Regional Economic Transformation: The role of clusters in specialised diversification

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Abstract: *Territories are facing an uncertain and complex context, characterized by globalization and economic, social and environmental challenges. Regarding these context conditions and the role of territories on competitiveness and innovation, clusters have become progressively a spreading phenomenon all around the world. Nowadays, the importance of clusters has been mixed with the concept of smart specialization, a territorial development model that seeks to increase the efficiency and effectiveness of economic systems. Nevertheless there are certain gaps in smart specialisation to be covered, especially when referring to the role of clusters. The aim of this article is to analyse the concept of both cluster and smart specialization form a twofold perspective: the economic development theoretical approach and the policy perspective. These aspects are translated into the Basque Country case in order to show the potential implications of new RIS3 strategies regarding clusters, and vice versa, as well as their role as policy instruments.*

Key words: *smart specialisation, clusters, Basque Country*

JEL: *R12 - Size and Spatial Distributions of Regional Economic Activity*

Introduction

Nowadays, territories are facing an uncertain and complex context, characterized by globalization and economic, social and environmental challenges. In this context, competitiveness and innovation have become central topics of academic, business and political debates with regard to the ability of the economies to generate wealth and employment. Furthermore, this topic has focused on how to generate the necessary conditions (social, cultural, institutional and territorial) to achieve the highest competitiveness and innovation levels possible.

Regarding context conditions and the role of territories on competitiveness and innovation, clusters have become progressively a spreading phenomenon all around the world. The increasing importance gained as a theoretical explanation for economic development and the recurrent use as public policy instruments, make cluster organisations and cluster policies the focus of many debates about current competitiveness.

Recently, the importance of clusters has been mixed with the concept of smart specialization, a territorial development model that seeks to increase the efficiency and effectiveness of economic systems with the aim of contributing to sustainable development. This new model has been strongly incorporated within the new Regional Policy logic defined by the European Commission for the period 2014-2020, in the shape of the upcoming Regional Smart Specialisation Strategies –RIS3, a strategic process that will lay the foundations for a new governance model that will offer the territories more coordinated, efficient and effective economic systems.

Hence, the aim of this article is to analyse the concept of both cluster and smart specialization form a twofold perspective: the economic development theoretical approach and the policy perspective. To do so, the first chapter will introduce briefly the traditional cluster approach, differentiating the development model behind it, as well as the cluster policy dimension that has led to the explosion of cluster initiatives around the world. The second chapter will introduce the relationship between the clusters and the new smart specialization development model as two perspectives that mutually reinforce and share common elements that contribute one to another. The third chapter will analyse all these elements regarding clusters and smart specialisation into the Basque Country case, a region with a cluster policy since the 90s and where a reflection

must be done regarding the upcoming RIS3. Finally, a fifth chapter will add a number of generalised recommendations about how to reformulate cluster policies regarding smart specialisation model and the likely role of cluster initiatives within the new governance system that regions probably develop under smart specialisation.

1. Clusters and Cluster Initiatives: Some preliminary insights

In the past two decades, clusters have become explanatory elements of regional development and policy tools for it (MITYC 2011a). No wonder that in the context of new regional innovation strategies promoted by the Commission and focused on smart specialisation, clusters will play an important role, by joining throughout the process of definition, implementation and monitoring (IPTS 2012).

In the words of the modern father of the concept (Poter 1998) a cluster can be defined as *"geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related sectors and related institutions (e.g., universities, R&D institutions, trade associations etc.) in fields that compete but also cooperate*."

In the new competitiveness context mentioned, we have witnessed a generalize "explosion" of these phenomena colloquially known as clusters (Council on Competitiveness 2001 and EC 2007) [1], making it necessary to ask about their roots, and how they can help companies in their regional and local environments to compete internationally, and even more importantly, ensure a sustainable welfare over time.

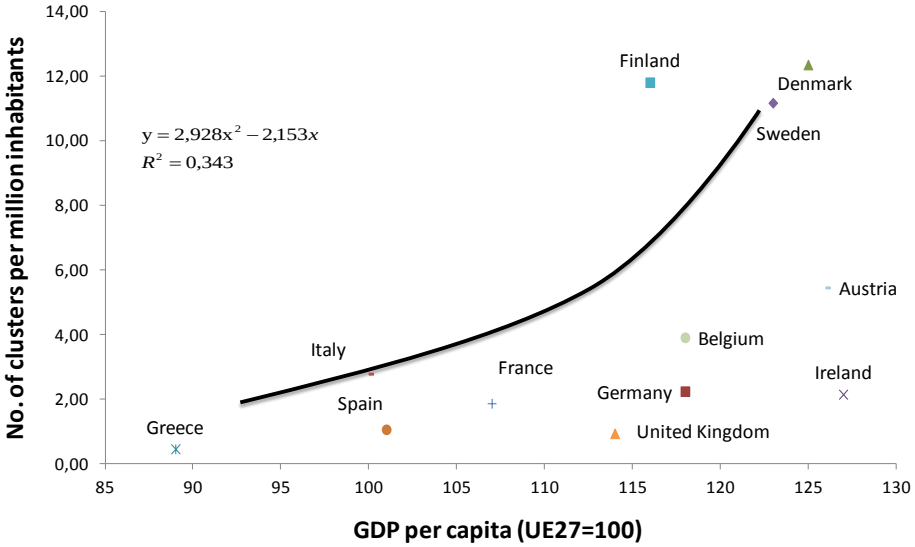
The figure of cluster is generally used to represent a concentration of companies capable of producing synergies due to their geographical proximity and the interdependencies between them (Rosenfeld 1998), which generate positive externalities ("spill-overs" of knowledge, agglomeration economies etc.) contributing to enhancing the levels of competitiveness of the entire cluster (MITYC 2011b). These externalities, far from affecting only the cluster, go beyond the borders of the activity and also indirectly benefit the whole territory where they are located (Cooke 2001). For long, classic authors such as Marshall (1890), and more recently others such as Porter (1990) and Krugman (1992), attributed a higher performance of certain spatial economic

[1] There are much more cluster cases than those that can be identified but some efforts have been made recently to mapping clusters (European Cluster Observatory and/or Cluster Mapping Project). Thus, in the United States more than 40 types of clusters at regional level were identified. In Europe, similar studies have identified more than 2,000 clusters across the 258 European regions.

concentrations to positive externalities that encourage innovation throughout the business tissue.

