Territorial benchmarking methodology: The need to identify reference regions

Mikel Navarro Arancegui; Juan José Gibaja Martíns; Susana Franco Rodríguez; Asier Murciego Alonso

SUMMARY

Benchmarking analysis facilitates the formulation of competitiveness and innovation strategies. It also helps in the monitoring and assessment of the initiatives that have taken place. The aim of this work is to provide an instrument to facilitate the development of the three stages that benchmarking exercises should undertake, adding its application to the Basque Country as an illustrative example. The first requirement of a good benchmarking exercise is the comparability principle, that is, contrasts should take place among comparable entities. Hence, the first stage is the identification of homogeneous areas to carry out the territorial comparison. The second stage is the identification of territories or regions with best performances, which should be established through empirical comparisons. Finally, the third stage of benchmarking exercises is analysing the causes of a better or worse performance. Even if the combination of quantitative and qualitative information, together with the active participation of regional representatives, would be preferable, this paper focuses in the analysis that can be carried out with secondary data.

KEYWORDS: Regional Benchmarking, Best Practices, Indicators, Innovation, Basque Country, European Union
1. Introduction to regional benchmarking

The decisive role played by innovation in economic growth, productivity and competitiveness is widely recognised (Lundvall, 1992; Nelson, 1992; Nelson and Rosenberg, 1993; Verspagen, 1995; Archibugi and Michie, 1998). There is also common agreement that it is not sufficient to understand innovation and competitiveness as the fruits of the actions of individual agents; rather, they are social processes. Hence, the actions of innovation agents cannot be separated from the system of innovation in which they operate (Rothwell, 1994). Initially the literature focused on national and sector-based/technological systems, but later, influenced by economic geography, it also turned its attention to the regional sphere. Soon, the publication about regional innovation systems surpassed those that addressed national and sector-based/technological systems (Cooke, 1998; Carlsson et al., 2002). This reflects the growing acceptance that the key factors impacting competitiveness and innovation are largely determined systemically and at the regional level (2003). All this has resulted in a confluence of industrial, technological and regional policies around competitiveness and innovation and on a shift from national to regional areas of application (Oughton et al., 2002).

Yet while innovation can be regarded as a relevant competitiveness strategy for all regions (Asheim et al., 2007), a given region should not develop carbon copies of policies designed and used in other regions. The core competitive strategy of a region should establish a unique value proposition, which is likely to be influenced by the particular structural characteristics of the region (OECD, 2011). Even with similar structural characteristics, regions can set different strategies and goals (Niosi, 2002).

Indeed, the literature on regional innovation systems has highlighted the vast richness and diversity of regional innovation patterns, showing that there are no “one size fits all” policies (Tödtling and Trippl, 2005; Nauwelaers and Reid, 2002). Regional policies must pursue two goals: the development of unique regional strengths in some key areas of innovation and competitiveness (in Porterian terminology, “strategic positioning”); and a broad focus on the remaining competitiveness and innovation factors, avoiding the development of weaknesses that are too great in comparison with those of the other competing regions (for Porter, “operational efficiency”) (Porter, 1998, 2003).

What is the role of benchmarking in this respect? Even though there is no universally accepted definition of benchmarking, it can be said that benchmarking is generally understood to be an improvement and learning method based on comparisons and the application of the knowledge generated from them (Huggins, 2008). Benchmarking can facilitate the formulation of a strategy and mission insofar as benchmarking analyses can help to identify the strengths and weaknesses of the organisation or territory being analysed (OECD, 2005). Toward this end, benchmarking seeks to measure the levels of what Niosi (2002) calls “x-inefficiency” (the gap or difference between the current performance in a particular area and the best performance) and “x-efficiency” (the degree to which the mission is being accomplished).

However, as pointed out by Huggins (2008), benchmarking exercises have been met with caution by many innovation analysts. This is because benchmarking exercises in the corporate environment are understood to entail the systematic comparison of one organisation with another organisation, in order to replicate their ‘best practices’ (Lundvall and Tomlinson, 2001). However, these optimum processes and general models are meaningless in the evolutionary theory that is the basis for innovation systems in contexts of uncertainty and high
complexity (Edquist, 2001; Paasi, 2005). The literature on innovation systems considers that what is good or bad depends of the systemic context (Tomlinson y Lundvall, 2001) that is empirically determined rather than adjusted to the theoretical ideal (Balzat, 2006). In addition, excessive imitation is problematic because it reduces the diversity required by the system and goes against the very idea of strategy (Huggins, 2008). Even from an operational point of view, we have to consider that data are not perfectly comparable (Mairesee y Mohenen, 2009) and the lags to obtain data that would delay the implementation of such strategy. This would result in a “lamb effect”, implying that practices that were considered appropriate at one time were deemed as obsolete later on. In summary, what may be valid for simple environments such as corporations is not applicable in environments as complex as innovation systems (Polt et al., 2001).

However, as Huggins (2008) or Pappaioannou et al. (2006) point out, benchmarking analyses have evolved substantially. Although the criticisms of the first benchmarking analyses, labelled by Lundvall and Tomlinson (2001) as naïve and simplistic, are accurate, another type of ‘intelligent’ or ‘systematic’ benchmarking that accounts for context (Nauwelaers et al., 2003) has been developed. Instead of merely pursuing a “copy and paste” approach, this type of analysis encourages the identification of “good” practices (instead of “best” practices), recognises relative strengths and weaknesses and examines performance areas using more cost-effective and efficient processes than those based on “trial and error” (Balzat, 2006; Paasi, 2005; Nauwelaers et al., 2003).

Hence, the first question regional benchmarking exercises should address is who to be compared with. There are three options: with targets set for oneself,¹ with oneself along the time or with others (Edquist, 2008). In case of comparing one region with others, several options arise: regions can be chosen according to criteria such as localization, economic structure or high performance. More simply, they can be regions that wish to enhance cooperation and learn from each other. Generally, benchmarking exercises have taken place according to an intraregional perspective (rather than an interregional approach) due, among other factors, to their requirement of fewer resources. However, advances towards more multi and interregional benchmarking exercises are occurring (Huggins, 2008).

