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Knowledge and diversity of innovation systems: a comparative analysis of European regions

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Connaissance et diversité des systèmes d'innovation : une analyse comparative des régions européennes

Résumé

Cet article cherche à rendre compte de la diversité des systèmes régionaux d'innovation et de leurs performances économiques en Europe. Nous proposons d'adapter l'approche par les Systèmes Sociaux d'Innovation et de Production (SSIP) de Amable, Barré et Boyer (1997) au niveau régional en identifiant l'articulation locale des composantes des systèmes d'innovation et de production. L'élément central de l'approche réside dans la notion de complémentarité institutionnelle qui permet d'envisager un certain nombre de configurations pouvant être viables. Ce cadre d'analyse est mobilisé sur les régions européennes de façon à traiter de trois éléments principaux : la diversité des configurations régionales en termes de SSIP, les interactions entre les échelles régionales et nationales de ces systèmes et la relation entre ces configurations et les performances économiques. Nous établissons une typologie des configurations régionales en Europe à partir d'une analyse de données portant sur les quatre domaines institutionnels retenus : science, technologie, industrie et éducation. Nous examinons ensuite les performances économiques des régions selon leur appartenance aux configurations identifiées. Les résultats mettent en évidence une importante diversité des configurations régionales en Europe, en particulier au sein des régions réputées intensives en connaissance, mais aussi la prégnance des effets nationaux dans la définition des configurations régionales. Nous notons par ailleurs que les performances régionales sur la période 2003-2007 sont fortement dépendantes du niveau national. Nous nous interrogeons finalement sur la dimension réellement régionale de ces systèmes.

Mots-clés : Systèmes régionaux d'innovation, connaissance, croissance régionale, institutions

Knowledge and diversity of innovation systems: a comparative analysis of European regions

Abstract

This article aims at assessing the diversity of regional innovation systems and their economic performances within Europe. We propose to adapt the Social Systems of Innovation and Production (SSIP) framework developed by Amable, Barré and Boyer (1997) at the regional level by identifying specific arrangements of each part of the innovation and production system. A key feature of this approach is the concept of complementary institutions, allowing a limited number of viable and stable configurations to be identified. Three key features of European regions are investigated using this framework: the diversity of regional SSIPs, the interplay of regional and national determinants of such systems, and the impact of SSIPs on regional performance. We identify a typology of regional configurations resulting from the combination of scientific, technological, educational and industrial indicators, using multivariate data analysis. We then test the existence of specific regional growth regimes. The results highlight a persistently high level of diversity of regional configurations, notably among knowledge intensive regions, but also show that national institutional settings remain of fundamental importance in shaping a number of regional configurations. A final conclusion relates to the weak correlation observed between the structural characteristics of regions and their performances over the 2003-2007 period: regional performance remains primarily shaped by national trends. Overall, the paper questions the regional dimension of these "systems".

Keywords: Regional innovation systems, knowledge, regional growth, institutions

JEL: R11, O43, O18

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Introduction[1]

Since the early 90's, there has been a growing interest into the subnational dimensions of innovation systems, partly because of a growing unsatisfaction with the relevance of the national level (Cooke, 2005). The theoretical as well as empirical concern with territorial dimensions of innovation encompasses a considerable range of research fields: local knowledge spillovers, innovative milieux, technological districts, Regional Systems of Innovation, Porter's clusters…A major issue addressed in this paper relates to the way to copy with the diversity of regional configurations of innovation. The focus of existing litterature on some specific territorial models of innovation, combining spatial agglomeration, intensive and informal knowledge flows and networking leads to the conclusion that best pratices can be identified to foster innovation processes. This argument combines with a growing agreement that innovation, science and technology are growing sources of economic performance, at all (national, regional, local) levels. However, the strong institutional dimension (national, sectoral and regional levels) in the generation and dissemination of knowledge implies a strong possible remaining heterogeneity through coherent combination of different resources (sources of knowledge, intensity of interactions…) leading to various viable local configurations. We propose here to adapt the Social Systems of Innovation and Production framework developed by Amable, Barré and Boyer (1997, Amable 2000) at the regional level for European regions by identifying specific arrangements of each part of the innovation and production system.

A key feature of the research on Social Systems of Innovation and Production is the crucial role played by the concept of complementary institutions, allowing identifying a limited number of viable and stable configurations in terms of Science, Technology, Industry and Education associations (STIE). This method allows addressing the diversity issue at two levels: firstly, by identifying which stable configurations result of the coherent combination of Science, technology and industry, at the European level. Secondly, by addressing the issue of the economic performances of such regional configurations: do we observe differences in performances between regions with same STIE structure? Do we observe differences in STIE structures between regions with same performances? The paper is three parts made up: Firstly we propose a review of existing literature emphasizing the interest of implementing the SSIP method at the regional level. The second part of the paper presents results of a systematic analysis of 129 European regions leading to a typology of Science-Technology-industry-Education (STIE) regional configurations in Europe. The third part proposes an analysis of the performances of the different STIE profiles. The paper finally raises the question of the regional dimension of these “systems”, our approach recalling that regions are first in nations.

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1. The diversity of regional knowledge-related configurations: analytical framework

1.1 Innovation and knowledge in Regional Systems of Innovation (RSI)

It is now largely acknowledged that innovation has a strong geographical dimension. The literature has produced numerous explanations and it is difficult to find a unified theoretical framework on the subject. From externalities to regional systems of innovation, extend to which innovation is local remains at stake.

1.1.1 Knowledge tacitness and space-bounded knowledge flows

Considerable pieces of theoretical and empirical work stress the crucial role of geographical space in shaping knowledge spillovers. The main theoretical argument invoked to justify the existence of such "geographically mediated knowledge spillovers" relies on the intrinsic tacit nature of scientific and/or technical knowledge. Following the well-known distinction from Polanyi between explicit easily communicable knowledge and the tacit one, the current literature dealing with "the geography of innovation" (Feldman, 1994) assumes that most of strategic knowledge that spills over "*is highly contextual and difficult to codify, and therefore is more easily transmitted through face-to-face contacts and personal relationships, which require spatial proximity*." (Breschi and Lissoni, 2001, pp.258). Von Hippel (1994) argues that "sticky" knowledge (ie contextual and uncertain knowledge) is best transmitted via face-to-face repeated interactions whereas Storper and Venables (2004) discuss main features of face-to-face contacts. Grounded on the main hypothesis that physical proximity may foster local flows of knowledge, an increasingly convergent empirical literature has developed since the 90's aiming at identifying such local externalities (Feldman, Massard, 2001; Döring, Schnellenbach, 2007).

Whatever the method used, these studies suggest that strong local KS should exist. However, as stressed by Breschi and Lissoni (2001) most of the results obtained do not really provide a demonstration of the existence of LKS, but rather some evidence that could be explained by the existence of LKS: debates remain on the codification/tacitness trade-off (Steinmueller, 2000; Cowan, David, Foray, 2000), on the respective roles of pecuniary versus technological externalities and intended/formal versus unintended/informal flows (Antonelli, 2008, McCann, Simonen, 2005), and on the role of physical proximity as a "mechanic" medium of knowledge transfer enhancing that is put into question, particularly through the work of the "proximity school" (Rallet, Torre, 2005; Carrincazeaux, Coris, 2011).

In contrast to studies of LKS, the family of "territorial models of innovation" (Moulaert, Sekia, 2003) developed since the 70's offers useful insights into the pre-conditions and channels leading to an effective role of the "local" upon innovation performances of firms. Initially developing in the context of the crisis of traditional regional policies in the 70's through the industrial districts school (Becattini, 1992 ; Paniccia, 2002), the "family" expands to the concept of innovative milieu during the 80's through the work of the GREMI (Aydalot, 1986 ; Camagni, 1991) and to the Porter's successful concept of clusters during the 90's (Porter, 1990). The profusion of concepts is even more pronounced when considering the "new industrial spaces" of the Californian school (Scott, 1988 ; Saxenian, 1994), the "local systems of innovation"(Kirat, 1993) or "technological districts" (Antonelli, 2000). Despite of the remaining diversity and somewhat confusion of theoretical approaches supporting these studies (Martin, Sunley, 2002 ; Moulaert, Sekia, 2003) one can identify some basic elements shared, at some degree, by most of authors[2]: the territory as a specific mode of coordination, the relevance of socio-cultural preconditions for local-specific dynamics (Cappelo, Faggian, 2005) and the importance of local institutional dynamics (Amin, Thrift, 1995, Kirat, Lung, 1999).

One question remaining is of course the relevant spatial scale of these "territorial effects". A distinctive feature of the RIS approach compared to previous territorial models of innovation is that it is primarily defined as a governance structure, administratively defined. The approach is thus extremely clear on the relevant space level and seeks to avoid both the issue of spatial boundaries and the problem of the diversity of the space scales: the area is defined as a place in which firms and innovation are supported by public or private decentralized organizations. The region appears to be a significant meso-level structure of coordination of economic activities, between the national and local levels, and is thus the level of governance adapted to the operation of a RIS as Asheim and Coenen (2005) point it out. Even in the absence of a commonly accepted definition of the RIS, it can be depicted as a systemic and administratively supported interaction between the regional production structure (or "knowledge exploitation subsystem" in the terms of Asheim and Coenen (2005, p. 1177)) and a regional supportive infrastructure (subsystem of creation of knowledge according to Cooke and alii, 1998) made up of government or private research laboratories, technology transfer agencies, technology incubators, training systems, etc. A RIS is thus a system characterized by a high level of local interactions and interdependence. The focus on institutional arrangements is clearly underlying the definition of a RIS given by Cooke and Schienstock (2000, p. 273) as consisting of "*a geographically defined, administratively supported arrangement of innovative networks and institutions that interact regularly and strongly to enhance the innovative outputs of firms in the region*".

The RIS approach offers a broader and synthetic view on the local dimensions of innovation systems. On the one hand, it encompass most of key features of previous territorial models of innovation, such as the contextual and interactive nature of innovation processes, the centrality of local untraded interdependencies coming from embeddedness and the role of regionally concentrated networks and industrial clusters. On the other hand, through focusing primarily on the governance structure, the RIS approach avoids the issue of confining the analysis on a specific model of territorial developement, and thus allows for coping with the variety of regional configurations.

1.2 Issues in the identification of Regional Systems of Innovation

1.2.1 Global versus Local interactions

One of essential criticisms relates to the postulated character of local interactions within the majority of the territorial approaches. As illustrated by most of studies evoked previously, it is always possible to identify local interdependences as well as a certain local coherence, having previously identified the limits of such a "local system". The "proximity school" seeks to avoid this issue by taking the firm as the starting point of analysis. This allows deducing the role of space in relation to innovation activities and the relations of proximity which bind the firms, organizations and institutions. Space is not thus postulated any more, but built though it results from the superposition of various forms of proximity. The "local" becomes only one component of the innovation process, but not an inevitably and obligatory channel.

[2] An exhautive presentation of the different concepts is of course beyond the scope of this paper, the more so as some literature surveys have been published (Mac Donald, Bellussi, 2002; Moulaert, Sekia, 2003; Paniccia, 2002).