It is no coincidence that there is in fact a direct relationship between the presence of clusters and the degree of economic development of a territory (Del Castillo and Paton 2012): in those countries and regions where the cluster phenomenon is consolidated, regional innovation and competitiveness model has also reached the high levels. Moreover, the more entrenched these phenomena are with the territory the more they contribute to the creation of wealth and employment.

Figure 1. The relationship between clusters and economic growth: No. of clusters and GDP per capita in 2012



Source: Del Castillo and Paton 2012

Clusters not only allow explaining and understanding the determinants of competitiveness from a theoretical perspective, but also act upon them. Even in some cases clusters have grown spontaneously, most times they appeared as an instrument of regional competitiveness policy defined and implemented by regional/national governments that have probed to positively impact on business competitiveness (MITYC 2011a).

In this sense, clusters organisations have been, at least in those territories where a real commitment to them has been experienced, important initiatives generating many benefits and positive externalities for its members (Sövell et al. 2003). This is the reason

why clusters are progressively becoming a priority in the context of competitiveness policy (EC 2010).

Although currently both cluster initiatives and the understanding of clusters are close conceptually, and are often understood as the same thing, not all clusters have an initiative to represent them. Thus, where the cluster is treated as a phenomenon of agglomeration that belongs to an economic structure, the cluster initiative is the formalized entity that is occasionally started to represent the different members of the cluster (Del Castillo et al 2011).

Following Sövell et al. (2003) organised efforts to facilitate and accelerate the growth and consolidation of clusters linked to a territory, involving in the process companies related to the activities, public administrations and the research community (known as the regional triple helix).

Today, the growing importance of the "living lab" approach (Bilgram et al. 2008) and the models of open innovation (Chesbrough 2003), force to reconsider the regional system in terms of a quadruple helix (Carayannis and Campbell 2009). Thus, they are incorporated into the analysis in the shape of user communities and society in general as important agents that influence the processes of innovation and implicit governance of the entire value chain. In the framework of smart specialization, the regional system would consist of a number of clusters with a conceptual approach very close to what is understood as quadruple helix. That is clearly reflected by the European Commission in the current definitions of regional policy in the field of innovation (Landabaso 2011).

The aim of these cluster initiatives is to promote and maximize the dynamics of collaborative work between its members to increase the synergy and its effects on the general competitiveness of the group. In order to do this, the initiatives look to systematise and guide the actions of its members towards maximizing the relationships in the frame of triple/quadruple helix.

Moreover, it must be taken into account that both the cluster and the cluster initiative are subject to changes in the competitive environment. Accordingly, clusters are seen to evolve in a sort of life cycle consisting of embryonic, growth, maturity and decay stages (Rosenfeld 2002 and Swann et al. 1998). These changes convert both in “living” elements that undergo various stages that must be taken into consideration (Sövell

2008). These stages determine their role and their reach in policy and regional dynamics Del Castillo et al 2011):

Table 1. Stages of a cluster initiative: the cluster life cycle

STAGES	*DESCRIPTION*
Launch and growth	Launch and growth, in which the CI integrates the most important members of the cluster, define priorities and a Strategy Plan for the medium and long-term.
Consolidation	Consolidation, the CI defines a series of services, collaborative dynamics and actions that are more and more sophisticated and directed towards reinforcing trust and social capital.
Reinvention	Re-invention, by expanding the boundaries of the cluster and its intersection with technology domains of other clusters, leading to radical innovation and the emergence of new business opportunities.
World-class cluster[2]	World-class Cluster, when the consolidation and growth of the CI reach the maximum in a territory and the need arises to orientate the cluster globally, leading to the formation of global value chains.

Source: Authors

2. Clusters and Smart Specialisation: what theory says…

The concept of smart specialisation comes from the reflection generated around the innovation "gap" between Europe and the U.S. (Pontikakis et al. 2009) as a result of lower economic and technological specialisation, and by the reduced ability to prioritize efforts on a the matter in regions. This concept guides the reorientation of European Regional Policy in the context of the Europe 2020 strategy, to the point of being included as part of two of the conditionalities for obtaining ERDF funds during the period 2014-2020 (EC 2011a and 2011b).

The smart specialisation is still a developing concept, originally proposed by the same authors that currently advise the Commission itself (Foray 2009 and McCann and Ortega-Argilés 2011) and can be defined as "*the establishment of priorities that at a regional-level take place in a series of activities and / or technology domains, and that are potentially competitive and able to generate new business in a global context faced competition from other places*" (Del Castillo et al 2012b).

The concept is composed by three main elements: (1) process consistency on a global context, (2) prioritization of specific specializing patterns, and (3) specialized diversification through the exploitation of regional related variety. Del Castillo et al.

[2] EC (2011d)

(2013a) understand smart specialisation as a strategic governance process focused on "*prioritizing the diversified specialisation, consistent with the historical heritage and capabilities of the region taking into account the constraints and opportunities of the global economy.*"

Table 2. What is smart specialization? Main elements

STAGES	***DESCRIPTION***
Considering the global context	Reach COMPETITIVE ADVANTAGES through the specilisation starting from the possibilities that the actual reality offer (comparative advantages). And this is in line with the priorities of other regions in the context of globalization.
Prioritizating specialisation patterns	Achieving COMPETITIVE ADVANTAGES prioritizing choices of specialisation based on key enabling technologies.
Expliting related variety	Exploiting the potential of SPECIALIZED DIVERSIFICATION from the relation between different but related activities/technologies.