If the option is to compare oneself with others, which is the one this paper focuses on, a key requirement is what Papaioannou et al. (2006) call the comparison principle, that is, contrasts should take place among comparable entities. You can also learn from those who are very different, but the need to take into account the context, that was mentioned above, means that a comparison is likely to bring more valuable lessons when it is carried out between fundamentally equivalent entities (Archibugui and Coco, 2004; Archibugi et al., 2009). Thus, a first step is the identification of homogeneous areas in which the comparison exercise will be carried out.

This has not been the norm in benchmarking exercises. Regions were compared to those that exhibit a better performance, whether they shared similar characteristics or not. In fact, early benchmarking exercises have been criticized for limiting comparisons to relative performances, merely providing lists or rankings without a proper analysis of the causes of

¹ This would be the case, for instance, of a system’s x-efficiency measure. As we have seen before, Niosi (2002) used this term to assess the degree to which the mission is being accomplished, as opposed to x-inefficiency, that considers the difference between a particular area and others.
those different performances (Papaioannou et al., 2006; Huggins, 2008; Polt, 2002). Once the identification of regions with similar structural conditions has taken place, it does make sense to prioritize those with better performances, since these will be the ones that will provide the best lessons. Nevertheless, it might also make sense to consider the others later on because, as Polt (2002) or Salazar and Holbrook (2004) point out, unsuccessful cases and those that do not achieve the best results can also provide information and be a source of learning. Good or bad performance cannot be determined according to theoretical rules but must instead be established through empirical comparisons (Lall, 2001; Balzat, 2006; Edquist, 2008). To sum up, the second will be to identify, among the territories that share similar structural conditions, those that exhibit better performance.

It follows from the above that the third step of every benchmarking exercise should determine the causes of better or worse performances. As noted by Edquist (2001), a proper diagnosis consists of both the identification of performance problems and the analysis of their causes. Weak performing regions should reflect on how they differ in terms of framework conditions, activities or input indicators from regions with high performance (OECD et al., 2004).

This paper stops at the third phase because our main goal here is to provide an instrument to facilitate the development of the three above mentioned stages in benchmarking exercises for European regions. However, we should bear in mind that there are further steps. In particular, such exercises are of no use if their implantation, policy assimilation, control and revision are ignored (Balzat, 2006; Paasi, 2005; Polt, 2002). Proper implementation, aside from requiring a full understanding of the changes required by the system, necessitates the involvement of policymakers and stakeholders, their coordination and a permanent evaluation (Nauwelaers and Reid, 2002; Nauwelaers et al., 2003).

It should also be noted that a complete benchmarking exercise requires both a quantitative and qualitative analysis, as quantitative indicators alone cannot encompass all key aspects of innovation systems (Lundvall y Tomlinson, 2001), soft elements (Huggins, 2008) or factors related to more tacit knowledge (Polt, 2002). However, due to the limitations that generally exist, benchmarking exercises are usually restricted to the first phase of the analysis, merely dealing with quantitative data (frequently obtained from secondary sources). Our main contribution rests on this area, focused on the quantitative analysis.

In what follows we will analyse more deeply how to identify reference regions. We will also select the variables that should be considered to identify the best performing regions and to understand the activities that explain such better performance.

2. Procedure for the identification of reference regions

   a) Literature on the identification of reference regions

As noted above, while benchmarking was born in the business field, more recently it has been extended to also cover territories. Here the benchmarking exercise will be applied to regions. As statistical units to define regions we will use NUTS2, except in Belgium, Germany and United Kingdom, where NUTS1 will be instead used.²

² The choice between NUTS2 or NUTS1 has been based on the level where regional powers rest in each country. As Clarysse and Muldur (2001) and Baumert (2006) point out, NUTS usually reflect statistical units that differ in size and, in many cases, they do not coincide with the economic units.
Among all NUTS, we want to identify those that are homogeneous or share similar structural conditions to a given one, as it will be from these that we will learn more and their identification is not straightforward. Many authors and studies highlight the need to compare homogeneous entities according to a range of characteristics: industrial structure (Akerblom et al., 2008; Atkinson and Andes, 2008); economic structure and institutional framework (Andersson and Mahroum, 2008); relative patterns of innovation (Arundel and Hollanders, 2008); geographic, cultural and economic factors (Archibugi and Coco, 2004); size, income, infrastructure and human resources (Archibugi et al., 2009); social values, political goals and economic development (Balzat, 2006); geography (including latitude, longitude, extension, elevation, access to the sea and climate), demographics (including population density, ethnic groups and other types of classification), natural resources and history (Fagerberg et al., 2007; Fagerberg and Srholec, 2008); cluster structure (John Adams Innovation Institute, 2009); level of development (Lall, 2001); economic specialisation, history, degree of openness, size of the economy, firms size, culture and social capital (Nauwelaers et al., 2003); institutional factors, industrial specialisation and size (OECD et al., 2004); industrial structure, policy context and geographic and cultural dimensions (OECD, 2005); economic structure and development level, natural resources, size, culture and history (Paasi, 2005); and GDP per capita (World Economic Forum, 2009).

However, despite the numerous studies arguing that comparisons or benchmarking exercises must be carried out with similar regions, or must correct and account for differences, very few have put this idea into practice. Perhaps one of the most significant cases in which this strategy was actually used is the Index of the Massachusetts Innovation Economy (John Adams Innovation Institute, 2009), in which the economy and innovation in the state of Massachusetts are only compared with those states that display an elevated concentration of employment in specific clusters. Many of the studies focusing on developing economies (for example, the Fagerberg papers cited above) incorporate a series of external variables in their regression analyses to investigate the influence of technological capabilities. These variables seek to control for the geography, demographics, natural resources and history of the different countries and thus to correct for their heterogeneity. They also incorporate the composition of the economy (which would be equivalent to the industrial structure highlighted above) in the analysis. In reports like The Global Competitiveness Report (World Economic Forum, 2009), each of the sub-indexes that are combined in order to construct a composite index of competitiveness is given a different weight, according to the level of development of the country. In any case, with the exception of the Index of the Massachusetts Innovation Economy, we barely find in the literature attempts to identify homogeneous territories to base benchmarking exercises.