The main conclusions drawn from this field of work are that localization does not result inevitably in local interactions and that even the existence of local relations does not imply that the innovation process depends primarily on them: local and non-local relations are complementary in the innovation processes (Kirat, Lung, 1999). In this framework, the territory corresponds to a superposition (which can be only temporary) of forms of geographical and organized proximity (Bouba-Olga *et al*, 2008).

Nevertheless, the firm organization-based approach does not make it possible to fully understand the dynamics of specific territories. It cannot be else than complementary with a more territorial-grounded analysis (Crevoisier, 2004). Only an approach combining the territorial, organizational and technological dimensions make it possible to appreciate the role of space in the innovation processes. The innovation systems can (and must) be analyzed at various scales which can be territorial or not (Malerba, 2002; Carlsson and alii, 2002).

The RIS approach is a good illustration in the way that it immediately integrates the existence of innovation networks which inevitably do not have only a local dimension. The regional system then becomes the starting point for a reading of the articulation between local and global dimensions of innovation and knowledge flows, which take place within a specific institutional context.

The debate turns therefore around two questions, corresponding to two levels of criticism.

On a first level, the debate relates to the degree of taking into account the relations external to the regional system. These relations can be largely underestimated in the analyses of localized systems, as typically in the clusters literature (Oinas, Malecki, 2002; Simmie, 2004) which has tended to "fetishize" local networks, according to Amin and Cohendet (1999). Theoretical works as well as case studies generally insist on local networking, learning and the role local institutions, but the external relations are often absent, according to Bathelt (2005). A growing number of case studies emphasize nowadays the crucial and often dominant role of external interactions over local ties (Crevoisier, Jeannerat, 2009).

On a second level, when opting for directly spatial approach, the most difficult problem is undoubtedly that of the choice of the spatial level: local, regional or national systems of innovation? The literature on the national systems of innovation has developed in the 1990's parallel to the emergence of the question of the public intervention in the field of science and technology. Works by Lundvall (1992), Freeman (1995) or Edquist (1997) among others, largely contributed to popularize the concept. Basically, the identification of these systems rests on bringing together innovation and institutions and thus makes it possible to explain coherence between productive specializations and the performances in the innovation for various countries.

The debate was gradually placed on the field of the political intervention and institutions. For Lundvall (2002), local interactions have some importance in the production of innovation, but these regional interactions depend to a great extent on their national context, as these regional configurations remain primarily defined by institutions and policies implemented at the national level. Similarly Bathelt (2003) argues that the regional perspective seriously underestimate the remaining vital role of national institutions. Conversely, Asheim and Coenen (2005) or Cooke (2005) defend the idea according to which the national technological policies showed their limits and that only a strictly regional approach should be adopted since it is the relevant governance level: the concept of national system of innovation is considered to be useful, but insufficient.

These debates show that various scales remain possible for the study of innovation systems, but that the question of the relevant scale of analysis seems without immediate theoretical answer. The problems of the relevant scale can only be treated within the framework of institutional analysis.

1.2.2 Sectoral versus regional innovation systems

The focus of the RIS approach on the regional dimension of innovation systems could underestimate the purely sectoral determinants of innovation and spatial organization of activities. In other words, the industrial composition of regional economies, in terms of knowledge base and technological specificities, strongly influences regionally accessible performances and/or trajectories. The sectoral approach is at the heart of numerous territorial approaches. A traditional way of dealing with the industrial structure of spaces is based on the externalities literature and the unsolve question of specialisation vs diversity of regional systems (Döring, Schnellenbach, 2007, Beaudry, Schiffauerova, 2009). More recently, these questions have been investigated through the concept of related variety (Frenken *et al.,* 2007; Boschma, Immartino, 2009; Quatraro, 2010) underlying the role of industrial "complementarities" in regional growth.

The theoretical proposition from Breschi (2000) constitutes also an interesting attempt to spatialize the concept of technological regime initially introduced by Nelson and Winter. A technological regime is defined as the combination of four fundamental factors: opportunity conditions, appropriability conditions, cumulativeness of technical change and the nature of the knowledge base. Each of these dimensions clearly influences the spatial organization of activities as well as possible regional outcomes[3]. The empirical study conduced by Breschi (2000) also reveals that spatial cumulativeness of innovation[4] is strongly correlated with regional innovation performances.

1.2.3 How to copy with the variety of Regional Innovation Systems?

Initial research on territorial models of innovation and RSI has strongly focused on a limited number of case studies. As claimed by Doloreux (2002, p. 259-60), "*The RSI research agenda is still highly focused on metropolitan regions or successful regions. Indeed, we do not know how valuable this concept is and how effectively it can be applied to structure action–policy in remote areas*". A number of recent studies have thus focused on the diversity of forms of RIS, looking for a taxonomy of such systems.

A first and still dominant attempt to reflect the diversity of the relationships between the production structure and institutional set-up of a region is oriented towards the governance mode of regional technology transfer. Three main categories are identified in a similar way by Cooke (1998) and Asheim and Coenen (2005): the "Grassroots" or "territorially embedded" RIS, the "regionally networked innovation systems" and the "dirigiste" RIS or "regionalized national innovation systems". The usefulness of this classification is exemplified by the case studies compiled by Braczyk and al. (1998) when opposing the Bade-Wurtemberg (networked) to Tuscany (Grassroots) or Midi-Pyrenées (Dirigiste). However, this typology tends to promote the "regionally networked innovation systems" as an ideal type of RIS, cumulating the advantages of the localist mode (embeddedness and market-oriented innovation) and of the dirigiste one (R&D effot and science-industry relationships) . As quoted by Asheim and Coenen (2005, p. 1181) *"Similar to the regionalized national innovation system, the knowledge infrastructure plays an indispensable role. But in contrast to it, the cluster is not science-driven but market-driven. In comparison to the territorially embedded regional innovation system, the networked RIS often involves more advanced technologies combining analytic and*

[3] See Breschi (2000) for details.

[4] Measured as the first-order autocorrelation coefficient of patents held by regions between 1978 and 1991.

synthetic knowledge". Cooke (2004) thus stress that most of regions initially classified in either the localist or dirigist categories tend to evolve towards a regionally networked mode, as for Tuscany or Midi-Pyrénées.

This raises a central debate addressed in this paper: to which degree can we theorize/observe a persisting diversity of RIS or a convergence towards some 'best practices'? Two main issues should be addressed:

(i) Firstly, the dynamics of RIS are not only tied to the regional governance structure, but also to the sectoral patterns of innovation. The regional configurations of innovation greatly depend on the heterogeneous regional industrial structure, leading to differentiated ways to innovate. The regional "performance" is thus no more a question of optimal governance structure (including the question of the global, national or regional level) but rather of *coherence* between industrial structure and the knowledge creation and diffusion set-up.

(ii) The relation between the economic performance and the differentiated characteristics of the different types of RIS must be addressed directly and more systematically. As a key assertion influencing policies implementation across Europe relates to the crucial role of innovation for regional competitiveness and the correlative shared objective of building regional "knowledge laboratories " (Cooke, Piccaluga, 2005), the remaining diversity in attained performances of RIS is of special interest, as well as the identification of distinctive types of regions exhibiting low performances.

1.3 Analyzing the diversity of regional knowledge-related configurations: implementing the Social Systems of Innovation and Production (SSIP) at a regional level

1.3.1 The Social Systems of Innovation and Production (SSIP) framework (Amable, Boyer, 1997)

The conceptual framework of "social systems of innovation and production" (SSIP) was initially proposed by Amable, Barré and Boyer (1997) in order to overcome several weaknesses of existing institutional approaches such as the National Systems of Innovation (NSI) studies, the "diversity of capitalisms" school or the regulation theory. In short terms, the SSIP methods aims at overcoming the tendency of most of the studies of NSI to concentrate on national case studies, thus identifying as many configurations as countries. While sharing a number of common features with the "diversity of capitalisms" school, the approach is more macro or meso-economic and thus less focused on the firm level (Amable, Petit, 2001). It’s also more restrictive than the regulation theory in the set of institutions considered but shares the same ambition to analyse whole production systems.

A key feature of the research on Social Systems of Innovation and Production is the crucial role played by the concept of complementary institutions, allowing identifying a limited number of viable and stable configurations among those resulting from the mechanic association of each institutional form considered in the analysis (Amable, 2000).

A SSIP can thus be defined as a coherent combination of different institutional components. Amable, Barré and Boyer (1997) identify six institutional sub-systems: science, technology, industry (forming together the production and innovation system), financial system, human resources and education/training system. The combination of these institutional forms led to identify four idealised models of social systems of innovation and production, each one having its distinctive pattern of institutional complementarity and hierarchy: The market-based SSIP, the social-democratic SSIP, the meso-corporatist SSIP and the public SSIP.

1.3.2 The implementation of the SSIP method at the regional level

Following Carrincazeaux and Lung (2006), we propose to adapt the SSIP framework at the regional level by identifying specific arrangements of each part of the system. Compared with previous case studies of territorial models of innovation or RIS, this method presents several advantages.

(i) Focusing on a regional level does not here constraint to presuppose a high degree of internal cohesion or of functional autonomy, as would imply the concept of “regional system”, since some of the institutional forms introduced in the analysis are still implemented at the national level. Insofar it’s preferable to identify “regional configurations of innovation” resulting from the coherent combination of institutional settlements defined at various scales.

(ii) The concept of institutional complementarity can be useful to consider in a systematic way the articulation between the regional knowledge creation infrastructure and the sectoral specific patterns of innovation of the industrial regional structure. As discussed previously, these sectoral patterns are influenced by fundamental factors like technological opportunities, appropriability conditions, and cumulativeness of technical change, but also by sometimes sectoral-defined institutional forms concerning the competition regime, relations to customers or interfirms relationships.

(iii) The concept of institutional complementarity allows identifying a limited number of coherent regional configurations, while much of the empirical work during the last decades has been concerned with a growing number of case studies, thus focusing interestingly on the specificity of each regional context but loosing in the generality of the principles.

(iv) The SSIP appears to be well designed for coping with the diversity of regional configurations. Putting together the SSIP configurations and local economic performances allows defining different regional configurations in order to identify regional trajectories and patterns of articulation between knowledge dynamics and performance. Our hypothesis to be tested is that regional growth is not a problem of best practices but rather of coherent knowledge combination: institutional differences may lead similar (or different) STIE structures to different (respectively same) performances.

2. Identifying regional configurations in Europe

2.1 Method and data

2.1.1 SSIP at the regional level

The statistical approach presented here is an attempt to identify systematically Social systems of innovation and production at the regional level. The systematic character aiming at comparing European regions is of course strongly limited by available data, but we also face some theoretical limitations.

The SSIP approach is based on the complementarity of different institutional blocs, conceptually defined, but actually thought at a macro level. The first main bloc is the Science-Technology-Industry (STI) one. This bloc is at the core of the analysis of SSIPs, the innovation process relying on the articulation of these three dimensions. Analysing STI configurations at the regional level can make sense but we immediately face the difficulty of the regional openness: can we assume STI complementarities at the local level for each technological domain or industrial sector? How to articulate local and global levels of complementarity? This raises the question of the critical mass of STI activities and symmetrically, the question of the pertinent spatial scale. We will retain an administrative definition of regions based on the NUTS and just try to look at the existence of apparent complementarities at this level.