Source: Del Castillo et al. 2013a

The cluster theory is closely related to the theory of smart specialisation and could even be said that, to some extent, the latter is derived from the first (IPTS 2012), because they share many of their basic conceptual aspects. These aspects can be summarized and compared between one another (see table 3). More specifically, the theory of the cluster can be understood as a specification (instrumental approach) within the theory of smart specialisation, highlighting the following elements from both of them (Del Castillo et al 2013b):

- Global context: clusters are good channels for both the internationalization of enterprises (especially SMEs) and identification of global trends.
- Specialisation patterns: clusters are an indicative reflection of the current and potential regional specialisation pattern and in addition, cluster initiatives are channels to reach (access) the critical mass they represent
- Related variety: cluster initiatives facilitate relationships in the quadruple helix, as well as they contribute to technological hybridization through intercluster processes and identifying and seeking support for entrepreneurial discovery initiatives.

Table 3. Synergy between smart specialisation and clusters

	CLUSTERS LINKED TO SMART SPECIALISATION	*SMART SPECIALISATION ADDRESSED BY CLUSTERS*
Global context	• Progressive formation of Global Value Chains	• Generation of internationally competitive advantages • Interregional networking under a business model
Specialistaion patterns	• Social capital and intermediary between regional actors	• Critical Mass (agglomeration economies) • Efficiency and effectiveness of public policies (leverage) • Systemic performance
Related variety	• Dynamics of intercluster collaboration	• Exploitation of related variety based on specific priorities • "Spill-over" effects and externalities

Source: authors

3. The Case of the Basque Country: Basque clusters as tools for RIS3

As localization theories became an area of interest during the 90s, especially those related to innovative milieus and clusters (Becattini 1990 and Porter 1990), the Basque Government, along with the main businesses and innovation agents built a new strategy focused on economic specialization and collaborative approaches: the Basque cluster policy (Monitor Company 1991).

The rationale for these conceptual approaches from which the Basque cluster policy was defined comes from Marshall's (1890) analysis, where the advantages arising from geographical proximity have been associated with external economies in the form of specialised labour markets, input suppliers and knowledge spillovers, giving rise to productivity benefits. In addition, technological externalities arise through shared technological information and knowledge spillovers, giving rise to innovation benefits (Langlois and Robertson 1996) that result directly in competitiveness benefits.

Nevertheless, these theories also point out that overspecialisation could be associated with certain disadvantages such as congestion and competition effects both in input and output markets (Swann et al, 1998) and could also lead to raising the cost of real estate, as well as the cost of specialised labour (Baptista 1998). OECD (2009) notes how the economic benefits from clusters in certain locations may be offset by economic costs or competitive advantages in other locations. But probably, the most significant pitfall regarding cluster models is the risk associated also with long term lock in, inability to adapt and therefore greater vulnerability vis a vis external shocks (Grabher 1993).

So, regarding the benefits and risk associated to clusters, it is interesting to evaluate to what extent clusters may contribute to regional development. Especially, since many of the cluster approaches are quite similar to those of smart specialisation as show in chapters 2 and 3, it is relevant to assess how they can contribute to it in the upcoming framework of regional smart specialisation and RIS3. In order to do that, we have analysed that contribution of Basque clusters to a number of economic variables related to smart specialisation fields pointed out in chapter 2. This will allow as not only to check the cluster contribution to territorial development in the Basque Country since the 90s, but also to make some recommendation regarding the new Basque RIS3.

3.1. Methodology

Although there are many controversies about conceptual and empirical approaches of what clusters are and how they emerge and evolve (Pitelis et al. 2006), the literature include degree of specialisation in a particular industry, relationships within the cluster, and scale or/and critical mass as defining elements of clusters (Enright, 1996; Spencer et al, 2010). We have designed a model linking these defining elements to some economic variables as proxies of territorial development (linked somehow to what smart specialisation tries to achieve).

Table 4. Specialisation pattern identification and contribution to competitiveness

TYPOLOGY	***AREAS***	***METHODS***	***DATA SOURCE[3]***
Defining elements	*Economic specialisation*	*Specialization coefficient*	*DIRAE – CNAE 2009*
	Geographic concentration	*Spatial heterogeneity index*	*DIRAE – CNAE 2009*
	Interrelationships and intensity	*I-O multipliers*	*Regional Accounts – A84*
Characteristics elementS	*Competitiveness levels*	*Labour productivity*	*Regional Accounts – A84*
	Market orientation	*Data on exports*	*Regional Accounts – A84*

Source: Own elaboration from Eustat and Del Castillo and Paton (2010)

The methodology developed in this section has its roots in the work of Del Castillo and Paton (2010) that it is in turn based on the classical approach for cluster identification and analysis (Porter 2003, Brenner 2005 and Duranton and Overman 2005). As a starting point we consider to establish a set of variables (5 in total) to be

[3] CNAE is the Spanish National Classification of Economic Activities resulting from the international revision process according to NACE Rev.2. It includes a detailed breakdown of 87 sectors: http://www.ine.es/jaxi/menu.do?type=pcaxis&path=/t40/clasrev&file=inebase

included in the analysis, namely: economic specialization, geographic concentration, interrelationships and their intensity, competitiveness level and market orientation.

These variables will allow analysing the supposed cluster benefits (Marshall 1890 and Langlois and Robertson 1996), as well as potential pitfalls and barriers (Swann et al. 1998, Baptista, 1998 and Grabher, 1993) against the framework of smart specialisation. In addition to that, in order to cover the related variety dimension in smart specialisation, we have included and analysis of the evolution of technological proximities of Basque clusters following the model used by Frenken et al. (2007) and Los (2000). Next there a reference to the methodological approaches to defining variables:

Economic specialisation

Economic specialization is one of the most visible characteristics of any given cluster and has to do with the progressive division of labour according to products and processes becoming more complex and requiring further deepening of the value chain. In this sense, we define the specialization of a location as a greater relative value for a particular variable with respect to the same measure in a superior geographical scope. In the work of Porter (2003) this has been called the location quotient. Mathematically the expression of the location quotient for a sector "x_{ij}" would be:

Analytical expression 1

$$CE(x_{ij}) = \frac{\frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}}}{\frac{\sum_{j=1}^{z} x_{ij}}{\sum_{i=1}^{n}\sum_{j=1}^{z} x_{ij}}} \cdot 100$$

where "x_{ij}" is the number of firms for the sector "i" and the region "j", "n" is the total number of sectors within the economic classification and "z" the total number of regions.