An alternative for the identification of reference regions is resorting to groups arising from regional typologies of innovation undertaken through different initiatives. Regional typologies seek the identification of common patterns in the territories and therefore they might be considered an alternative instrument to identify common regions. Nevertheless, the problem rests in the variables chosen to construct the typologies. The review by Navarro and Gibaja (2009) points out that existing typologies include both variables similar to the above mentioned (e.g. industrial specialization), that would reflect the territories’ structural conditions, and behavioural variables (e.g. R&D expenditure), that are greatly influenced by the structural conditions (since R&D expenditure is greater in the pharmaceutical rather than textile sector) and performance variables (e.g. patents or productivity), that are influenced by the two previous types of variables. That is, existing typologies have not isolated the variables
that are relevant for the identification of similar regions according to their structural conditions, even if, as we show below, it is possible to do so.

**b) Proposal of variables for the identification of regions with similar structural conditions**

Of the factors mentioned in the literature as helpful in evaluating the degree of homogeneity of the territories under study, there are some that are not available from statistical secondary sources (for example, degree of commercial or productive openness). These are therefore left out of this study. The aim of this sub-section is to identify those indicators that may be considered as components of a region’s structural conditions and are publicly available through Eurostat, OECD or other regional databases. Taking into account such availability and considering their pros and cons, we will proceed to make recommendations. Nonetheless, we will start mentioning two indicators that, despite being cited by some of the above mentioned authors, we would rather not take into account: GDP per capita and business size.

Per capita GDP levels have been used by many studies of economic development or by reports such as the World Economic Forum’s and is available in Eurostat. However, a problem is that the causal relationship between GDP per capita and innovative performance operates in two ways (Lall, 2001). As Lall mentions, the majority of analysts consider the principal causal relationship to flow from innovation to technological and competitive performance. As the main goal of *benchmarking* is to improve innovative and competitive performance, a circular argument would be established if GDP per capita is placed among the factors that explain such performance. We therefore also leave out this variable.

Among the structural statistics, Eurostat publishes data on the average size of local manufacturing units for most European NUTS. In principle, this indicator might be used as a proxy for business size, which Nauwelaers et al. (2003) mention. However, a detailed exam of such data uncovers strange patterns (particularly for German regions) that have made us to decide to avoid their inclusion.

Leaving aside, due to the above mentioned reasons, GDP per capita and business size, the rest of indicators that might be used to identify regions with similar structural conditions can be grouped in for blocks for operational reasons:

**(i) Size, demographic and location indicators**

The region’s size, mentioned by many of the studies we have cited, might be proxied through GDP and population. Both are available in Eurostat. In order not to multiply variables and for coherence with the other variables in the group, in this paper we are only using population.

Among demographic factors, there are two frequently used in innovation economics: population density and aging rate (percentage of the population 65 year old or more). Both are available in Eurostat.

Regarding geographic factors, there are some that encompass the synthetic effect of location on competitiveness: accessibility indexes. ESPON (2009) has recently published multimodal indicators at NUTS3 level for the year 2006. It is possible to aggregate them for higher NUTS and use them here.
(ii) The economy’s industry structure

We consider the distribution of employment among the ten major sectors of Eurostat’s regional economic accounts (based on the new CNAE rev2: Agriculture, forestry and fishing (Section A), Manufacturing (B, C, D y E), Construction (F), Trade, transportation, accommodation and food service activities (G, H e I), Information and communication (J), Financial and insurance activities (K), Real estate activities (L), Professional, scientific, technical, administration and support service activities (M y N), Public administration, defense, education, human health and social work activities (O, P and Q), Arts, entertainment, recreation and other services (R, S, T and U)

(iii) Industrial specialization

Even if the above allows a first approach to the economy’s industry structure, it is obvious that the disaggregation of the manufacturing industry is not satisfactory. Industrial sectors are more oriented towards exporting and less limited by the local market, which allows them to develop and specialize more. Based on the OECD’s STAN database classification, we divide industrial employment in eleven large sectors. The data was provided by Eurostat, upon a special request to extract this information from the Labour Force Survey.  

(iv) Especialización tecnológica

Lastly, the technological areas of specialisation of the region are defined according to the percentage distribution of EPO patents among the 8 sections of the international patent classification (IPC). The source for this information is the OECD’s January 2010 EPO regional patent database. Given the small number of EPO patents in several regions, we have opted for adding the patents applied for over the period 2000-2008.

c) Procedure to obtain reference regions from variables

Having defined a set of variables to identify reference regions, several transformations are required in order to obtain composite indices that measure the distance between a particular region and all others.

Firstly, the indicators are corrected for outliers, asymmetries and kurtosis using the usual statistical techniques. Secondly, in order to add them up, variables are normalized using the mini-max method, re-scaling them so all values fall between 0 and 100. Thirdly, distances are calculated between each NUT and all the others.

There are different alternatives to assign weights to the variables. We have chosen the simplest option: equal weights are given to the variables within each of the above blocks and

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3 The 11 large sectors are: Mining and quarrying (NACE rev2, codes 05-09), Food products, beverages and tobacco (10-12), Textiles, textile products, leather and footwear (13-15), Wood, paper, printing and publishing (16-18), Chemical, rubber, plastics and fuel products (19-22), Non-metallic products (23), Basic metals and fabricated metal products (24-25), Electrical, electronic, computing and optical equipment (26-27), Machinery (28), Transport equipment (29-30) and Other equipment (31-33).

4 The eight sections of the IPC are: Human Necessities (code A), Performing Operations and Transporting (B), Chemistry and Metallurgy (C), Textiles and Paper (D), Fixed Constructions (E), Mechanical Engineering, Lighting, Heating and Weapons (F), Physics (G) and Electricity (H).
then equal weights are also assigned to each block to come up with the total distance between NUTS.

Hence, total distance between two regions would be calculated through the following formula:

\[ d(i, i') = \sum_{j=1}^{k} m_j (x_{ij} - x_{i'j})^2 \]

where \( j \) is the variable, \( i \) is the first region, \( i' \) the second region and \( m_j \) is the weight assigned to the variable. With the distance between one NUTS and all the others, we obtain a distance matrix.

Based on this distance matrix, two different approaches may be followed:

- Firstly, a typology of regions can be established via cluster analysis to identify groups of regions with similar structural conditions that will influence their economic and innovative performance.
- Secondly, the row indicating the distances between the selected region and the other regions can be extracted from the distance matrix. Based on that row, those interested in analysing a particular region can order all other regions according to these distances.

