community-Veneto/La Rioja-Marche-Norte); Employment in Knowledge-intensive high-technology services (Lazio- Midi-Pyrénées/ Île de France-Stockholm); Business enterprise sector R&D expenditure (Midi-Pyrénées/Stuttgart-Eastern- Braunschweig- Västsverige); Government sector R&D expenditure (Midi-Pyrénées-Lazio- Languedoc-Roussillon/ Midi-Pyrénées- Flevoland); Higher education sector R&D expenditure (Ipeiros-Umbria- Languedoc-Roussillon- Dytiki Ellada/ Gießen-Groningen- Alentejo- Wien- Övre Norrland); Patent applications to the EPO (Emilia-Romagna/ Oberbayern-Noord Brabant-Stuttgart); High-tech patent applications to the EPO (Provence-Alpes-Côte d'Azur /Noord-Brabant).

¹⁰ The regions that comprise the Mediterranean area are: **5 from Spain** (Catalonia, Valencian Community, Murcia, Andalucía and Balearic Islands); **4 from France** (Provence-Alpes-Côte d'Azur, Languedoc-Roussillon, Midi-Pyrenees and Corsica); **15 from Italy** (Piemonte, Valle D'aosta, Liguria, Lombardia, Trentino-Alto Adige, Veneto, Emilia Romagna, Toscana, Umbria, Lazio, Campania, Basilicata, Calabria, Sicilia and Sardegna); and **13 from Greece** (Anatoliki Macedonia-Thraki, Kentriki Macedonia, Dytiki Macedonia, Thessalia, Ipeiros, Ionia Nisia, Dytiki Ellada, Sterea Ellada, Peloponnisos, Attiki, Voreio Aigaio, Notio Aigaio, and Kriti).

¹¹ The indicators concerning ICT and Biotechnology patent applications to the EPO (per million labour force) were initially included in the benchmark analysis, but due to the low degree of homogeneity observed, finally they were not integrated.