The result of applying this specialisation coefficient (CE) is a percentage that can range within the following values:

- "CE" (X_{ij}) ≤1.10 - The sector "x_{ij}" has no specialization (lower relative weight than the average).
- "CE" (X_{ij})>1.10 - The sector "x_{ij}" has a certain degree of specialization (relative weight greater than average).

The economic activity classification in DIRAE (CNAE2009) provides information on employment stratum. This information can be further broken down, taking into account the weight of employment in the identification. Thus, together with the criterion of specialization of more than 10% of the average, taking into account the different levels of employment (without employees, with employees and with +10 employees) we can further detail the economic specialisation pattern considering the most remarkable regional clusters (see table 5),

Geographic concentration

Along with economic specialization, the geographic concentration of economic activity was the most visible element in cluster definition. Although nowadays the relative importance of geographic proximity has been reduced due to globalization and transportation and communication cost (Cairncross 2001), distance generates considerably effects regarding knowledge spill overs, cost efficiencies and cluster synergies. We propose a measure of geographic concentration based on the GINI index:

Analytical expression 2 $$L_c = \left| 1 - \sum_{c=1}^{c=n-1} (X_{c+1} - Y_c) \right|$$

Where "X_c" is the percentage of enterprises located in a zip code "c", and "Y_c" is the percentage of area accumulated for that zip code "c".

This spatial heterogeneity index ranges from 0 and 1 where 0 represent and equality distribution of enterprise across territory and 1 represent a total inequality distribution (total concentration in a given location).

Interrelationships and intensity

The increasing importance of innovation as a source of economic specialisation has led to a further analysis of networking performance as a key explanatory element of the superior performance of economic agglomerations and clusters.

The regional input-output framework is the instrument that provides most information on the relationships between economic sectors. The measurement of technical coefficients (commercial relationships) gives the degree of dependence between one sector and the rest of the regional economy. Thus, those sectors that exceed

a certain value regarding others become part of either suppliers (if the sector is the client) or customers (if the sector is the provider). In this sense, the input-output analysis will allow us to identify through these coefficients both suppliers of the core activities of the cluster as well as the customers of these sectors. The technical coefficients of each pair of sectors “i” and “j” are calculated by the following expression:

Analytical expression 3 $$a_{ij} = \frac{x_{ij}}{X_j}$$

Where “a_{ij}” is the technical coefficient for the sector "j", "x_{ij}" the inputs in sector "j" for the sector "i" and "X_j" the total production in sector "j". The value of “a_{ij}” is always in the range [0.1] and $\sum_i a_{ij} < 1$

From the expression 3 (obtaining the coefficients for the entire matrix), it can be identified the value chain for a given fixed value “a”. The number of sectors in the value chain will be the interrelationship variable to be used in our analysis. Mathematically the value chain can be defined as:

Analytical expression 4 $$\forall j, i \subset A_j \quad if \quad | a_{ij} > a_{Fj}$$

Where the fixed value “a_{Fj}” is defined by us as follows: $$a_{Fj} = \frac{x_{ij_{max}}}{n}$$

From the expression 3 and the coefficients for the entire matrix, the multiplier effects (intensity proxy) can be calculated for all the sectors in the economy aggregating the inverse coefficients by columns:

Analytical expression 5 *Multiplier matrix* $BR = (I-A)^{-1}$

Where “I” is the identity matrix, “A” is the internal coefficient matrix and therefore “BR” is the interior inverse matrix.

Technological proximity

To calculate the potential technology relationships within a regional economic structure we use a method based on the input-output framework. From the I-O inverse matrix from the expression 3, Jaffe (1986) uses the following measure to the cosenic distance between a pair of sectors "i" and "j":

Analytical expression 6 $$w_{ij} = \frac{\sum_{k=1} a_{ik} a_{jk}}{\sqrt{\left(\sum_{k=1} a_{ik}^2 \sum_{k=1} a_{jk}^2\right)}}$$

Where "w_{ij}" is the new coefficient from the I-O inverse matrix which ranges from 0 (total technological inequality) to 1 (total technological equality), and "a_{ik}"and "a_{jk}" are the I-O inverse matrix coefficients calculated from the expression 3.

Following Frenken et al. (2007) and Los (2000), "w_{ij}" coefficient can be considered a good proxy for technological proximity. Using MDS technique (Mutidimensional Scaling) we can represent the technological distances between sectors for a given regional economy and obtain the evolution between two different periods. The comparison between sectoral performances leads us to identify the related variety possibility frontier (see table 7 and note 5).

3.2. Results

We have used the data available in Basque Statistical Institute (Eustat)[4] for business structure (DIRAE) and regional economic accounts in 2010. We have used also the CANE2009 classification of economic activities from DIRAE data and used the correspondence tables from Eustat between the CNAE2009 and A86 classifications (the latter used in regional economic accounts)[5].

The application of expression 1 (location quotient – CE) has resulted in the identification of 3 different groups of sectors from high to medium and low specialisation. The number of sectors, enterprises and employment differs considerably across groups, but in total the 27 sectors considered account for nearly 40% of total Basque enterprises and more than 75% of total employment (table 5)

[4] www.eustat.es

[5] These tables can be found in Eustat: http://en.eustat.es/estadisticas/tema_44/opt_0/tipo_9/ti_Input-Output_Tables/temas.html#axzz2Xnocyn2c

Table 5. Basque specialised sectors

	No. Sectors	*%*	*No. Enterprises*	*%*	*No. Empl.*	*%*	*CNAE sectors*
TOTAL	87	100.00	171,345	100.00	1,032,796	100.00	-
GROUP 1 *High specialisation*[1]	18	20.68	15,575	9.09	615,546	59.60	11;17;19;24/29;38/39;50;62;65;70;72;87;91;94
GROUP 2 *Medium Apecialisation*[2]	2	2.29	22,806	13.31	111,541	10.80	42;53
GROUP 3 *Low specialisation*[3]	7	8.04	28,940	16.89	73,638	7.13	16;18;20;32;77;81;85
No specialisation	60	68.96	102,961	60.09	232,069	22.47	-

Source: own elaboration from Eustat 2010 DIRAE and Regional Accounts

[1]*High specialisation: those sectores with more than 1.10 in CE for all employment stratifications*