Each approach responds to different needs or interests. Obtaining a typology of regions is particularly interesting for policy-makers or analysts who work with regions at the European regional level as a whole, because it provides a collective vision of Europe’s regions. As we have mentioned above, there are already many typologies on regional innovation patterns. However the common flaw they share for benchmarking analysis is that they mix different types of variables: structural conditions, economic and innovation output variables and input variables. The typology we present here is only based on variables that reflect the structural conditions of the regions and, hence, it would not incur in the same flaw.

The second approach is a better option for those who are interested in the benchmarking analysis of a particular region. This procedure has significant advantages over considering regions corresponding to groups determined using cluster analysis:

- Given that the cluster analysis process does not reveal the distance between the centre of gravity of the group and each one of its components, it is possible that those components most distant from the centre are in fact closer to some regions assigned to other categories than to some regions in its own group. Cluster analysis does not usually allow for direct visualisation of the distance between a given region and regions placed in other groups.
- From each region’s ordered row of distances, the number of NUTS to be compared with can be selected. In cluster analysis the number of regions varies among groups. The number of regions in which our target region is included might not be appropriate for our purposes.

3. Regional performance

   a) Economic and innovation output performance

Having identified reference regions for benchmarking, the following step consists in identifying, among them, those regions that exhibit better performances, as these are the ones we are more likely to learn from.
As Edquist (2008) points out, the analysis of the innovation system should not get mixed up with the analysis of the whole economic system; economic performance is affected by innovative performance, but also by other factors. Thus, following Archibugi and Coco (2005: 177), “it is useful and necessary to separate the two concepts and find independent measurement tools for each of them.” The inclusion of production indicators among the measures of innovation would prevent us from exploring the effects of innovation on production and vice versa.

It is also interesting to distinguish between the performance that a territory has achieved in a moment in time (the last year with available data) and the evolution the performance has undergone over a period (five years, in our exercise).

Given data availability from European regional databases, the following indicators might be used:

- Level of economic performance: GDP per capita, employment rate and productivity.
- Variation in economic performance: annual percentage change of employment, productivity, real GDP and real GDP per capita.
- Level of innovation output: EPO patents (per million inhabitants), scientific publications (per million inhabitants), employment in high and medium-high technology manufacturing sectors (%) and employment in knowledge intensive services (%).
- Variation of the innovation output: percentage change of EPO patents, publications, employment in high and medium-high technology manufacturing sectors and employment in knowledge intensive sectors.

As with the variables used to identify reference regions, the values corresponding to the performance indicators are subjected to some treatments in order to correct potential asymmetries, kurtosis and outliers, and their values are standardized are weighted to obtain four composite indicators of output (namely, those of economic and innovative performance in a moment in time, and those of evolution of economic and innovative performance).

b) Inputs for the innovation process

After having identified among regions with similar structural conditions those that exhibit the best performance, we want to explain the reasons for the disparities in performance. In particular, we want to identify which innovation activities have been undertaken by regions with top performances, in order to learn from them and reveal some of their key elements for success.

Taking into account available data, we have selected three types of indicators regarding human resources, R&D and connectivity. The following indicators have been considered:

- Level of human resources: human resources in science and technology (% of population), population aged 25-64 that has attained upper secondary and tertiary educational level (% of population aged 25-64), students in tertiary education (% of population aged 20-24) and population aged 25-64 taking part in long-life learning (% of active population).

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5 All of these indicators can be obtained from Eurostat regional databases, except for publications, that are available from Erawatch.
6 All of these indicators can be obtained from Eurostat regional databases, except for co-invention, which is our own calculation from the OECD regional patent database; and new foreign firms, which is taken from ISLA-Bocconi.
• Variation in human resources: percentage change in human resources in science and technology, population aged 25-64 that has attained upper secondary and tertiary educational level and population aged 25-64 taking part in long-life learning.
• Level of R&D: business R&D expenditure (% of GDP), public R&D expenditure (% of GDP), business R&D personnel (% of employment) and public R&D personnel (% of employment)
• Level of connectivity: families with broadband Access (%), patent co-invention (% of patents) and new foreign firm (per million inhabitants).
• Variation in connectivity: percentage change in patent co-invention.

As in previous steps, after having selected the variables and estimated the missing values, data was subjected to some treatments - correction of asymmetries, kurtosis and outliers -, standardized and weighted to construct composite indices.

4. Illustration of the Procedure: The Basque Country Case

As mentioned above, the identification of reference regions can be carried out following two different approaches:

• By an individual approximation that ranks regions by distance from any region of interest and allows us to consider any number of regions for comparison with the one we are interested on.
• By a cluster analysis that identifies groups of similar regions.

Table 1 shows the resulting reference regions for the Basque Country using both approaches: the left column lists regions with the lowest distance to the Basque Country, and the right column lists the regions included in the Basque Country’s group according to the cluster analysis.
The identification of regions is quite different, depending on the approach that is chosen: in the Basque Country case, almost half of the 30 closest regions were not in the Basque Country’s cluster group and, conversely, some of the regions in that group were quite far from it according to the distance calculated from the structural conditions. The individual approach includes mainly German, Italian and Austrian regions, followed by French and Spanish regions and a couple of regions from Sweden and the United Kingdom. Previous exercises carried out to identify reference regions for the Basque Country come up with regions that are closer to those identified by the individual approach than the cluster approach. Nevertheless, and compared to previous attempts, the current exercise offers some advantages: apart from being based in a more objective and quantitative approach, it offers an array of regions for comparison. Despite being quite obvious, some of them had been previously ignored due to the lower visibility of their countries (e.g. Austrian regions). Implicitly, as there are no regions from Nordic countries or from the Benelux among the closest regions, this approach warns us about the difficulty to import experiences from such regions, despite having been the focus of attention from our innovation policies.