Following the SSIP approach, the STI coherence must be articulated with human capital, productive organization and financial system. Human capital classically refers here to education and training, the organization of the educational system being central in the creation and dissemination of knowledge. We consider that the regional educational level can be accepted even if the educational system can have a strong national dimension based on history and state involvement.

The two other components are more difficult to consider at the regional level. Productive organization and labour relations are often defined by national laws even if specific relations may exist at a more local level. Here again, countries may differ on institutional settings around the relation between State (law), firms' management and labor unions. The question of the specificity of local arrangements is a heavy one we won't deal with here as data to evaluate labour relations is only generated at the national level.

The same question arises when considering the financial relation and the financing system. The relative importance of financial markets or banking system is of major importance in this type of approach because it determines the possibility of long term financing, the compatibility between liquidity and demand characteristics (stability or risky new technologies), and also productive organization (relations between shareholders, managers and employees). These features are particularly national dependants, but it can have heavy consequences in local relations between large corporations and SMEs, in the regional governance (dependence degree) and modes of knowledge accumulation and dissemination (appropriability, secret). We can hardly assume a regional influence on this financial systems (except certainly for national metropolises), but regional knowledge dynamics are influenced by the financial system (Dupuy *et al.*, 2010). Here again, the lack of regional data on this domain can also reflect its poor local relevance, but we will try to take the financial system into account by incorporating the presence of financial services as an indicator of financial potential for innovative activities. Our analysis of SSIP at the regional level is then limited to STI and educational profiles (STIE).

2.1.2 The statistical approach

The statistical qualification of regions is relative, each indicators being expressed as a ratio or a share aiming at neutralising size effects. This can lead to associate very different regions in terms of size or wealth, but this is exactly the aim of the analysis: identifying regional relative configurations in terms of coherent articulation between different blocs. The analysis of absolute differences is nowadays well documented in the European regional scoreboards.

Following the method presented by Amable, Barré and Boyer, the study consists in qualifying each region by a set of indicators used in a principal component analysis. This allows analysing the relative position of each region, according to the indicators selected, and identifying main configurations. A hierarchical classification on factorial axis is then used to construct a regional typology.

The interpretation of the STIE profiles through complementarities between each bloc first necessitates a separate analysis of these blocs. We perform successive classifications for scientific, technological, industrial and educational configurations. These classifications are then used to interpret STIE profiles. These profiles are established for year 2003[5]. We finally compare these regional profiles with economic performances of regions in recent years (2003-2007), considering that these performances result from the global profile.

2.1.3 Data sources and the regional level

If countries or regions provide well documented databases or specific case studies, we face much more problems when one wants to adopt a systematic approach. The more complete database on European Regions is provided by the REGIO database from Eurostat that constitutes our main source. This database is completed by Cambridge Econometrics for some industrial data, investment, or GVA. We also use data from the French Observatory of Science and Technology (OST) for patents and scientific publications in European regions.

Facing an important lack of information for new entrant countries, we decided to limit our study to UE15 regions. The definition of scientific disciplines, technological domains and industrial sectors results of availability of data. Categories remain rather broad and this must be kept in mind when interpreting specialization or diversification of activity (see appendix 1 for variables).

Another important question refers to the geographical scale we choose. Most information is available at the NUTS2 level, but European countries differ largely in their regional organization. If NUTS2 level makes sense for France, Spain or Italy, it is not the case for Germany or United Kingdom for instance. Our approach being institutional, we wanted to take into account the administrative organization of countries instead of the usual size criteria. This of course lead to compare very different regions, but this is partly overcome by working on sub samples and relative indicators. We decided to adopt NUTS2 as often as possible, but NUTS1 or State level is chosen when this scale is more relevant for regional economic policy in certain countries or when data is not available at each NUTS level (this constraint is generally linked with administrative organization). Regional levels adopted are presented in appendix 2. This leads to a sample of 142 European regions, finally limited to 129 as a consequence of data availability (modifications of NUTS 2003 or regional specificities for some islands and very small regions).

2.2 Global STIE profiles of EU regions

We first perform a cluster analysis on each of the four domains of science, technology, industry and education on the 129 UE15 selected regions for which data are available. These cluster analyses lead to different spatial structure and knowledge trends[6]. From the scientific bloc, we learn that life sciences and high scientific activity are associated but some variations appear in public involvement. North regions exhibit a more dynamic scientific activity but some South European regions have also a high scientific activity. We notice infra-national heterogeneity with some metropolitan effects.

The usual opposition between North and South of Europe is more obvious on the technological side. As intense technological activity is more often associated with electronics or pharmaceuticals domains, average technological activity is linked with more traditional domains and low technological effort associated with households' consumption. This North/South structure also covers technological specialization.

[5] For most variables, except for patents and publications (only available on a 3 years average for the period 2000-2002).

[6] We are unable here to present extended results of the numerous analyses performed. Statistical details can be asked directly to the authors and can also be found in deliverable WP4b of the Eurodite integrated project (FP6).

The industry bloc indicates some strong national orientations in regional specialization. This is particularly true for France, Germany or United Kingdom. Most of clusters are dominated by a limited number of nations and the North/South differences also appear on industrial specialization (textile and agriculture in the South of Europe). Services also define some metropolitan profiles. The national dimension is also very strong (and stronger) for educational profiles. Moreover, we notice a North/South logic in the definition of these profiles.

If we now consider knowledge configurations at the regional level through the combination these blocs (science, technology, industry and education), we can try to raise different possible configurations for knowledge complementarities and geography.

The first line of differentiation is certainly the North/South geographical structure. North European regions are generally active on science and technology with a high educational level. Some heterogeneity exists between regions through industrial specialization or scientific and technological intensity. On the other side, more traditional sectors (textile, metal working or mechanical industries) or food and agriculture define the South configuration. The question is then the one of national trends in industrial specialization and educational orientations. We can expect some variations and go beyond the simple and usual North/South opposition when dealing with a wider conception of knowledge dynamics (not limited to the technological side in which this opposition seems strong). Another interesting trend is the isolation of some metropolitan regions active in S&T with a high share ok KIBS and high educational level. Cities are of course and important milieu for knowledge generation through interactions.

If we combine all this, we can expect two polar configurations. The first usual high tech configuration would be for North regions or metropolitan ones with high scientific activity in life sciences (and sometimes industrial processes or chemistry), very high educational level (science being associated with universities), high technological activity on electronics, transportation and pharmaceutical domains and corresponding industrial specialization (concentration and share of KIBS). The opposite South configuration with low educational level, poor scientific and technological activity would be specialised on traditional industries.

Between these polar configurations, and according to industrial specialization, national trends and local history, we can imagine numerous configurations in which complementarities are limited to science and technology or technology and industry and on specific domains. This is the aim of the global STIE analysis.

In order to identify these complementarities at the regional level, we performed the same statistical method on the 129 European regions using the 56 variables associated with the 4 blocs (Science, Technology, Industry and Education). The 11 classes are interpreted in the light of the dominant classes to which regions belong in the previous individual bloc analysis. The results of the cluster analysis are summarized in table 1.

The different clusters obtained result from specific association between STIE blocs. The three first clusters and the last one associate very homogeneous regions according to each bloc analysis: regions in each cluster generally belong to the same scientific, technological, industrial or educational cluster. Nevertheless, complementarities between blocs may differ among clusters as recalled by table 1.

Table 1 – STIE global profiles

Regional STIE configuration	Main features	Main complementarities	Representative regions	Number of regions
Metropolitan regions	Services and financial services, high scientific, technological et educational levels	STI complementarities on electric/electronics S&T on life sciences	London, Paris, Stockholm, Wien, Berlin, Brussels	6
North high tech regions	Very high R&D effort and educational level, industrial specialization on Electronics, Mechanical and metal working products	TI complementarities on electronics and mechanical industries	Sweden and Finnish regions	5
North scientific regions	High scientific activity and high share of HRST, lower on the technological side.	STI in life sciences	Denmark, Netherlands' regions	10
British services profile	High educational level, vocational, share of services (manufacturing weakness)	Heterogeneous, TI on chemicals and electric/electron., STI in some regions	UK regions	12
German industrial profile	Industrial specialization, small units, vocational and medium educational level	TI complementarities on traditional industries, heterogeneous	German regions	14
Intermediary industrial and south metropolitan regions	South metropolises and intermediary regions	Heterogeneous	Madrid, Roma, Lisbon, Athens, Irish, French and Belgian other regions	15
Intermediary manufacturing regions	High manufacturing share in traditional industries, low scientific activity	STI mechanicals and metalworking products	Mainly North European regions	9
Intermediary agro-food profile	Food industry, low share of services, medium educational level	Heterogeneous, chemicals	Mainly French and Austrian regions	24
Italian textile profile	Textile specialization, low educational level	Heterogeneous, some exceptions	Italian regions	13
Spanish profile	Manufacturing traditional, low educational level	Heterogeneous, exceptions on mechanical and chemical products	Spanish regions	13
South agricultural regions	Agriculture and textile specialization, low educational, small units		Spain, Portugal, Greece	8

When industrial and educational classifications explain the cluster's formation, the national dimension is predominant. That is the case with British, German, Agro-food and Italian profiles: industrial specialization and educational profiles are at the heart of these clusters. In those cases, complementarities between blocs are hard to find because science and technology profiles may be very different among regions of a same nation. We can notice the same lack of apparent complementarities for the Spanish profile originating from a particular educational system (very contrasted).

Two intermediary clusters are apart from this trend. Industry and education explain the *Intermediary industrial and South metropolitan regions* profile, but without heavy national trend. Finally, *Intermediary manufacturing regions* are based on the association between technology and industry on more traditional industries: T&I complementarities explain this cluster.

This typology put the stress on the general profiles we previously identify: North vs South configurations according to technological activity and education, a strong national dimension that can rely on education (UK), industrial specialization (DE) or agriculture and food industries (FR), and finally some transversal profiles for metropolitan regions or traditional industrial regions. In this last case, we must also notice that we can isolate northern from southern capitals. In a way, we must consider the strong national component of regional configurations and maybe never analyse regions without countries.

We also must recall that the statistical methods of principal component and cluster analyses construct groups on the basis of resemblance and dissemblance between individuals: the approach is relative to the average profile and heterogeneity necessarily remains inside groups. The STIE analysis shows that UK regions are close to each other if we consider services activity and educational orientation, there are much differences on technological activities or industrial specialization for example. What we underline here, is the evident limit of this type of method that can reveal very general relative profiles using lots of different indicators but that as well vanish other discriminating criteria.

If we accept this limit and the general trends we raised, we can try to propose a complementary analysis by changing the relative reference. By performing the same analysis on subgroups, we may expect identifying more homogeneous configurations, deviating from the general trend of intermediary regions for example.