[2]*Medium specialisation: those sectors with more than 1.10 in CE in two employment stratifications*

[3]*Low specialisation: those sectors with more than 1.10 in CE in one employment stratification*

Table 6. Correlations between defining and characterizing variables

Correlations (pearson)		*All sectors (27)*	*Without odd sectors*	*Odd sectors CNAE*
Defining variables	*Specialisation-agglomeration*	+0,187 (.35)	+0,449 (.028)	24;25;28
	Specialisation-relationships	-0,227 (.256)	-0,464 (.019)	65;42
	Specialisation-intensity	+0,175 (.382)	+0,444 (.026)	42;19
	Agglomeration-relationships	+0,290 (.142)	+0,477 (.018)	11;19;50
	Agglomeration-intensity	-0,478 (.012)	-	-
	Relationships-intensity	-0,517 (.002)	-	-
Characterizing variables	*Specialisation-productivity*	+0,182 (.366)	+0,456 (.022)	19;20
	Specialisation-exports	+0,594 (.001)	-	-
	Agglomeration-productivity	+0,458 (.016)	-	-
	Agglomeration-exports	+0,471 (.013)	-	-

Source: own elaboration

[1] Figures in brakets show the statistical significance

[2] In case the correlation did not reach sufficient statistical significance (<0.05) dummy sectors have been considered and noted as "odd" sectors (out of the analysis)

The application of expression 2 (GINI index), expressions 3 and 4 (number of relationships) and 5 (intensity of relationships) allows us to elaborate a data panel for the 27 sectors including the three defining elements in table 4. This data panel has been also completed with the information from Basque regional accounts for productivity and exports (the 2 characteristics elements in table 4).

As the results from table 6 shows, it seems that the traditional theories on clusters and economic agglomeration are reflected on the case of the Basque Country. The

specialisation level is positively correlated to spatial agglomeration (clusters tend to locate in areas with high economic density). It is also positively correlated to relationship intensity but negatively to the number of them (the intensity of the relationships matter but a higher number of them may suppose a significant pitfall for higher levels of economic specialisation). In this sense, the number of relationships is negatively correlated with their intensity since it is more difficult to maintain the quality of them when they increase significantly.

On the contrary, spatial agglomeration (the geographic area where clusters tend to locate) is positively correlated to the number of relationships but not to the intensity of them. This shows the nature of urbanization economies where clusters can find the assets (knowledge, labour markets, specialised providers etc.) needed. Therefore, the analysis of specialisation, agglomeration and relationships shows two interesting dimensions to be considered: the performance characteristics of clusters (the role of location and relationships regarding specialisation levels) and the characteristics of the places where clusters tend to locate (areas with high business density and urbanization economies/ sectorial diversity).

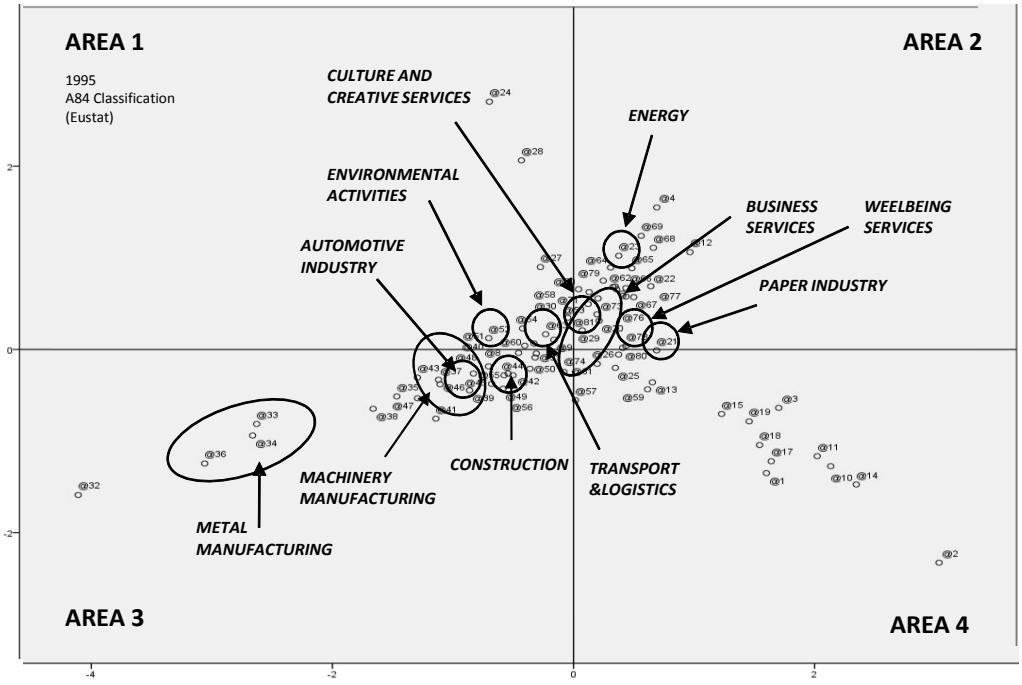
The specialisation level is positively correlated to both productivity and exports figures. This result shows the theses proposed by literature. Spatial agglomeration is also positively correlated to productivity and exports due to a direct effect from the higher specialisation levels the clusters in these locations have. Therefore, regarding the smart specialisation elements mentioned in chapter 2, it can be understood that the Basque case shows how the specialisation (in the shape of clusters) tend to contribute to a higher competitiveness levels (through higher productivity levels) as well as to a more open economy (through increasing export rates).

Some of the pitfalls mentioned previously regarding the lock-in risk inherent to higher levels of specialisation could be qualified in the case of the Basque Country. Basque clusters tend to locate in areas characterised by urbanization economies, where higher range of potential relationships is possible (with other sectors/clusters). So, this could contribute to reduce the pitfall due to the opportunity behind the exploitation of the related variety in these locations. Nevertheless, this must be further analysed using the technological proximities proposed in the methodology. We propose a method (expression 6) to search for sectoral convergence at macro level using a cluster dynamic

analysis approach, and systematize the process of identification potential niches of related variety through the so called entrepreneurial discoveries. Figures 1 and 2 shows the technological proximities between all the economic sectors in the Basque Country in 1995 and 2005. They show four different areas depending on the technological nature of each sector. Areas 2 and 3 are related to services and industry activities respectively while area 4 focuses on primary inputs activities and area 1 does not represent a specific activity (but a transition stage).