Once the reference regions have been identified, the benchmarking exercise can attempt the characterization of the group vis-à-vis all other regions regarding structural conditions. It can also attempt the characterization of the Basque Country with respect to the regions in the reference group. Tables 2, 3, 4 and 5 have been produced with such purposes in mind.
Table 2: Geo-demographic variables of the Basque Country reference group

<table>
<thead>
<tr>
<th>NUTS Code</th>
<th>NUTS name</th>
<th>Cluster group</th>
<th>Population</th>
<th>Population density</th>
<th>65+ year old</th>
<th>Accessibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT12</td>
<td>Niederösterreich</td>
<td>2</td>
<td>1,600,830</td>
<td>83</td>
<td>18.4</td>
<td>112</td>
</tr>
<tr>
<td>AT22</td>
<td>Steiermark</td>
<td>2</td>
<td>1,408,534</td>
<td>74</td>
<td>18.6</td>
<td>97</td>
</tr>
<tr>
<td>AT31</td>
<td>Oberösterreich</td>
<td>2</td>
<td>528,335</td>
<td>74</td>
<td>16.0</td>
<td>116</td>
</tr>
<tr>
<td>AT34</td>
<td>Vorarlberg</td>
<td>2</td>
<td>366,721</td>
<td>141</td>
<td>14.9</td>
<td>106</td>
</tr>
<tr>
<td>DE1</td>
<td>Baden-Württemberg</td>
<td>2</td>
<td>10,749,631</td>
<td>301</td>
<td>18.7</td>
<td>136</td>
</tr>
<tr>
<td>DE9</td>
<td>Niedersachsen</td>
<td>2</td>
<td>7,959,464</td>
<td>167</td>
<td>20.0</td>
<td>121</td>
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<tr>
<td>DE6</td>
<td>Nordrhein-Westfalen</td>
<td>2</td>
<td>17,964,843</td>
<td>527</td>
<td>19.7</td>
<td>152</td>
</tr>
<tr>
<td>DE2</td>
<td>Rheinland-Pfalz</td>
<td>2</td>
<td>4,036,997</td>
<td>203</td>
<td>20.1</td>
<td>137</td>
</tr>
<tr>
<td>DEC</td>
<td>Saarland</td>
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<td>130</td>
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<td>1,124,099</td>
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<td>20.4</td>
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<tr>
<td>ES21</td>
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<td>295</td>
<td>19.1</td>
<td>93</td>
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<tr>
<td>ES22</td>
<td>C. F. de Navarra</td>
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<td>59</td>
<td>17.6</td>
<td>75</td>
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<td>ES51</td>
<td>Cataluña</td>
<td>3</td>
<td>7,264,172</td>
<td>226</td>
<td>16.6</td>
<td>114</td>
</tr>
<tr>
<td>FR71</td>
<td>Rhône-Alpes</td>
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<td>1,336,370</td>
<td>98</td>
<td>14.8</td>
<td>112</td>
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<tr>
<td>ITD2</td>
<td>P. A. Trento</td>
<td>1</td>
<td>516,579</td>
<td>83</td>
<td>19.2</td>
<td>85</td>
</tr>
<tr>
<td>ITD3</td>
<td>Veneto</td>
<td>2</td>
<td>1,226,499</td>
<td>156</td>
<td>23.2</td>
<td>92</td>
</tr>
<tr>
<td>ITD4</td>
<td>Friuli-Venezia Giulia</td>
<td>2</td>
<td>4,306,891</td>
<td>195</td>
<td>22.5</td>
<td>110</td>
</tr>
<tr>
<td>ITD5</td>
<td>Emilia-Romagna</td>
<td>2</td>
<td>1,226,499</td>
<td>156</td>
<td>23.2</td>
<td>92</td>
</tr>
<tr>
<td>ITD6</td>
<td>Umbria</td>
<td>2</td>
<td>889,336</td>
<td>105</td>
<td>23.2</td>
<td>83</td>
</tr>
<tr>
<td>UKG</td>
<td>West Midlands</td>
<td>6</td>
<td>5,296,400</td>
<td>515</td>
<td>16.5</td>
<td>126</td>
</tr>
</tbody>
</table>

Average of 30 closest regions: 3,780,814 | 194 | 19.5 | 110 |

Average of all 206 NUTS: 2,407,231 | 296 | 17.2 | 86 |

Table 3: Employment distribution in the Basque Country’s reference group (%)