This kind of approach is important for three main reasons. First, it is difficult to compare on a same scale very high tech regions and agricultural or more traditional ones. Second, as all indicators are relative, we have poor information on the critical mass of activities when shares are important (on certain industries, on patents or publications…). Third, the regional urban structure and density of population may affect the geographical proximity between agents and the geographical size of regions could also be of importance.

For all these reasons, we reproduce strictly the same method but on two subgroups elaborated following these basic principles. We first select regions on the basis of the technology and science cluster analysis. We select regions classified as very high scientific profile or from average to very high technological profile. We also add regions with more than 6 million inhabitants or with population density over 400 (but with GDP per capita higher than the European average) and exclude regions with less than 500 000 inhabitants.

The initial cluster criteria (high science or technology[7]) isolates 53 regions, the population/density criteria add 5 regions (Lombardia, Zuid-Holland, Noord-Holland, Utrecht and Cataluña) and the complementary criteria of R&D intensity (public or private) add 5 other regions (Tirol, Alsace, Languedoc-Roussillon, Lazio and Groningen)[8]. Our first subgroup is consequently compounded of 63 regions. The second one groups the 66 remaining regions (of 129). We obtain two comparable subgroups, the first one being more technology oriented.

2.3 STIE synthetic profiles : regions in nations

2.3.1 Analysis of the first subgroup (high tech regions)

Correlations between variables are pretty the same than in the previous global analysis of the 129 regions. Nevertheless, we observe some differences that are worse noted. On the scientific/technological side, publications in biology and patents in pharmaceuticals are more often associated within this first 63 regions subgroup. The link between science and technology may be

[7] The technology cluster analysis introduces some bias according to the weight given to patent specialization (see above): some regions are associated to relative high tech clusters according to their technological specialization (share of patents) despite a low intensity of R&D expenditure (and conversely). We therefore introduce a complementary criteria based on minimum technological (or scientific) activity in order to exclude some regions with low R&D effort.

[8] 16 regions initially selected through the cluster criteria are excluded from the “high tech” group: 4 regions with less of 500000 inhabitants and 12 with too low R&D, patents or publication relative level.

higher for these regions. The share of R&D public expenditure is also better correlated with public R&D level indicating that a high share of public spending is not reflecting the poor level of private effort but a "real" scientific effort. Correlations between core HRST and high educational level are higher indicating a better access on the labour market for high qualified students, but it also indicates that northern regions have a higher weight among 63 regions. Variations in the correlation matrix are often linked to specific national configurations already commented in the STIE global analysis (lower concentration in the metalworking sector is the consequence of a higher weight of small German units for example).

Differences are more important in the definition of factors in the principal components analysis[9]. The main opposition between services (and high educational level or HRST) against agriculture and textile logically disappears inside this subgroup. Manufacturing against services, educational level and scientific publications now define the major differences between these 63 regions (19% of the total inertia). Metropolitan regions (London, Stockholm or Brussels) highly contribute on the one side, Italian and Spanish ones on the other side (Piemonte, Emilia-Romagna or Pais Vasco and Cataloña among others). The second main divergence between these regions (second factor, 12,5% of inertia) is on technology (private R&D, patents and specialization in mechanical industry) against share of R&D public spending associated to food industry but correlations are weak in this last case (around 0,53) indicating that this association (food and public research) and opposition (between food and technology) is not a general regional feature. The technological side is well defined by German and North regions (Baden-Württemberg, Bayern or regions of Goteborg or Eindhoven). Axis three is driven by north regions around their specific educational profile, as axis four by UK regions. It seems that changing the reference group doesn't lead to less importance for national trends. The cluster analysis confirms this first feeling.

The hierarchical classification used for the cluster analysis leads to identify 9 clusters[10]. These clusters are often parts of original clusters identified in the global STIE analysis, but some are different (mix of initial groups). The subgroup analysis gives more insight for intermediary clusters that are more influenced by changes. The national profiles remain (divided according to our subgroups) and "polar" clusters (Metropolises or North clusters) are pretty the same. By dividing our sample into two subgroups, we were expecting more accurate comparisons between regions of comparable level in S&T. We actually obtain a rather different classification, but heavy national trends remain.

Table 2 – Regional configurations: 9 clusters on the first subgroup

Knowledge intensive profiles	H01 Metropolitan regions	AT, BE, DE, FR, UK, SE
	H02 North high tech regions	2 FI, 3 SE
	H03 North scientific regions	1 AT, DK, 6 NL, 1 FI, 1 UK, 1 SE
	H04 British services and educational profile	6 UK
	H05 German high tech industrial profile	8 DE
Medium tech intermediary profiles	H06 Secondary metropolises regions	5 FR, 2 BE, 1 ES, 1 IE, 1 IT
	H07 North industrial regions	2 NL, 1 SE, 1 FI, 1 DE
	H08 North Italian and Spanish industrial regions	3 IT, 2 ES
	H09 French agro-industrial profile	5 FR, 2 AT

The first five "intensive knowledge" clusters are largely national ones: Netherlands, British or German profiles. The northern high tech profile is built upon Finish or Swedish regions and the metropolitan profile remains also. Countries and metropolises appear to be determinants of regional

[9] See appendix 4.
[10] See appendix 5 for the list of regions and clusters

knowledge profiles even if complementarities differ among clusters. The other four clusters, labelled intermediary, are less nationally defined even if a French profile is emerging. These clusters lead to a separation between industrial and more metropolitan profiles with different specializations or complementarities, cross with a North/South distinction.

What we learn here from the shift from a global STIE analysis to a subgroup analysis is that countries and metropolises remain the first basis for regional knowledge configurations. We also isolate industrial profiles that were merged in a large intermediary cluster in the first analysis. We are also able to underline more diversity in the northern profile with more traditional manufacturing regions.

From a *geographical point of view*, we can observe 3 main logics.

- ✓ The metropolitan one divided into very high metropolitan profile (capitals with high science, high technology, high educational profile…) and intermediary metropolitan profile. Medium profiles in each blocs and an industrial specialization (with STI complementarities) on chemical products or food industry explain the latter clustering.
- ✓ The national logic is generally based on industrial and educational initial profiles. The German high tech industrial profile is also very homogeneous on technology and to a less extent on science. The British services and educational profile also draws upon homogeneity around science and technological profiles, but complementarities differ according to specialization. The French profile presents a different specialization and an average technological profile.
- ✓ Finally, the North/South logic is mainly a Northern one as only five regions from Spain or Italy constitute the south industrial cluster. Industry and Education with lower scientific and technological profiles explain this cluster. Nordic clusters are more heterogeneous with a high tech one (close to the metropolitan one), a science push logic for one other and finally and industrial profile for the last one.

Another way of interpreting the cluster analysis can be performed through complementarities between S,T,I and E profiles.

We first find the traditional high tech model for metropolises and some North regions with STIE complementarities mainly in electronics or life domains. We also isolate a science push profile for some other North regions mainly oriented on life sciences. More industrial profiles can be found with strong T&I complementarities for German and North industrial clusters. The same trend qualifies the south industrial cluster on other industries (mainly textile) with less favourable scientific effort. Food and chemicals industries better define STI complementarities for French and secondary metropolises clusters. Finally, the services profile of British regions leads to more heterogeneity on STI complementarities.

2.3.2 Analysis of the second subgroup (medium/low tech regions)

The analysis of correlations through this subgroup is symmetric to the previous one. We don't observe the same association in regions between science and technology in life sciences and the link between educational and scientific or technological profiles appears to be weaker. The main originalities in correlations in this subgroup, as compared to the first one, are unsurprisingly concentrated on the S&T side.

We must notice first that public research doesn't seem to follow the same logic in these regions as correlations are lower between public research expenditure and its intensity (spending by researcher) or between public R&D and share of students in the tertiary level. The ratio of scientific publications is less correlated with public R&D spending or the regional share of public research. The link among publication ratio and share of students in tertiary level is also lower. This picture can be better understood by analysing correlations with private R&D. The regional shares of public R&D expenditure is negatively correlated with private R&D as for regions belonging to the first subgroup, but absolute value is higher (from 0,6 to 0,8). Correlations are weak between private and public research efforts, but it is positive for the first subgroup and negative for the second one. All this can be interpreted as a sort of substitution between public and private research in this subgroup, by opposition to more complementarities in the first one. The example of lower correlations between publications in biology and patents in pharmaceuticals in the second subgroup illustrates this fact. Public R&D could represent an effort to compensate the weakness of the private one.

Two other trends may also stresses some differences between the two subgroups. On the educational side, a high proportion of students in the total population is not associated with a weak share of low skills in active population, and the core of human resources in S&T is less associated with the educational level or proportion of students. It illustrates a lower educational profile and perhaps more difficulties on the labour market. The last feature refers to the industrial structure that seems to be less concentrated with stronger correlations between employment and units shares (confirmed by the correlation between the concentration indexes).

Finally these differences among the two subgroups on science, technology, education and industrial structure have consequences on the definition of factors in the principal component analysis as this second subgroup is closer to the global STIE analysis. This point is rather amazing as the more intensive knowledge regions are out of the sample (isolated in subgroup 1), however we observe the same trends in the association or opposition among European regions. Correlations are weaker and tendencies less clear but general trends are pretty the same (S&T or educational level being less important).

The first axis is based on the opposition between employment in high and medium technology industries and a low educational level of active population ((HTMT vs ACT2). In the first case, industry shares in electronics or mechanicals are higher, KIBS and private R&D or patents are more present with a secondary or postsecondary educational level of active population. Low educational level is rather associated with employment share in agriculture in the second case. With weaker correlations, textile industry and the share of public R&D are also part of this regional profile. This axis confirms the opposition between South (Italian, Spanish and Greek) and North (German, British, Netherlands) European regions even in our case of less intensive knowledge regions. The second axis is based on the opposition between the share of manufacturing employment against the one of public R&D. This global opposition relies on weak correlations and is difficult to interpret in terms of regional profiles: we find on the one hand regions characterized by a high share of manufacturing employment or (and not “and”) high public research effort, and on the other hand the opposite configuration (high public R&D or low manufacturing). This unclear tendency is the consequence of lower correlations in this subgroup (more heterogeneity between regions). The following axes reflect some general trends of specific regions and different specializations from which we don’t learn more on regional profiles. The food industry is at the heart of axis three (but not only defined by French regions), the educational profile defines axis four (share of total students or primary educational level of UK regions) and axis five is also partly defined by the educational structure (high educational level of active population of Spanish regions)

Table 3 – Regional configurations: 7 clusters on the second subgroup

Low tech intermediary profiles	L01 French food profile	10 FR, 1 IE
	L02 British low tech profile	4 UK
	L03 North low urbanized regions	4 AT, 3 NL, 2 SE
	L04 German Low tech profile	6 DE, 1 AT, 1 NL, 1 IT, 1 GR
Low tech profiles	L05 Italian textile profile	13 IT, 2 ES
	L06 Spanish profile	9 ES, 1 PT
	L07 South agricultural profile	3 GR, 2 ES, 2 PT

The hierarchical classification on factorial axes leads to identify 7 clusters (table 3). If we compare the classification obtained with the global STIE analysis, we can consider that national trends are largely confirmed. First, some clusters are just part of the initial ones and regions are grouped following national trends (North, German, UK or French low intensive knowledge regions). Second, the South and intermediary clusters remain largely based on nations.