Regarding the values for technological proximities, the 27 sectors in table 5 have been aggregated into 11 economic areas[6]. As we can see in figures 1 and 2, although Basque economic structure has experienced minor changes since 1995, if we quantify the precise movement of each cluster, we can perceive a certain evolution pattern. In other words, if a given position in the chart defines a specific relative technology situation for a cluster (the nature of the productive process itself) a change in its relative position necessarily implies an indirect change in its technological nature.

Figure 1. Basque technology specialisation patterns in 1995 (A84 classification)*

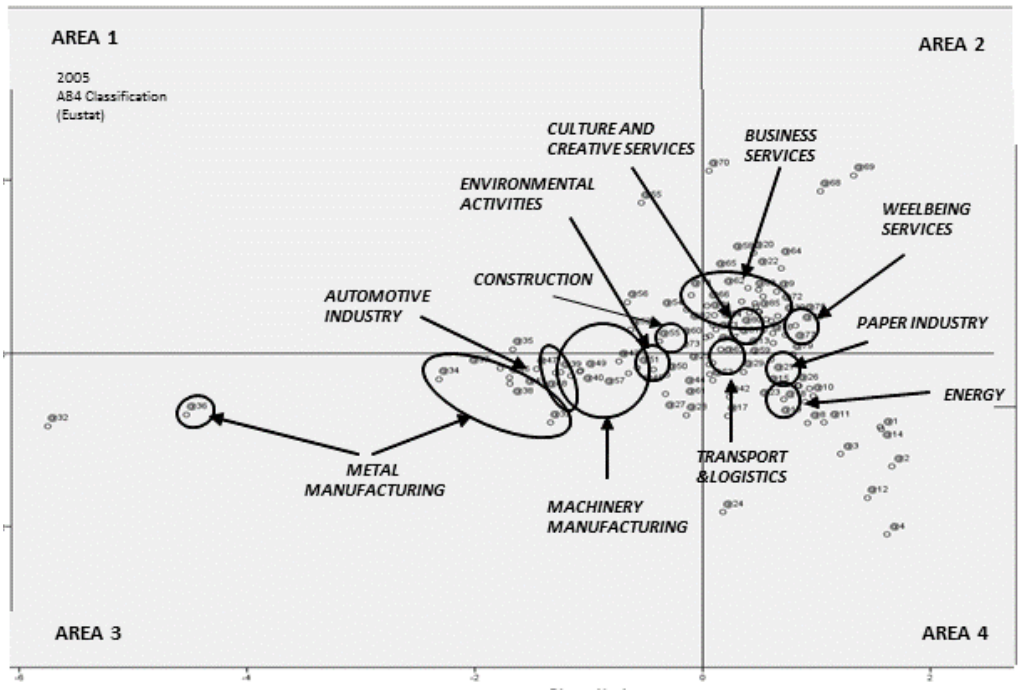


Source: Authors. Data from EUSTAT: Input-Output tables 1995

*The proximities have been calculated for all the sectors in IO95 (84 sectors)

[6] The correspondence between the 11 sectors and the 27 CNAE2009 sectors considered can be seen in table 8

Figure 2. Basque technology specialisation patterns in 2005 (A84 classification)*



Source: Authors. Data from EUSTAT: Input-Output tables 2005

*The proximities have been calculated for all the sectors in IO05 (84 sectors)

Table 7 shows the coordinates of each cluster in the period 1995-2005, the change experienced across areas, and the quantity of the total movement intensity represented by a Change Index -CI[7]. In general, the values obtained show that Basque clusters tend to go towards a slow but continuous process of specialisation (they are deepening further in their respective technological areas 2 and 3). This is the case of industry sectors such as metal manufacturing, machinery and electric material, automotive sector and construction, but also in services such as specialised services, welfare and creative and cultural activities. Only a couple of economic areas (environmental activities and logistics) are experiencing a relocation in terms of technological areas.

[7] The Change Index is a measurement of the differences of relative positions experienced by sector/cluster due to its technological nature change. For a complete description of the index see Del Castillo, Paton and Barroeta (2012)

Table 7. Basque technological specialisation patterns evolution 1995-2005

Economic Areas	*1995*			*2005*			*Change Index (CI)*
	Coor. DimA	*Coor. DimB*	*AREA*	*Coor. DimA*	*Coor. DimB*	*AREA*	
Paper industry	0.68	-0.01	4	0.60	-0.07	4	0,14
Energy	0.37	1.02	2	0.71	-0.53	4	1,89
Metal manufacturing	-2.37	-0.87	3	-2.89	-0.52	3	0,87
Machinery and electric material	-0.84	-0.35	3	-1.03	-0.16	3	0,38
Automotive	-1.12	-0.33	3	-1.69	-0.28	3	0,62
Construction	-0.99	-0.35	3	-1.30	-0.22	3	0,44
Environmental act.	-0.32	0.06	1	-0.57	-0.16	3	0,47
Transport & logistics	-0.23	0.16	1	0.15	0.04	2	0,5
Specialized services	0.24	0.05	2	0.20	0.19	2	0,18
Welfare services	0.43	0.03	2	0.55	0.39	2	0,48
Creative and cultural activities	0.19	0.38	2	0.41	0.46	2	0,3