<table>
<thead>
<tr>
<th>NUTS Code</th>
<th>NUTS Name</th>
<th>Agriculture</th>
<th>Industry</th>
<th>Trade, transport, hotels and restaurants</th>
<th>Information and communication</th>
<th>Financial and insurance services</th>
<th>Real estate activities</th>
<th>Professional, scientific, technical, admin and support services</th>
<th>Public administration, education and health</th>
<th>Arts, entertainment, recreation and other services</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT12</td>
<td>Niederösterreich</td>
<td>1.4</td>
<td>22.9</td>
<td>8.0</td>
<td>24.3</td>
<td>2.8</td>
<td>2.4</td>
<td>0.5</td>
<td>10.6</td>
<td>19.5</td>
</tr>
<tr>
<td>AT22</td>
<td>Steiermark</td>
<td>3.7</td>
<td>24.9</td>
<td>7.8</td>
<td>23.5</td>
<td>2.6</td>
<td>3.2</td>
<td>0.6</td>
<td>9.3</td>
<td>17.7</td>
</tr>
<tr>
<td>AT31</td>
<td>Oberösterreich</td>
<td>7.5</td>
<td>21.2</td>
<td>9.9</td>
<td>25.7</td>
<td>1.6</td>
<td>2.6</td>
<td>0.5</td>
<td>7.2</td>
<td>20.4</td>
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<tr>
<td>AT34</td>
<td>Vorarlberg</td>
<td>1.7</td>
<td>21.0</td>
<td>9.2</td>
<td>21.0</td>
<td>2.5</td>
<td>2.3</td>
<td>1.0</td>
<td>10.1</td>
<td>26.6</td>
</tr>
<tr>
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<td>Baden-Württemberg</td>
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<td>21.6</td>
<td>8.0</td>
<td>26.6</td>
<td>2.7</td>
<td>3.9</td>
<td>0.6</td>
<td>7.6</td>
<td>21.5</td>
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<td>Niedersachsen</td>
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<td>26.9</td>
<td>7.3</td>
<td>23.2</td>
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<td>0.6</td>
<td>9.3</td>
<td>20.8</td>
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<tr>
<td>DEB</td>
<td>Rheinland-Pfalz</td>
<td>1.8</td>
<td>19.6</td>
<td>10.2</td>
<td>21.1</td>
<td>2.7</td>
<td>3.4</td>
<td>0.8</td>
<td>9.8</td>
<td>18.1</td>
</tr>
<tr>
<td>DEG</td>
<td>Thüringen</td>
<td>7.5</td>
<td>21.5</td>
<td>8.4</td>
<td>25.1</td>
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<td>0.6</td>
<td>9.8</td>
<td>26.9</td>
</tr>
<tr>
<td>ES21</td>
<td>Pais Vasco</td>
<td>1.1</td>
<td>27.0</td>
<td>7.9</td>
<td>23.9</td>
<td>1.9</td>
<td>3.3</td>
<td>0.8</td>
<td>11.5</td>
<td>23.1</td>
</tr>
<tr>
<td>ES22</td>
<td>C. F. de Navarra</td>
<td>2.9</td>
<td>21.4</td>
<td>8.3</td>
<td>26.6</td>
<td>1.7</td>
<td>3.7</td>
<td>0.4</td>
<td>7.0</td>
<td>19.0</td>
</tr>
<tr>
<td>ES51</td>
<td>Cataluña</td>
<td>2.6</td>
<td>22.2</td>
<td>6.5</td>
<td>22.8</td>
<td>2.0</td>
<td>4.1</td>
<td>0.2</td>
<td>9.6</td>
<td>26.9</td>
</tr>
<tr>
<td>FR71</td>
<td>Rhône-Alpes</td>
<td>2.2</td>
<td>22.8</td>
<td>9.9</td>
<td>21.6</td>
<td>2.1</td>
<td>2.2</td>
<td>0.7</td>
<td>8.6</td>
<td>25.5</td>
</tr>
<tr>
<td>ITD2</td>
<td>P. A. Trento</td>
<td>1.8</td>
<td>26.7</td>
<td>7.4</td>
<td>23.9</td>
<td>2.1</td>
<td>3.1</td>
<td>0.4</td>
<td>9.6</td>
<td>16.6</td>
</tr>
<tr>
<td>ITD3</td>
<td>Veneto</td>
<td>2.0</td>
<td>21.4</td>
<td>6.5</td>
<td>24.6</td>
<td>2.0</td>
<td>3.4</td>
<td>0.5</td>
<td>9.2</td>
<td>25.9</td>
</tr>
<tr>
<td>ITD4</td>
<td>Friuli-Venezia Giulia</td>
<td>2.5</td>
<td>20.8</td>
<td>6.5</td>
<td>25.1</td>
<td>1.6</td>
<td>3.1</td>
<td>0.7</td>
<td>6.2</td>
<td>27.3</td>
</tr>
<tr>
<td>ITD5</td>
<td>Emilia-Romagna</td>
<td>1.3</td>
<td>29.9</td>
<td>5.8</td>
<td>18.3</td>
<td>3.6</td>
<td>3.5</td>
<td>0.5</td>
<td>8.6</td>
<td>23.2</td>
</tr>
<tr>
<td>ITD6</td>
<td>Umbria</td>
<td>2.2</td>
<td>22.0</td>
<td>6.5</td>
<td>22.8</td>
<td>2.0</td>
<td>3.6</td>
<td>0.7</td>
<td>10.0</td>
<td>25.6</td>
</tr>
<tr>
<td>UKG</td>
<td>West Midlands</td>
<td>2.7</td>
<td>18.9</td>
<td>7.8</td>
<td>23.2</td>
<td>2.6</td>
<td>2.8</td>
<td>1.3</td>
<td>8.1</td>
<td>27.9</td>
</tr>
</tbody>
</table>

Average of 30 closest regions: 2.9 | 21.5 | 8.0 | 23.8 | 2.2 | 2.8 | 0.7 | 6.0 | 23.6 |

Average of all 206 NUTS: 4.6 | 17.6 | 8.4 | 21.2 | 2.3 | 2.6 | 0.7 | 7.6 | 24.3 |
Metals and Electrical, electronic, computing and optical equipment. In EPO patents they excel in Entertainment and recreational activities. Within the industrial sector, they are specialized in professional, scientific, technical, administrative and support service activities; and arts, entertainment and recreational activities. By comparing the two lowest rows in the above tables, it is possible to characterize the Basque Country’s group of reference regions. Such regions are characterized by their considerable size, aging population, good accessibility and a marked specialization in manufacturing and knowledge intensive sectors (Financial and insurance activities; Professional, scientific, technical, administrative and support service activities; and Arts, entertainment and recreational activities). Within the industrial sector, they are specialized in Metals and Electrical, electronic, computing and optical equipment. In EPO patents they excel...
in the Performing Operations, Mechanical Engineering and Fixed Constructions sections. By comparing the values in the Basque Country row with those in the last two rows, we can characterize the Basque Country with regards its reference group and all European NUTS, observing that the above features hold \textit{grosso modo} for the Basque Country.

a) Economic and innovation performance

Even if we propose to compare regions with those that exhibit similar structural conditions, the data allow for performance comparisons with all other NUTS. However, if we want to follow the procedure described above, Table 6 presents a simple and direct way to assess the position, strengths and weaknesses of a region’s performance with respect to its reference group and all the European NUTS.

Table 6: Level of economic and innovation performance of the Basque Country and its reference group