By performing our analysis on two subgroups, we were expecting more homogeneous groups based more on common features than main differences between regions. The result is quite surprising for the "low subgroup" that reinforces the national dimension. Of course, industrial specialization is at the heart of clusters obtained, but situations are more complex. The "Low tech intermediary profiles" (French, British, North and German profiles) exhibits main complementarities on chemical industry but on a different basis. The French profile is rather homogeneous on industrial (food and chemicals) and educational profiles, but scientific and technological profiles are close, generally low or on average. The British profile is coherent on technology and industry around chemical products, but the overall STIE profiles are also homogeneous. The North cluster is rather based on scientific profiles (low effort) but complementarities exist between technology, industry and education on traditional manufacturing activities. German regions are also close by scientific profiles (high public relative effort) and industrial specialization on traditional industries (with STI on chemicals and TI complementarities for mechanical or instrument industries). The last three "Low tech profiles" (Italian, Spanish and South profiles) are also based on industrial and educational profiles: Italian textile industry and low educational level, contrasted educational level and construction or metalworking for Spanish regions (but with better integration on labour market). The South agricultural profile is homogeneous for all STIE dimensions.

2.3.3 Regions remain in nations

The aim of the work on two subgroups was to try to overcome a rather simple opposition between north and south regions. The elaboration of two subgroups avoids comparing very heterogeneous regions in terms of S&T resources, size and wealth. Nevertheless, this method confirms previous results and sometimes reinforces national trends.

More complex profiles than the standard North/South

The subgroup method allows taking into account more intra-zone heterogeneity. This is particularly true for the Northern profiles, previously consistent with the opposition on S&T but finally less homogeneous than supposed through the global STIE analysis. Some North regions belong to more intermediary and low tech profiles. Conversely, North industrial regions of the South (Spain and Italy) are isolated. A second group is highly influenced by this method: the labelled "intermediary" STIE group. The subgroup method also isolates a secondary metropolitan profile grouping South capitals or metropolitan regions from intermediary countries (France, Belgium). The final typology obtained does not fall into a simplistic high/medium/low classification of European regions. The results notably show an important variety of knowledge intensive regional configurations, with specific local coherences in the H01 to H05 profiles. Several distinctive ways to the knowledge economy appears to be viable, some focusing on a regional scientific potential, other on education or regional coherence between industry and technology.

Strong national trends

National trends keep strong with this method: most of regional clusters are often national or dominated by regions belonging to the same country, in spite of our attempt to reduce interregional heterogeneity in the analysis. German industrial profile, British services and educational one or French agro-food profile remain in the two subgroups. What is also worse noticed are the national trends that emerge for Italy and Spain respectively on Textile specialization or on educational structure.

What relevant level for diversity?

First, the analysis confirms the predominant influence of national trends in the determination of regional profiles. This feature is close to the conclusion of the diversity of capitalism approach proposed by Amable (2003) identifying North versus South capitalism, a continental one (France and Germany) or a more liberal one (United Kingdom). Regions are firstly group under this logic even by separating high intensive knowledge regions. Second, some regions (generally the richest ones) are apart from this trend. Two metropolitan profiles are identified and remain robust amongst classifications. North Italian and Spanish regions are original according to their industrial profile.

3. STIE profiles and performances

The relation between economic performances and the differentiated characteristics of STIE regional profiles must be addressed directly and more systematically. As a key assertion influencing policies implementation relates to the crucial role of innovation for regional competitiveness, the remaining diversity in performances of regional configurations is of special interest, as well as the identification of distinctive types of regions exhibiting low performances.

3.1 Do STIE configurations lead to specific economic performances?

A first way to analyse the link between the STIE configuration and economic performances is to control for differences between configurations for a set of performances indicators. The table below gives clusters means for different indicators.

Table 4. STIE configurations and performance indicators

	GDP per cap.	GDP growth 03-07 (%)	Empl. growth 03-07 (%)	Unemp. rate 08 (%)	Unemp. Growth 03-08 (%)	LT unnemp. rate 08 (%)
H01 Metropolitan regions	***42017	10.11	3.83	*9.54	0.57	***4.33
H02 North high tech regions	27940	***15.96	3.05	6.88	-1.65	*0.95
H03 North scientific regions	***31927	12.93	3.45	***3.92	*-15.80	***0.95
H04 British services and educational profile	26767	9.71	2.85	5.36	***31.13	1.26
H05 German high tech industrial profile	***33463	*7.74	2.87	6.44	-13.91	3.27
H06 Secondary metropolises regions	27950	12.61	*7.45	7.26	0.35	2.69
H07 North industrial regions	27660	12.74	4.53	6.18	*-20.30	2.24
H08 North Italian and Spanish industrial regions	31720	9.57	8.27	5.48	1.39	1.48
H09 French agro-industrial profile	24457	8.29	2.36	5.93	-8.60	1.98
L01 French food profile	*23282	10.28	3.92	7.31	-1.41	2.55
L02 British low tech profile	22875	9.18	3.38	6.00	*19.17	1.49
L03 North low urbanized regions	26767	11.63	3.28	***4.00	4.22	***0.90
L04 German Low tech profile	25540	12.09	4.60	8.29	*-16.87	***4.29
L05 Italian textile profile	***22300	***6.53	5.11	***8.91	-3.67	***3.81
L06 Spanish profile	25490	***14.59	***13.09	***9.42	*12.41	1.95
L07 South agricultural profile	***17943	11.11	5.66	*9.26	10.88	3.27
General mean	*26960*	*10.8*	*5.0*	*7.0*	*-1.3*	*2.5*

Difference between cluster mean and general mean: *** significant at 1% level, * significant at 5% level

The first element we must notice is that there are very few significant performance indicators among clusters. For example, GDP growth for the period 2003-2007 is significantly higher for *North high tech regions* (H02) or regions from the *Spanish profile* (L06, except Lisbon region), and lower for the *German high tech industrial profile* (H05) or the *Italian textile profile* (L05, except Islas Baleares). Regions from the other STIE clusters are more heterogeneous on GDP growth and don't exhibit any significant mean difference from the general trend. The same can be noticed when looking at the different indicators, clusters' means being not significantly different from the general mean of the sample. This indicates that STIE profiles are not conducive to homogeneous performances of regions.

Another interesting feature is that clusters are neither homogeneous on the association between performances indicators, except for the *Italian textile profile* (low GDP, low growth and high unemployment) or the *North scientific regions* (on the employment side). Spanish regions are specific as they perform well on growth, but no on employment.

It is therefore difficult to find an association between STIE profiles and economic performances. The richest *Metropolitan regions* for example don't exhibit high relative performances as a consequence of a strong heterogeneity in this cluster: London and Stockholm regions have a high GDP growth in the period (around 15%, the three other metropolises being below 8%), and the bad performances on the employment side are due to Berlin and Brussels regions. The same heterogeneity exists between the five *North high tech regions* for which a high GDP growth is associated with a high unemployment reduction for the two Finish regions, but not the Swedish ones.

These trends may also be interpreted as the consequence of a low number of regions in each cluster, the poor association between STIE profiles and economic performances resulting from some specific regional configurations. Nevertheless, we performed the same tests on a four clusters basis (Knowledge intensive profiles H01-H05; Medium tech intermediary profiles H06-H09; Low tech intermediary profiles L01-L04; Low tech profiles L05-L07)[11] and obtain the same unclear association between regional knowledge profiles and economic performances. The *Knowledge intensive profiles* (36 regions) have a higher GDP per capita and a lower level of unemployment (6.1% against 7%), but creates less jobs (3.2% for employment growth on the period) with a small increase in unemployment (0.5%). At the opposite, *Low profiles* (32 regions) have a lower GDP per capita, higher unemployment rate (9.1%) but employment growth is high (7.7%) and long term unemployment decreases (-15.8%). No significant mean differences exist on these indicators for the two intermediary profiles (except a lower GDP per capita for the *Low tech intermediary*).

This analysis confirms the unclear link between STIE profiles and specific indicators of economic performance.

3.2 Crossing STIE and performances regional configurations

A second way to analyse this link is to adopt a broader view of regional economic performances through the combination of different factors instead of analysing them separately. This method allows a comparison between STIE profiles and performances profiles (Appendix 6).

We use 10 indicators of regional economic performances: 5 indicators of variations with GDP, disposable income, employment, unemployment and long term unemployment growth on the period 2003-2007 (or 2008 for the two last); 5 relative indicators with intensive knowledge positions (2007), part time jobs (2009), unemployment, long term unemployment and activity rates for 2008. The correlation matrix on the 129 regions under study reveals weak correlations between these variables, underlying the diversity of regional configurations on economic performances. The main (expected) correlations are found between unemployment and long term unemployment rates (0.78) or between part time and activity rates (0.63). These two couples of variables are negatively correlated and therefore define the first axis of the principal component analysis. The following axes

[11] See appendix 3 for the European weight of these profiles

take into account GDP, disposable income and employment growth (axis two), unemployment variation (axis 3) and intensive knowledge employment share (axis 4).

The hierarchical cluster analysis performed on the 6 first axes (93.3% of the total inertia) leads to isolate 11 classes clearly understandable[12]. Four classes of high GDP growth regions (around 15% against 10.8 for the whole sample) isolate convergence regions from Spain and Greece (clusters 01 and 03, with a high and increasing unemployment for the last one) or North European regions (mainly from Austria, Sweden and Finland). These last high GDP growth regions present two different profiles on the labor market side with low and decreasing unemployment for one group (cluster 02) and increasing unemployment for the other (cluster 03). At the opposite, low growth German, British and Italian regions (GDP growth between 4% and 9%) are grouped in 4 clusters with low but increasing unemployment (clusters 08 and 09) or high but decreasing unemployment (clusters 10 and 11). Intermediary configurations mainly group regions from France (medium/low growth, average unemployment) and Netherlands (medium/high growth, low and decreasing unemployment).

Crossing performances clusters with STIE configurations helps clarifying the first trends we identified previously. There are very few STIE profiles homogeneous on economic performances. Good performances on growth and income are often associated with contrasted labor market performances (North clusters H02 and H03 or South profiles L06 and L07). British and German profiles are rather homogeneous, but around low performances (with decreasing unemployment for the latter). It remains difficult to associate STIE profiles and economic performances.

A second interesting trend is the dominant national dimension in economic performances for numerous countries, whatever the STIE profiles to which regions belong. It is obvious for French and Netherlands regions presenting intermediary performances, Swedish and Austrian regions with high growth performances associated with lower performances on the labor market side, or British (medium/low growth and increasing unemployment), German (close to the previous but with decreasing unemployment) and Italian (low growth, high unemployment) regions. Finish and Spanish regions are also concentrated in high growth clusters but with heterogeneous labor performances. Belgium is certainly and exception in our sample with 3 regions performing very differently.