Source: Authors

Table 8. Sectors within the related variety possibility frontier matrix

Economic areas	*Specialised sectors CNAE*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1) Wood and paper industry	*16;17;18*	0										
2) Energy	*19*	**0,77**	0									
3) Metal manufacturing	*24;25*	-0,03	**1,02**	0								
4) Machinery & electric material	*26;27;28;32*	**0,14**	**0,47**	-0,17	0							
5) Automotive	*29*	-0,38	**0,19**	**0,35**	-0,48	0						
6) Construction	*42;43*	-0,04	**0,41**	**0,01**	-0,18	-0,3	0					
7) Environmental act.	*20;38;39*	-0,19	0	**0,3**	**0,47**	-0,05	**0,29**	0				
8) Trans. & logistics	*50;53*	**0,52**	**0,33**	-0,43	-0,26	-0,78	-0,44	-0,73	0			
9) Specialized services	*42;62;63;65;70;72;77;87*	-0,16	-0,13	-0,27	-0,1	-0,62	-0,28	-0,55	0,38	0		
10) Welfare services	*85;87;88*	-0,22	-0,03	-0,65	-0,48	-1	-0,66	-0,89	**0,04**	-0,34	0	
11) Creative & cultural activities	*91;94*	**0,16**	-0,47	-0,47	-0,3	-0,82	-0,48	-0,77	-0,04	-0,1	**0,38**	0

Source: Authors

Note: figures in bold (+) shows a reduction of the overall technological distance between sectors

Therefore, while the cluster phenomenon in the Basque country seems to go towards and increasing specialisation with the mentioned links with productivity and exports, one may think about a potential lock-in regarding this increasing specialisation. However, there seems also to be room for related variety exploitation (shown in terms

of the closer technological proximities in some clusters). So, in order to systematize the possibilities from related variety in the Basque clusters considered, we have used the previous data from table 7 to obtain a related variety possibility frontier by aggregating the value of the into a double entry (symmetric) matrix[8]:

As we can see in table 8, the related variety possibility frontier is composed for all those pair of sectors whose technological distances (or gaps) have been reduced. Thus, even though a prominent specialisation has been identified across the economic areas, the grey marked figures show a number of potential hybridization areas where clusters may work together in order to identify and promote entrepreneurial discoveries. Some of them have indeed resulted in specific entrepreneurial discovery initiatives (Del Castillo et al. 2012 and Del Castillo et al. 2013d).

4.3. The role of Basque clusters in Basque smart specialisation

Since the 90s, 11 cluster initiatives have been launched in the most strategic and competitive sectors as a common space for debate and discussion regarding competitive challenges and innovation tied to territory (Aranguren et al. 2009). Since 2005, 11 additional emerging clusters have been considered within the cluster policy in order to include additional economic activities.

As it can be seen in table 9, almost every sector identified in our analysis (table 5) has a cluster initiative. Therefore, to a certain extent, the cluster policy in the Basque Country has been well oriented, (at least in terms of cluster identification), to those economic sectors representing natural clusters.

Regarding the sectors linked to cluster initiatives, it can be said that they represent nearly 35% of total Basque enterprises and more than 65% of total employment. Even though a cluster policy in general is not supposed to be a direct "hard" support measure, it is a significantly cheaper policy regarding the potential indirect impacts it may achieve (Boekholt and Thuriaux 1999 and MITYC 2011a). In fact, as a recent study for the MITYC (2011b) has shown, cluster initiatives services may contribute significantly to cost reduction and turnover increase of the enterprises in the cluster (with its respective impact on productivity and exports).

[8] For aggregation of coordinates A and B in 1995 and 2005 the following expression has been used:
$A_{ij}=[(CoorDimA_{i95}-CoorDimA_{j95})^2+(CoorDimB_{i95}-CoorDimB_{j95})^2]-[(CoorDimA_{i05}-CoorDimA_{j05})2+(CoorDimB_{i05}-CoorDimB_{j05})^2]$
Where A_{ij} is the internal coefficient for the related variety possibility frontier identification matrix (figure 8)

Table 9. Cluster initiatives launched since 1990

Activity	*Specisalised sector identified (CNAE)*	*Cluster*	*Year*	*No. members*
Machine tools	*28*	*AFM*	*1992*	*99*
Home appliances	*27*	*ACEDE*	*1992*	*7*
Automotive	*29*	*ACICAE*	*1993*	*104*
Environment	*20;38;39*	*ACLIMA*	*1995*	*84*
Bilbao Port	*50*	*Unipor Bilbao*	*1995*	*135*
Telecommunications	*26;27;62*	*GAIA*	*1996*	*267*
Energy	*19*	*Cluster de la Energía*	*1996*	*90*
Aeronautics	*32*	*HEGAN*	*1997*	*38*
Marine sector	*32*	*Foro Marítimo Vasco*	*1997*	*322*
Paper (wood)	*17*	*Paper Cluster*	*1998*	*21*
Audio-visual	*18;62*	*EIKEN*	*2004*	*38*
Transport & logistics	*53*	*ClusterTIL*	*2005*	*108*
Food	*11*	*ClusterAlimentación*	*2008*	*43*
Iron and steel foundry	*24*	*FEAF*	*2009*	*66*
Biosciences	*72*	*Biobasque*	*2006/09*	*45*
Habitat & contract	*16*	*HABIC*	*2009*	*103*
Forging and casting	*24*	*SIFE*	*2009*	*14*
Construction	*42;43*	*Eraikune*	*2010*	*80*
Hand tools	*28*	*Herramex*	*2010*	*26*
Steel production	*24;25*	*Siderex*	*2010*	*71*
Languages	*85;91*	*Langune*	*2012*	*60*
Railways	*32*	*MAFEX*	*2012*	*22*
Sectors not represented	*65;70;77;87;94*	-	-	-

Source: Aranguren et al (2009) "Asociaciones cluster de la CAPV" y Orkestra 2013 "Basque Cluster Policy Brief" May 2013

In the case of the Basque Country, As Aranguren and Navarro (2003) state, though the better performance of Basque economy since mid-90s occurred in parallel to cluster policy and cluster initiatives launch, it is difficult to find a direct link between one and another. However, Ahedo (2003) highlights the positive contribution of Basque cluster policy to collaboration promotion within the cluster initiative launched.

According to Aragón et al. (2010) the Basque cluster policy and initiatives has a very positive impact in terms of qualitative aspects such as trust building, social capital strengthening and transfer of knowledge, experiences and good practices. These aspects

are in fact those highlighted by our finding as main contribution to clusters´ more specialisation, productivity and exports (quality and intensity of relationships).