<table>
<thead>
<tr>
<th>NUTS Code</th>
<th>NUTS name</th>
<th>Level of economic output ranking</th>
<th>Level of economic output index</th>
<th>GDP per capita (thousand €)</th>
<th>Productivity (thousand €)</th>
<th>Employment rate (%)</th>
<th>Level of innovation output ranking</th>
<th>Level of innovation output index</th>
<th>Publications per million inhabitants</th>
<th>Patents per million inhabitants</th>
<th>Employment in H and BN technology (%)</th>
<th>Employment in knowledge intensive sectors (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT32</td>
<td>Salzburg</td>
<td>25 68</td>
<td>37 65 75</td>
<td>97 50</td>
<td>571 168</td>
<td>3.5 34</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT34</td>
<td>Vorarlberg</td>
<td>29 67</td>
<td>34 71 74</td>
<td>95 50</td>
<td>119 361</td>
<td>6.8 31</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>DE1</td>
<td>Baden-Württemberg</td>
<td>34 65</td>
<td>35 65 74</td>
<td>1 79</td>
<td>1694 513</td>
<td>10.8 38</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>AT31</td>
<td>Oberösterreich</td>
<td>38 63</td>
<td>32 62 74</td>
<td>83 53</td>
<td>342 205</td>
<td>7.7 31</td>
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</tr>
<tr>
<td>SE12</td>
<td>Östra Mellansverige</td>
<td>40 61</td>
<td>31 69 73</td>
<td>4 74</td>
<td>4340 230</td>
<td>8.8 48</td>
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<tr>
<td>AT22</td>
<td>Steiermark</td>
<td>49 59</td>
<td>34 70 66</td>
<td>57 57</td>
<td>768 141</td>
<td>9.0 32</td>
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<tr>
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<td>Emilia-Romagna</td>
<td>50 58</td>
<td>32 63 69</td>
<td>41 60</td>
<td>1210 169</td>
<td>9.3 30</td>
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<tr>
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<td>Niederösterreich</td>
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<td>27 62 72</td>
<td>105 47</td>
<td>157 130</td>
<td>4.4 38</td>
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<td></td>
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<tr>
<td>ITD2</td>
<td>P. A. Trento</td>
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<td>31 66 67</td>
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<td>1116 45</td>
<td>3.7 40</td>
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</tr>
<tr>
<td>FR71</td>
<td>Rhône-Alpes</td>
<td>54 56</td>
<td>30 72 65</td>
<td>24 65</td>
<td>1491 213</td>
<td>5.8 41</td>
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</tr>
<tr>
<td>AT22</td>
<td>Steiermark</td>
<td>55 56</td>
<td>28 57 71</td>
<td>45 59</td>
<td>1202 162</td>
<td>6.4 35</td>
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<tr>
<td>DE8</td>
<td>Rheinland-Pfalz</td>
<td>57 55</td>
<td>26 57 72</td>
<td>18 67</td>
<td>864 262</td>
<td>10.5 39</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>DE6</td>
<td>Nordrhein-Westfalen</td>
<td>58 55</td>
<td>20 61 68</td>
<td>21 66</td>
<td>964 236</td>
<td>9.3 39</td>
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</tr>
<tr>
<td>UKG</td>
<td>West Midlands</td>
<td>61 55</td>
<td>29 63 68</td>
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<td>5.9 46</td>
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<td>Schleswig-Holstein</td>
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<td>30 52 67</td>
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<td>63 56</td>
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<td>Friuli-Venezia- Giulia</td>
<td>87 51</td>
<td>29 61 63</td>
<td>70 55</td>
<td>681 123</td>
<td>7.0 33</td>
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<td>80 53</td>
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<td>6.7 32</td>
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<td>Lorraine</td>
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<td>64 56</td>
<td>819 58</td>
<td>6.7 41</td>
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<td>Picardie</td>
<td>105 48</td>
<td>24 66 62</td>
<td>69 51</td>
<td>344 74</td>
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<tr>
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<td>Umbria</td>
<td>112 45</td>
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<td>7.4 34</td>
<td></td>
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</tbody>
</table>

By comparing the two lowest rows in Table 6, we can characterize the output of the reference group with respect to all the NUTS. In this case we observe a superior level of economic performance, mainly caused by a higher productivity, and a superior innovation performance, mainly caused for their better results in patents and employment in high and medium-high manufacturing, that compensate worse results in publications. Similarly, by comparing the Basque Country row with the two lowest rows we can infer that the Basque Country’s economic success, while real when we compare it with the European average, is not so bright when compared with the reference regions. Therefore, rather than being the result of policies and behaviours of recent years, the success is largely due to its structural conditions (industrial and technological specialization, accessibility).

Additionally, it is also possible to identify the Basque Country’s strengths and weaknesses in economic and innovation performance. Its economic performance is negatively affected by a worse productivity and, after the adverse impact of the economic crisis on the region’s employment, by a lower employment rate. Its innovation performance is negatively affected by the bad results is patents and, to a lower extent, in publications. The comparison with the
In addition to compare economic and innovation performances with regards to the level reached the last available year, we can compare the variation in performance over the last five years. In table 7 we can see that, in general, regions that improve more are those that started from lower levels. We also notice that better or worse performances are shared by regions in the same country, thus indicating that variations are largely due to national rather than regional factors. Consequently, benchmarking analysis that aim to identify regions that exhibit better evolutions in their performances should consider, in addition to similar structural conditions, the level the regions started from and the differential evolution with respect to other regions in its country.

Focusing on the regions with similar structural conditions, table 7 shows the good relative performance of the Basque Country in innovation output. However, when economic output is considered, the performance has not been so satisfactory. One of the reasons for this poor performance is that the analysis of the employment variable has been extended to 2009, showing the adverse effects of the crisis that is affecting Spain. The other reason is that the analysis of the employment variable has been extended to 2009, showing the adverse effects of the crisis that is affecting Spain. The other reason is that the analysis of the employment variable has been extended to 2009, showing the adverse effects of the crisis that is affecting Spain.

Lastly, the third stage of benchmarking analysis consists in observing how the region behaved in a series of factors that might be considered as innovation input and that affect the innovation performance described above. We can see in table 8 that, with respect to its performance description above, the Basque Country shows an acceptable level of innovation input. In this respect, its main weaknesses (or areas for improvement) reside in the percentage of
population aged 25-64 with secondary or tertiary education, clearly below the group’s and total averages, but above that of other regions in the group. Likewise, the Basque Country exhibits low levels in patent co-invention and new foreign firms. Lastly, the high values in broadband access that other regions exhibit show that there is also room for improvement in this area.

Table 8: Level of innovation input in the Basque Country and its reference group

<table>
<thead>
<tr>
<th>NUTS Code</th>
<th>NUTS name</th>
<th>Level of innovation input ranking</th>
<th>Level of innovation input index</th>
<th>Population aged 25-64 with upper secondary or tertiary</th>
<th>Population students over 20-24</th>
<th>20-24 population in life-long learning</th>
<th>Business R&amp;D expenditure</th>
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In any case, the objective is not to increase the innovation input, but rather to increase the innovation output (which, in turn, should help to increase the economic output). In that sense, we should complete the comparison of the level of innovation with an indicator that reflects the efficiency in using this input. In this respect, graph 1 shows that the Basque Country’s reference regions (with orange diamonds in the graph) exhibit better efficiency levels in their systems than the European average (with small black triangles), while the contrary is true for the Spanish regions (represented with grey squares, with the exception of those that are also in the reference group, that are represented with green diamonds). During the last years the Basque Country (with a red circle) has substantially corrected the efficiency problem that had attributed to it over the last decade. Currently it practically sits on the adjusted line between innovation input and output for all the European regions.
Graph 1: Levels of innovation input and output in the European regions

Symbols: Basque country (red circle), non-Spanish reference regions (orange diamond), Spanish reference regions (green diamond), other Spanish regions (grey square) and other EU regions (small black triangle)

Lastly, the comparison of innovation inputs may refer to variations, instead of levels. In this respect, table 9 shows the Basque Country’s outstanding advance in innovation input, despite departing from an already high position compared to the reference group.