The third interesting feature is the poor association between regional knowledge intensity and economic performances. The common hypothesis on innovation and knowledge accumulation as engine for growth and economic performances is not the picture we draw from our analysis. The two North high tech and scientific profiles as the Spanish and South clusters fit more or less this hypothesis (technological concentration in the one side and catching up regions in the other side), but other clusters are far from these trends (British, German or Italian regions for example). These trends are coherent with some recent contributions that emphasize the possibility of decreasing innovative returns of agglomeration at the regional level, notably Antonelli, Patrucco and Quatraro (2008) or Brouillat and Lung (2010).

All this indicates that there is a clear need to introduce more obviously national settings in the analysis of regional knowledge dynamics and economic performances.

[12] Class 11 isolates Italian regions for which GDP level and growth are lower than for German ones (class 10). For practical reasons, these classes are grouped in the table, appendix 6.

4. Concluding remarks on regions and nations

Our aim in this paper was to insist on the need to adopt an institutional approach in order to shed some light on the diversity of regional systems. We have tried to develop this approach by using a large set of regional indicators at the European level. By doing this, we've raised more diversity in regional profiles than it is usually done through scoreboards aiming at classifying regions on a limited range of indicators. The regional diversity we obtain through complementarities between scientific, technological, industrial and educational profiles also put the stress on the dominant national dimension on what we label configurations more than systems. We also raise metropolitan profiles and transnational profiles following the traditional North/South opposition.

The expected association between STIE profiles and economic performances following the results of the Social Systems of Innovation and Production approach clearly doesn't emerge from our analysis of regional performances. Moreover, we also noticed a strong national dimension in the performance profiles. This implies that STIE profiles at the regional scale fail to fully explain the heterogeneity of regional performances. It constitutes a big challenge for institutional approaches on regional systems as complementarities seem to act more at a national level. Our hypothesis is that regional dynamics can't be analysed in isolation, but in their institutional/national context.

Another consequence of these assessments relies on the regional policy side. Investment in knowledge and innovation at the regional level is supposed to stimulate growth and employment, but the configurations we identified don't fit well the endogeneous growth hypothesis at the regional level. Several issues need now to be addressed around these questions of regional performances and regional resources concentration integrating the national dimension.

Appendix 1 : List of variables

Variable Label	Description / Source	
Sciences Bloc		
Rdpub	Public R&D spending (%GDP)	**Eurostat (Regio database)**
IntensRDpub	Public R&D spending (per 100 public researchers)	
%pub	Public R&D spending (% of total R&D spending)	
Pbiology	Share of publications in fundamental & applied biology (%)	**OST Database**
Pchemic	Share of publications in chemistry (%)	
Pphysics	Share of publications in physics + mathematics + ingenierie (%)	
Pmed	Share of publications in medecine (%)	
PublTot	Total publications (per 100000 inhabitants)	
Technology Bloc		
Rdpriv	Private R&D spending (%GDP)	**Eurostat (Regio database)**
INTRDpriv	Private R&D intensity (Share of private researchers on total employment %)	
INThrst	Share of Human Resources in Science and Technology (% total employment)	
HTMT	Share of high et mdium-high tech employment (% total employment)	
KIBS	Share of High tech services (% total services employment)	
PATchem	Share of patents in chemicals (%)	**OST Database**
PATconso	Share of patents in households consumption (%)	
PATelectr	Share of patents in electronic/electronics + instruments (%)	
PATmecha	Share of patents in mechanics + ingenierie (%)	
PATpharm	Share of patents in pharmaceuticals (%)	
PATTOT	Total patents (per 100000 inhabitants)	
Industry Bloc		
AGRI	Share of agricultural employment (% total employement)	**Cambridge Econometrics Database**
MANUF	Share of manifacturing employment (% total employement)	
CONSTR	Share of construction employment (% total employement)	
SERV	Share of market services employment (% total employement)	
speSERVtrans	Share of financial services employment (% total employement)	
speSERVfinanc	Share of financial services employment (% total employement)	
CONCunits	Theil concentration index (calculated on units number per sectors)	
CONCempl	Theil concentration index (calculated on employment by sectors)	
ETABmining	Share of mining industry units (% total industry units)	**Eurostat (Regio database)**
ETABfood	Share of food industry units (% total industry units)	
ETABtextil	Share of textile industry units (% total industry units)	
ETABchemic	Share of chemicals industry units (% total industry units)	
ETABmetal	Share of metalworking industry units (% total industry units)	
ETABmech	Share of mechanical industry units (% total industry units)	
ETABelectr	Share of electric/electronics industry units (% total industry units)	
ETABtransp	Share of transport industry units (% total industry units)	
EMPLmining	Employment share of mining industry (% total industry employment)	
EMPLfood	Employment share of food industry (% total industry employment)	
EMPLtextil	Employment share of textile industry (% total industry employment)	
EMPLchemic	Employment share of chemicals industry (% total industry employment)	
EMPLmetal	Employment share of metalworking industry (% total industry employment)	
EMPLmech	Employment share of mechanical industry (% total industry employment)	
EMPLelectr	Employment share of electric/electronics industry (% total industry employment)	
EMPLtransp	Employment share of transport industry (% total industry employment)	

Education Bloc		
EDUvoc	Share of vocationnal education (% total students)	**Eurostat (Regio database)**
EDUtot	Share of students in the regional population (% total population)	
EDU13	Students in primary and secondary educational level (% total population)	
EDU56	Students in tertiary educational level (% total population)	
ACT2	Primary and secondary educational level attained (% total active population)	
ACT34	Upper and post secondary (non-tertiary) level (% total active population)	
ACT56	Tertiary level attained (% total active population)	
LEARN1	people engaged in life-long learning (% total population)	
Noyau	Share of core HRST (education level correspondig to occupational level %)	

Appendix 2: Nuts level

Country	**Code**	**NUTS level**	**N level**	**Name**
Austria	AT	2	9	States
Belgium	BE	1	3	Regions
Denmark	DK	0	1	
Finland	FI	2	5	Large areas
France	FR	2	22	Regions
Germany	DE	1	16	Lander
Greece	GR	1	4	Groups of development regions
Ireland	IE	2	2	Regions
Italy	IT	2	21	Regions
Luxembourg	LU	0	1	
Netherlands	NL	2	12	Provinces
Portugal	PT	2	7	Comissoes de coordenaçao regional
Spain	ES	2	19	Autonomous communities
Sweden	SE	2	8	National areas
United Kingdom	UK	1	12	Regions
Total			142	

Appendix 3. European weight of knowledge profiles (UE25%)

	Knowledge intensive profiles	**Medium tech intermediary profiles**	**First subgroup synthesis**	**Low tech intermediary profiles**	**Low tech profiles**	**Second subgroup synthesis**
Regional pop	33,78	19,33	53,11	13,25	16,31	29,56
Patents	**67,34**	20,75	**88,09**	7,69	2,94	10,62
R&D priv	**64,72**	22,36	**87,08**	6,61	3,27	9,88
R&D publ	51,06	22,23	**73,30**	9,87	10,59	20,45
Scientif. Public.	**55,44**	19,03	**74,47**	9,84	9,37	19,21
KIBS	44,30	19,04	63,34	13,52	10,71	24,23
KIBS (financial)	48,85	18,64	**67,49**	12,56	9,73	22,29
HTMT employ.	44,16	21,89	66,05	11,65	8,89	20,54
Manufact.	34,83	21,18	56,01	11,96	13,93	25,88
Services	39,89	19,18	59,07	13,75	13,34	27,09
GDP 03	**48,27**	22,04	**70,31**	13,54	10,81	24,35