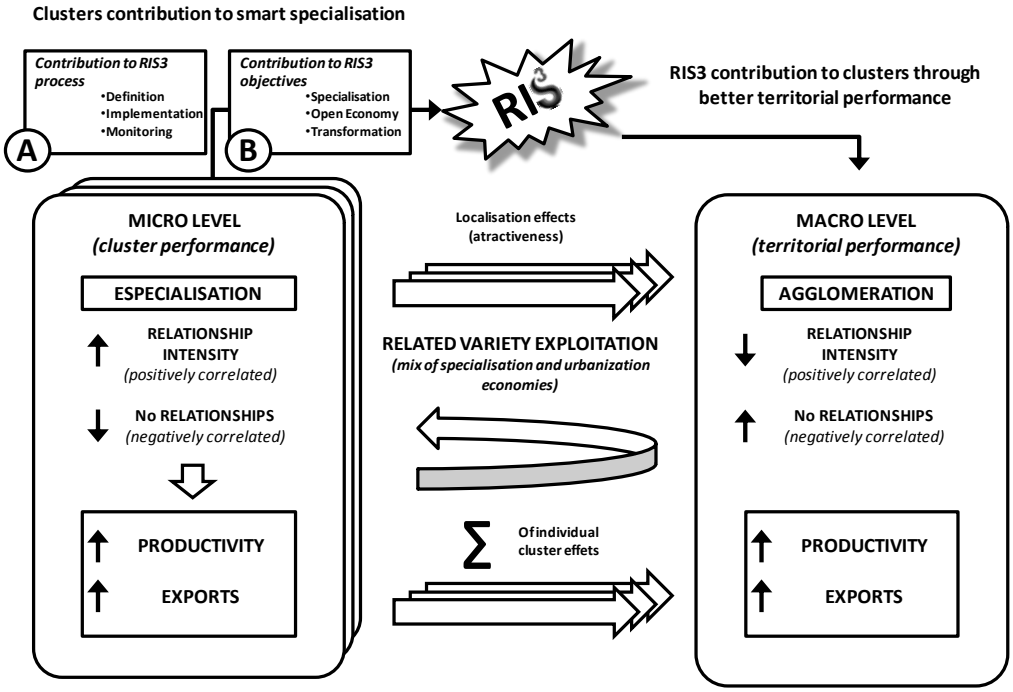
Therefore according to the results obtained in our analysis, since at micro level Basque clusters seem to be drivers for higher productivity and exports (possibly thanks to the role played by the intensity of their relationship intensity) it is interesting to consider them as catalysts for contributing and achieve the smart specialization main principles, specifically the themes of 1) achieving a higher degree of specialization in certain prioritized areas with competitive and comparative advantages, and 2) going towards a more open economy (see tables 2 and 3).

In addition to these, since Basque clusters tend to be located in areas with high business density and with urbanization economies (more favorable to exploit synergies with different clusters and activities), they also could be the key for the third theme in a RIS3 focused on contributing to specialised diversification through related variety exploitation and entrepreneurial discoveries (tables 2 and 3).

In figure 3 we have defined the logical framework behind clusters and smart specialization. Specifically the rationale for Basque cluster policy and Basque cluster initiatives in a framework of smart specialization and its strategy. Note that clusters may contribute in terms of their role in a RIS3 process (option A), as well as in terms of their contribution to general smart specialization objectives (option B). In the case of the Basque Country the evidence observed in the analysis done supports this logical framewok.

The latter (Option B) has been analysed previously in point 3.2 with the correlations between the defining and the characterizing elements of Basque clusters, and showed the importance played by the intensity of the relationships in them for their level of specialisations, as well as the relationship under specialisation and productivity and exports level. The first one (Option A) will consist in make a proposition from the different stages of a RIS3 process introduced by Del Castillo et al. 2012a, where the clusters´ role can be divided into three main stages, namely: a definition stage, and implementation stage and an evaluation and monitoring satage.

Figure 3. Basque clusters role in a framework smart specialisation and RIS3



Source: own elaboration

5. Conclusions and recommendations: Key aspects considering 2014-2020

As mentioned in the introduction, the importance of clusters has been mixed with the concept of smart specialization, a territorial development model that seeks to increase the efficiency and effectiveness of economic systems with the aim of contributing to sustainable development. To a certain extent that has been a result of the similarities between both approaches.

The cluster theory is closely related to the theory of smart specialisation and could even be said that the latter is derived from the first because they share many of their basic conceptual aspects. As the Basque case analysis has shown, cluster dynamics regarding the quality and intensity of relationships, the specialisation levels, productivity and exports, support the thesis about the narrow link between clusters and smart specialisation. However, although cluster theory has been put into policy practice since the 90s, the ideas behind smart specialisation implying at least a reformulation of the policy to this new context. There are in fact certain gaps in the orientations and specific aspects to be covered in the new framework of smart specialisation, especially when referring to the tools and the role of the agents for the upcoming RIS3 and its governance model.

Clusters initiatives can (and probably will) play a key role in the process of definition, implementation and monitoring of the new RIS3 strategies. As shown in the case of the Basque Country, at least to kind of contributions must be considered: 1) the contribution clusters can provide as tools for prioritization and rationalization (specialisation) and for favouring productivity and exports (e.g. through and optimal performance thanks to better relationships); 2) as key stakeholders (tools) for supporting a better definition, implementation and monitoring of RIS3 strategies.

Following the traditional nature of clusters and the insights obtained from the analysis of the Basque experience, cluster initiatives and their supporting policies must be understood as interfaces and tools for connectivity. In this sense they must reflect the capabilities and necessities of businesses, as well as act as adequate interfaces to communicate them not only to the Government, but also to the research community. They must play a central role in smart specialisation regarding the traditional gap of translating research results into innovations. Although the active role performed by Basque cluster initiative, they may foster their commitment (or at least their role) in the Basque innovation system (RVCTI).

In any case, the launching and support of "cluster just to clusterise" must not the solution: the clusters are mechanisms not goals on their own. The literature supports the idea of launching cluster initiatives and support certain sectors under a clear cluster evidence. The case of the Basque Country is a good example of how those initiatives launched under this logic prosper and consolidate, and those with no so evidence are relegated to second positions or even fading.

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