Table 9: Innovation input variation in the Basque Country and its reference group

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<tr>
<th>NUTS Code</th>
<th>NUTS name</th>
<th>Variation of innovation input ranking</th>
<th>Variation of innovation input index</th>
<th>Variation of human res. in science and technology</th>
<th>Variation in population with upper secondary or tertiary educ.</th>
<th>Variation in population in life-long learning</th>
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5. Summary and conclusions

Benchmarking can help on the formulation of the competitiveness and innovation strategy every territory should have. It can also help on the evaluation of the activities that have been carried out there. In order to do so, it is necessary to avoid simplistic approaches that do not take into account the territory’s context and are based on mere imitation that reduces diversity and goes against the very idea of a strategy. In fact, the first condition every territorial benchmarking exercise should accomplish is that comparisons should take place among homogeneous and comparable territories. Among them, particular attention should be placed on those regions with better performances. The analysis should not stop there: it should rather attempt to disclose the causes, analyzing the activities and inputs that have led to such results. Even if the combination of quantitative and qualitative information and the active participation of territorial agents would be preferable, this work focuses on the analyses an individual analyst may undertake using publicly available secondary sources on regional data.

Regarding the first stage of a benchmarking analysis, and despite the numerous authors who have underlined the need to compare homogeneous territories and have highlighted several factors that should be considered to assess homogeneity, existing territorial benchmarking analysis have frequently ignored such requirement and have used a very simple approach to determine homogeneity: grouping territories according to GDP per capita levels. Here we propose the identification of territories based on their structural conditions that have been grouped in four categories that are equally weighted: geo-demographic factors (population, population density, aging rate and accessibility), the economy’s industry structure (distribution in 10 large sectors), industrial structure (distribution in eleven sectors) and technological specialization (distribution in CIP patent sections). After subjecting the variables to a series of transformations (corrections and standardization) and assigning relative weights (equal for indicators within the same group), we obtain a distance matrix among all EU-27 regions.

Based on this matrix two different approaches may be followed. On one hand, we can take the row of distances from the region we are interested in carrying out the benchmarking for, ordering all the other regions according to their distance to the benchmarked region and choosing the number of regions for a detailed comparison. On the other hand, a cluster analysis can be undertaken to obtain a regional typology based on the structural conditions. The first approach is preferable for those interested in a particular region, since it allows for a finer selection of regions than the cluster analysis and the choice of the regions to be compared with. The second option is preferable for those interested in all European regions, since it provides a more complete picture.

Having identified the regions with similar structural conditions, the following step consists in identifying those with better performance to determine the relative strengths and weaknesses of the region the benchmarking exercise is undertaken on. Regarding relative performance, it is advisable to distinguish between economic and innovation variables, as, even if they are closely related, the distinction allows the analysis of their dynamic interactions. Likewise, performance analysis should distinguish between achievements at a point in time, from variation or evolution analysis.

In order to do so several variables were selected: employment rate, productivity and GDP per capita for the level of economic performance; annual rate of employment growth,
productivity, real GDP and real GDP per capita for its variation. With regards to innovation performance, the level was measured through EPO patents and publications per capita, and percentages of employment in high and medium-high manufactures and knowledge intensive services; and the variation through the growth rates of the same four indicators. As before, the original variables were subjected to the usual treatments (correction and standardization) and equal weights were assigned (within each level) to obtain composite indicators.

The third stage of the benchmarking exercise consists in comparing the drivers that affect the above mentioned innovation performance. Three types of indicators have been selected: some linked to human resources (human resources in science and technology (% of population aged 25-64); population aged 25-64 that has attained upper secondary and tertiary educational level (% of population aged 25-64), students in tertiary education (% of population aged 25-64), population aged 25-64 taking part in long-life learning (% of active population); others linked to R&D (business and public R&D expenditure and personnel) and connectivity (families with broadband access, patent co-invention and new foreign firms). Similarly to performance indicators, they have been subjected to usual treatments and weights have been assigned to compute innovation input composite indicators.

In order to verify its suitability, the benchmarking procedure has been tested on the Basque Country. The identification of reference regions depends on the approach chosen: the individual approach based on the row of distances taken from the distance matrix, or the collective approach based of the typology group from the cluster analysis. The observation of the Basque Country results seems to confirm the suitability of the individual approximation.

Distinguishing between economic performance indicators and innovation performance indicators makes the detection of “innovation paradoxes” possible. The analyses carried out also enable the identification of relative strengths and weaknesses in economic and innovation performances and the assessment on whether these are shared with the other regions in the reference group or quite specific to the region in question.

The analysis of variation performance in order to identify those with top results has uncovered the need to incorporate the starting point of the region’s economic and innovation performance (given the convergence observed) and the differential behaviour with respect to the rest of the country (given the similarities in evolution with other regions in the same country).

Finally, regarding innovation input, the benchmarking exercise we have proposed enables not only the characterization of the reference group with respect to all the NUTS, but also the identification of strengths and weaknesses both with respect to all the NUTS and its reference group (for instance, the Basque Country’s weakness in upper secondary or tertiary education). In any case, having high innovation inputs is not a regional objective per se. Rather, high innovation outputs are pursued (and these, in turn, only if they enable a better economic performance). Hence, the comparative analysis of innovation input should be complemented with an indicator that captures the efficient use of such input. This can be achieved by comparing innovation input and output. Thus, for instance, the benchmarking analysis uncovers a certain efficiency problem in the Spanish innovation systems, since their output indicators are considerably worse than their input indicators. Lastly, in order to identify the regions to learn from due to their positive evolution in input performance, we should take into account the dynamics in the reference group, the starting point of the region’s innovation input and the behaviour of the region’s country.
REFERENCES