Appendix 4 – Correlations between variables and factorial axes

	First subsample (63 regions)					Second subsample (66 regions)				
Label	**Axe 1**	**Axe 2**	**Axe 3**	**Axe 4**	**Axe 5**	**Axe 1**	**Axe 2**	**Axe 3**	**Axe 4**	**Axe 5**
Rdpub	0,51	0,07	0,04	0,24	0,61	0,02	-0,66	-0,29	0,31	0,33
IntensRDpub	0,34	-0,05	0,19	-0,36	0,25	0,63	0,22	0,05	-0,33	0,35
%pub	0,43	-0,49	0,08	-0,04	0,61	-0,56	-0,52	-0,17	0,15	0,44
PbioFond	0,53	-0,34	-0,1	0,09	0,24	-0,11	-0,2	-0,39	0,26	0,26
Pchemic	-0,63	0,15	-0,17	0,02	-0,07	-0,44	-0,22	-0,11	-0,18	-0,34
Pmath	-0,54	0,05	-0,16	0,1	-0,15	-0,32	-0,11	0,02	0,05	-0,46
Pphys	-0,39	0,36	-0,4	0,13	-0,04	-0,25	-0,37	-0,18	0,21	-0,01
Pmed	0,39	-0,23	0,22	-0,06	-0,08	0,41	0,44	0,17	0,07	0,17
Pingen	-0,33	0,31	-0,01	-0,15	-0,37	-0,2	0,04	0,18	-0,14	0,03
PUBLTOT	0,84	-0,05	0,01	0,14	0,21	0,18	-0,46	-0,39	0,26	0,08
Rdpriv	0,1	0,72	0,02	0,31	-0,22	0,66	0,3	0,18	0,04	-0,32
INTRDpriv	0,11	0,64	-0,16	0,48	-0,24	0,56	0,22	0,11	0,04	-0,39
INThrst	0,55	0,01	-0,38	0,45	0,08	0,53	-0,46	-0,14	0,24	-0,23
Noyau	0,58	0,11	0,37	0,33	-0,19	-0,21	-0,29	0,1	-0,64	-0,21
KIBS	0,7	0,3	0,29	0,14	-0,03	0,77	0,12	-0,02	-0,25	-0,07
PATchem	-0,11	-0,37	-0,32	-0,24	-0,16	0,17	-0,32	-0,19	-0,33	0,08
PATconso	-0,36	-0,38	0,13	-0,19	0,23	-0,44	0,29	-0,12	0,06	-0,02
PATelectr	0,4	0,47	0,11	0,39	-0,22	0,09	0,07	0,48	0,13	0,05
PATproc	-0,52	-0,03	0,16	0,08	0,09	0,28	0,3	-0,34	-0,17	0,1
PATinstr	0,57	0,14	-0,09	-0,29	0,12	0,16	-0,28	-0,03	0,34	-0,04
PATmech	-0,63	0,11	0,14	-0,17	0,23	-0,09	0,26	0	0,02	-0,37
PATpharm	0,57	-0,52	-0,26	-0,1	0,03	-0,09	-0,58	-0,06	-0,16	0,3
PATTOT	0,17	0,71	-0,13	0,22	-0,09	0,66	0,44	0,13	0,18	0,05
AGRI	-0,36	-0,07	0,52	0,19	0,16	-0,67	-0,04	0,47	-0,08	-0,06
MANUF	-0,83	0,28	0,17	0,08	0,06	-0,01	0,54	-0,39	0,15	-0,47
CONSTR	-0,27	-0,11	0,25	0,13	-0,16	-0,45	-0,4	-0,02	0	-0,1
SERV	0,61	-0,13	-0,41	-0,35	-0,35	0,54	-0,21	-0,1	-0,12	0,59
speSERVtrans	0,54	-0,05	0,02	0,04	0,09	0,42	-0,14	0,19	0,08	0,05
speSERVfinanc	0,48	-0,23	-0,47	-0,1	-0,19	0,54	0,16	-0,04	0,06	0,25
CONCunits	-0,06	0,49	0,19	-0,24	0,12	0,53	-0,06	-0,55	-0,08	0,03
CONCempl	-0,29	-0,25	0,05	-0,18	-0,33	0,23	0,13	-0,4	-0,08	-0,08
ETABmining	-0,03	0,28	0,43	0,03	0,11	-0,1	-0,47	0,61	0,07	0,02
ETABfood	-0,34	-0,44	-0,27	0	0,15	-0,35	-0,07	0,7	0,22	-0,12
ETABtextil	-0,06	-0,22	0,15	0,4	-0,32	-0,5	0,41	-0,44	-0,13	0,15
ETABchemic	-0,06	0,44	-0,46	-0,45	0,05	0,47	-0,45	0,01	-0,08	-0,03
ETABmetal	-0,47	0,18	0,4	0,02	-0,13	0,14	-0,18	-0,52	-0,11	-0,3
ETABmech	-0,25	0,7	0,02	-0,12	0,41	0,76	-0,18	-0,09	0,2	-0,23
ETABelectr	0,24	0,4	-0,64	-0,15	0,29	0,66	-0,15	-0,15	0,49	0,21
ETABtransp	0,36	0,51	0,05	-0,29	0,19	0,45	-0,25	-0,03	-0,06	0,07
EMPLmining	0,27	-0,13	0,44	-0,22	0,36	-0,17	-0,35	0,17	0,09	-0,08
EMPLfood	0,31	-0,48	-0,1	-0,14	-0,05	-0,3	-0,35	0,65	-0,08	0,01
EMPLtextil	-0,38	-0,34	-0,02	-0,01	-0,3	-0,56	0,43	-0,34	-0,14	0,22
EMPLchemic	-0,21	-0,14	-0,37	-0,19	-0,32	0,57	-0,22	0,06	-0,2	-0,23
EMPLmetal	-0,55	-0,09	0,46	0,16	0,03	0,08	-0,07	-0,19	0,21	-0,22
EMPLmech	-0,39	0,54	0,09	0,04	0,3	0,63	0,21	-0,17	0,29	0,01
EMPLelectr	0,36	0,41	-0,22	0,34	0	0,6	0,07	0,19	0,17	-0,06
EMPLtransp	0,08	0,43	-0,4	-0,24	0,17	0,26	-0,42	-0,12	0,15	-0,36
EDUvoc	0,22	0,03	0,22	-0,64	-0,43	0,62	-0,02	0,31	-0,3	0
EDUtot	0,62	0,05	0,44	-0,16	-0,42	0,34	-0,17	-0,02	-0,71	0,02
EDU13	0,47	0,09	0,49	-0,42	-0,5	0,44	-0,16	0,13	-0,75	0,1
EDU56	0,58	-0,09	0,15	0,38	0,16	-0,25	-0,23	-0,54	-0,28	-0,17
ACT2	-0,53	-0,49	-0,16	0,47	-0,02	-0,87	0,13	-0,27	-0,07	-0,06
ACT34	0,05	0,49	0,27	-0,58	0,2	0,76	0,11	0,32	0,17	0,28
ACT56	0,58	-0,12	-0,08	0,38	-0,27	0,27	-0,5	-0,07	-0,21	-0,53
LEARN1	0,61	0,31	0,57	-0,03	-0,18	0,63	-0,01	-0,1	-0,55	0,06
HTMT	0,04	0,65	-0,42	-0,1	-0,21	0,73	-0,22	-0,07	0,28	-0,24

Appendix 5. STIE regional profiles

H01 METROPOLITAN REGIONS	
AT13, BE1, DE3, FR10, UKI, SE01	**Main characteristics**
Main or representative regions AT13 Wien BE1 Région de Bruxelles DE3 Berlin FR10 Île de France SE01 Stockholm UKI London	Market and financial services (56% and 7%) HRST, Educational Level High technological and scientific Activity Low manufacturing, diversification
European Weight of the group (% EU25) *Regional pop* 5,76 *Patents* 11,02 *R&D private* 13,29 *R&D public* 14,97 *Scientif publ* 15,02 *Manufact* 3,09 *Services* 7,71 *GDP 03* 10,54	**Main complementarities** S&T in life sciences T&I in electronics High educational level, KIBS
Stockholm, Paris and Wien higher on the technological side London and Brussels lower on R&D spending, higher on services Berlin higher on manufacturing	

H02 NORTH HIGH TECH REGIONS	
FI18, FI1A, SE02, SE04, SE0A	**Main characteristics**
Main or representative regions FI18 Etelä-Suomi - Helsinki FI1A Pohjois-Suomi - Oulu SE02 Östra Mellansverige SE04 Sydsverige - Malmoe SE0A Västsverige - Goeteborg	High private and public research (average of 4,5% of GDP) Specialisation: mechanics, electronics (low on chemicals) High S&T activity High Educational level Low services (manuf.)
European Weight of the group (% EU25) *Regional pop* 1,71 *Patents* 4,76 *R&D private* 5,60 *R&D public* 3,42 *Scientif publ* 4,21 *HTMT employ* 2,19 *Manufact* 1,81 *GDP 03* 2,46	**Main complementarities** Very High S&T T&I in electronics Very High educational level
Difference with STIE global analysis: discriminating between north regions	

H03 NORTH SCIENTIFIC REGIONS	
AT33, DK, FI13, NL11, NL22, NL31, NL32, NL33, NL42, SE08, UKM	
Main or representative regions AT33 Tirol - Innsbruck DK Danmark FI13 Itä-Suomi NL31 Utrecht NL32 Noord-Holland NL33 Zuid-Holland NL42 Limburg SE08 Övre Norrland UKM Scotland	**Main characteristics** High Public Research / Scientific Activity Low private Research Low Manufacturing / HTMT Specialisation Food, Wood industries
European Weight of the group (% EU25) *Regional pop* 5,09 *Patents* 4,96 *R&D private* 5,23 *R&D public* 8,26 *Scientif publ* 10,02 *HTMT employ* 3,72 *Manufact* 3,98 *GDP 03* 6,98	**Main complementarities** High S&T (life sciences) KIBS, Non market services Medium/High educational Level / HRST
Noord-Holland, Limburg and Denmark are under average for the scientific profile but have higher technological profile. Low specialisation on electronics exclude these regions from the North high tech cluster	

H04 BRITISH SERVICES PROFILE	
UKD, UKF, UKG, UKH, UKJ, UKK	
Main or representative regions UKD North West UKF East Midlands UKG West Midlands UKH East Of England UKJ South East UKK South West	**Main characteristics** Vocational education and life-long learning Market services, HTMT Low Manufacturing and agriculture, Industrial concentration. Low public research
European Weight of the group (% EU25) *Regional pop* 7,68 *Patents* 9,21 *R&D private* 13,53 *R&D public* 7,20 *Scientif publ* 11,25 *HTMT employ* 8,93 *Manufact* 7,20 *GDP 03* 7,52	**Main complementarities** Rather heterogeneous on specialisation and S, T & I articulations. UKH, J and K are more active on science and technology. Electronics (T&I) and Life sciences (for UKH). More manufacturing for UKD, UKF and UKG.

H05 GERMAN HIGH TECH INDUSTRIAL PROFILE	
DE1, DE2, DE3, DE5, DE6, DE7, DE9, DEA, DEB	
Main or representative regions DE1 Baden-Württemberg DE2 Bayern DE5 Bremen DE6 Hamburg DE7 Hessen DE9 Niedersachsen DEA Nordrhein-Westfalen DEB Rheinland-Pfalz	**Main characteristics** High Technological Activity Intermediary educational Chemicals, mechanical, electric/electronics and transportation
European Weight of the group (% EU25) *Regional pop* 13,54 *Patents* 37,38 *R&D private* 27,08 *R&D public* 17,21 *Scientif publ* 14,94 *HTMT employ* 25,37 *Manufact* 18,75 *GDP 03* 20,78	**Main complementarities** Specialization on traditional Industry (SMEs) High tech activity Medium Educational Level T&I complementarities

H06 SECONDARY METROPOLISES PROFILE	
BE2, BE3, ES30, FR42, FR62, FR71, FR81, FR82 IE02, ITE4	
Main or representative regions BE2 Vlaams Gewest BE3 Région Wallonne ES30 Madrid FR62 Midi-Pyrénées FR71 Rhône-Alpes FR81 Languedoc-R FR82 Provence-Alpes IE02 South and Eastern ITE4 Lazio	**Main characteristics** Food industry heterogeneous manufacturing share, services on average High share of public research (but rather heterogeneous) Low patenting activity, private R&D on average Active population with medium/low qualification
European Weight of the group (% EU25) *Regional pop* 8,92	**Main complementarities** Average scientific activity (public R&D on average) with

Patents 7,36 *R&D priv* 10,46 *R&D publ* 17,97 *Scientif Publ* 10,86 *HTMT employ* 7,24 *Manufact* 6,83 *GDP 03* 10,46	publications in biology and chemicals and patents on the same domains (pharmaceuticals and chemicals with some heterogeneity) Also coherent with food industry scientific and technological background.
Some heterogeneity with Liège and Dublin (less scientific and public), Lyon (higher on patents), Roma and Montpellier below average on private R&D, Roma and Madrid much lower on food industry.	

H07 NORTH INDUSTRIAL REGIONS	
DED, FI19, NL21, NL41, SE06	**Main characteristics**
Main or representative regions DED Sachsen FI19 Länsi-Suomi NL21 Overijssel NL41 Noord-Brabant SE06 Norra Mellansverige	Low Scientific activity, traditional fields (engineering, math., physics, chemics) Medium/high technological activity Mechanicals and metalworking, low Services Average educational level (low on tertiary level)
European Weight of the group (% EU25) *Regional pop* 2,19 *Patents* 5,50 *R&D private* 3,06 *R&D public* 2,48 *Scientif publ* 1,59 *HTMT employ* 2,39 *Manufact* 2,41 *GDP 03* 2,51	**Main complementarities** Industrial specialisation and patents: S, T & I complementarities (trad. Scientific fields, Patents in mech. & industrial processes)
High private R&D effort for FI19 and NL41. Noord-Brabant is more high tech with a high specialisation on electronics patents. Nevertheless, its industrial and mainly scientific and educational profiles are consistent with this profile.	

H08 NORTH ITALIAN AND SPANISH INDUSTRIAL REGIONS	
ES21, ES51, ITC1, ITC4, ITD5	
Main or representative regions ES21 Pais Vasco ES51 Cataluña ITC1 Piemonte ITC4 Lombardia ITD5 Emilia-Romagna	**Main characteristics** Manufacturing, Textile and mechanical industries Active population with low qualification Low Services Average or low scientific & technological activity
European Weight of the group (% EU25) *Regional pop* 5,76 *Patents* 5,55 *R&D priv* 5,70 *R&D publ* 2,93 *Scientif. Public.* 5,15 *HTMT employ.* 9,13 *Manufact.* 8,96 *GDP 03* 6,19	**Main complementarities** Specialization on textile & mechanicals Low/average S&T (publications & patents) but more often on industrial processes and mechanicals: T&I complementarities. Rather low educational level of active population
Cataluña more active on textile, food industry and higher tertiary educational level. Pais Vasco very low on textile industry	

H09 FRENCH AGRO-INDUSTRIAL PROFILE	
AT31, FI19, FR22, FR23, FR24, FR43, FR72	**Main characteristics** Intermediary regions, original by the share of food and chemical industries. Industrial specialisation (with concentration) with relative low share for mechanicals and transportation industries. Average educational profile (low for this subgroup, but European average). Low scientific activity but private R&D higher than average.
Main or representative regions AT31 Oberösterreich FI19 Länsi-Suomi FR22 Picardie FR23 Haute-Normandie FR24 Centre FR43 Franche-Comté FR72 Auvergne	
European Weight of the group (% EU25) *Regional pop* 2,45 *Patents* 2,35 *R&D private* 3,15 *R&D public* 1,52 *Scientif publ.* 1,43 *HTMT employ.* 3,13 *Manufact.* 2,99 *GDP 03* 2,89	**Main complementarities** S & I with scientific publications in chemistry and a high share for chemical industry employment or food industry. Patents in mechanical domain and industrial processes (for some regions) are consistent with metal working employment and manufacturing employment share. Intermediate educational level of active population.
Complementary remarks: some heterogeneity for industrial and technological orientation	

L01 FRENCH INDUSTRIAL FOOD PROFILE	
FR21, FR25, FR26, FR30, FR41, FR51, FR52, FR53, FR61, FR63, IE01	
Main complementarities Intermediary regions, S&I on chemicals and food, but complementarities differ among regions (electronics in Bretagne or transport and chemicals in Aquitaine…)	**Main characteristics** Food industry Dominant Private Research / very Low Public Relative High HTMT & KIBS Intermediary Educational level
European Weight of the group (% EU25) *Regional pop* 5,15 *Patents* 2,55 *R&D private* 2,86 *R&D public* 3,35 *Scientif publ.* 3,27 *HTMT employ.* 4,48 *Manufact.* 4,87 *GDP 03* 5,64	**Main or representative regions** FR25 Basse-Normandie FR26 Bourgogne FR30 Nord - Pas-de-Calais FR41 Lorraine FR51 Pays de la Loire FR53 Poitou-Charentes FR52 Bretagne FR61 Aquitaine IE01 Border, Midland and Western

L02 BRITISH LOW TECH PROFILE	
UKC, UKE, UKL, UKN	
Main or representative regions UKC North East UKE Yorkshire UKL Wales UKN North. Ireland	**Main characteristics** British profile with vocational education and life-long learning. Low private research and very low public funding: average/low technological activity, rather high publication level and public spending by researcher. Industrial concentration, specialisation on chemicals and metalworking
European Weight of the group (% EU25) *Regional pop* 2,68 *Patents* 1,44 *R&D private* 1,24 *R&D public* 2,13 *Scientif publ.* 2,86 *HTMT employ.* 2,40	**Main complementarities** Services, KIBS Chemicals specialisation with publications (low), patents (but sometimes heterogeneous) and employment: T & I for chemicals, diversified on scientific fields (publications).

Manufact. 2,37 *GDP 03* 2,24	T&I in electronics for some regions

L03 NORTH LOW URBANIZED REGIONS	
AT11, AT12, AT21, NL12, NL13, NL34, SE07, SE09	
Main or representative regions AT11 Burgenland AT12 Niederösterreich AT21 Kärnten NL12 Friesland NL13 Drenthe NL34 Zeeland SE07 Mellersta Norrland SE09 Småland med öarna	**Main characteristics** Relative High private research / very low Public, relative important technological activity vs very low scientific one. Medium/Low educational profile Traditional industries, low on life sciences Relative high share for financial services
European Weight of the group (% EU25) *Regional pop* 1,19 *Patents* 1,16 *R&D private* 0,98 *R&D public* 0,19 *Scientif publ.* 0,17 *HTMT employ.* 1,15 *Manufact.* 1,29 *GDP 03* 1,46	**Main complementarities** Strong coherency between T, I & E: patents in industrial processes and mechanicals, industrial employment share higher for metalworking, mechanical and electronic products. Vocational education with secondary educational level

L04 GERMAN LOW TECH PROFILE	
AT32, DE4, DE8, DEC, DEE, DEF, DEG, GR3, ITC3, NL23	
Main or representative regions AT32 Salzburg DE4 Brandenburg DE8 Mecklenburg DEC Saarland DEE Sachsen-Anhalt DEF Schleswig-Holst. DEG Thüringen GR3 Attiki ITC3 Liguria NL23 Flevoland	**Main characteristics** Manufacturing German profile: industrial diversification (mechanicals, chemicals and also transportation or electronics), but also high share of services. Dominant public R&D funding, rather good scientific activity for the subgroup. Low tech profile (patents on average for the subgroup). Medium/Low Educational profile, vocational
European Weight of the group (% EU25) *Regional pop* 4,24 *Patents* 2,54 *R&D private* 1,52 *R&D public* 4,19 *Scientif publ.* 3,54 *HTMT employ.* 3,63 *Manufact.* 3,43 *GDP 03* 4,20	**Main complementarities** Industrial profile with complementarities between S, T & I on chemicals (bio/pharma/chemic.) or T&I on mechanicals and instruments: industrial specialisation sometimes associated with patent or publications. Public R&D to compensate low private one?
Industrial profile close to the North low urbanized one. Attiki is original in the subgroup with higher educational profile (less vocational) and different specialisations (more on textile and less on mechanicals, but chemical industry close to the profile). Also close to Spanish profile.	

L05 ITALIAN TEXTILE PROFILE	
ITD3, ITD4, ITE1, ITE2, ITE3, ITF1, ITF2, ITF3, ITF4, ITG1, ITG2, ES52, ES53	
Main complementarities No specific S&T orientation, textile specialisation and low educational level	**Main characteristics** Important specialisation on Textile Very Low private Research vs relative high level for public Research (diversified fields) Low technological activity Active Population with very low qualification
European Weight of the group (% EU25) *Regional pop* 8,30 *Patents* 2,40 *R&D private* 1,73 *R&D public* 6,37 *Scientif publ.* 5,29 *HTMT employ.* 5,23 *Manufact.* 7,24 *GDP 03* 6,28	**Main or representative regions** ITD3 Veneto ITD4 Friuli ITE1 Toscana ITE2 Umbria ITE3 Marche ITF1 Abruzzo ITF2 Molise ITF3 Campania ITF4 Puglia ITG1 Sicilia ITG2 Sardegna
Complementary remarks: close to the Spanish profile but with higher public R&D effort and different educational level (more intermediary here)	

L06 SPANISH PROFILE	
ES11, ES12, ES13, ES22, ES23, ES24, ES41, ES61, ES62,PT17	
Main or representative regions ES11 Galicia ES12 Asturias ES13 Cantabria ES22 Navarra ES23 La Rioja ES24 Aragón ES41 Castilla León ES61 Andalucía ES62 Murcia PT17 Lisboa	**Main characteristics** Contrasted educational level: high share of students or active population with tertiary educational level but also high share of low educational level (weak intermediate). High share of HRST and good level for core HRST Construction and metalworking, low on mechanical, transportation and electronic industries Low S&T activity, but dominated by private funding.
European Weight of the group (% EU25) *Regional pop* 4,45 *Patents* 0,42 *R&D private* 1,25 *R&D public* 2,93 *Scientif publ.* 2,48 *HTMT employ.* 2,52 *Manufact.* 3,29 *GDP 03* 2,82	**Main complementarities** Contrasted educational level, good level of core HRST

L07 SOUTH AGRICULTURAL PROFILE	
ES42, ES43, GR1, GR2, GR4, PT11, PT16	
ES42 Castilla-La Mancha ES43 Extremadura GR1 Voreia Ellada GR2 Kentriki Ellada GR4 Kriti PT11 Norte PT16 Centro	**Main characteristics** Agriculture and food industry Very low Scientific & Technologic Activity (Dominant Public research)
European Weight of the group (% EU25) *Regional pop* 3,56 *Patents* 0,12 *R&D private* 0,28 *R&D public* 1,29 *Scientif publ.* 1,60 *HTMT employ.* 1,14 *Manufact.* 3,39 *GDP 03* 1,70	**Main complementarities** Low educational level of active population and traditional sectors, good level for core HRST (coherent labour market)
Complementary remarks: Thessaloniki more textile oriented	

Appendix 6	*01 High performances (convergence regions)*	*02 High performances*	*03 Intensive growth (low unempl., high GDP)*	*04 Intensive growth (convergence regions)*	*05 Intermediary perf., employment oriented development*	*06 Intermediary performances*	*07 Low performances, decreasing unemployment*	*08 Low performances, increasing unemployment*	*09 Bad performances, low but increasing unemp.*	*10-11 Bad performances with decreasing unemployment*
H01 Metropolitan regions			SE01, **UK1**			**AT13,** FR10				**BE1,** DE3
H02 North high tech regions		FI18, FI1A	SE02, SE04, SE0A							
H03 North scientific regions		DK, FI13	AT33, SE08, **UKM**		NL11, NL22, NL31, NL32, NL33, NL42					
H04 British services profile								UKD, UKF, UKG, UKH, UKJ, UKK		
H05 German high tech industrial profile							DE1, DE2, DE6, DE7, DE9, DEA, DEB			DE5
H06 Secondary metropolises profiles		**BE2, FR62**		ES30, IE02		**BE3,** FR71, FR81, FR82, **ITE4**			**FR42**	
H07 North industrial regions		FI19	SE06		NL21, NL41					DED
H08 North Italian and spanish industrial regions		ES21		ES51					ITC1, ITC4, ITD5	
H09 French agro-industrial profile		AT22	AT31			FR22, FR23, FR24, FR72	FR43			
L01 French industrial food profile				IE01		FR21, FR25, FR26, FR30, FR41, FR51, FR52, FR53, FR61, FR63				
L02 British low tech profile		**UKN**						UKC, UKE, UKL		
L03 North low urbanized regions			AT11, AT12, AT21, AT34, SE07, SE09		NL12, NL13			**NL34**		
L04 German Low tech profile	GR3		AT32, **NL23**			**ITC3**	DEC, DEF			DE4, DE8, DEE, DEG
L05 Italian textile profile				ES52, ES53		**ITE2, ITF2**			ITD3, ITD4, ITE1, ITE3, ITF1	ITF3, ITF4, ITF5, ITF6, ITG1, ITG2
L06 Spanish profile	ES11, ES12, ES13, ES41			ES22, ES23, ES24, ES61, ES62					PT17	
L07 South agricultural profile	ES43, GR1, GR2, GR4			ES42				PT11, PT16		

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