INNOVATION POLICIES: ITALIAN TECHNOLOGICAL DISTRICTS AND THEIR REGIONAL INNOVATION SYSTEMS

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Abstract

This paper analyses a specific innovation policy instrument namely the establishment of technological districts (TDs) in Italy.

The Italian Ministry of Research, consistently with the relevant literature on the topic and with the European practice, has recently fostered the creation of high-tech systemic aggregations of firms at regional level. The instrument is still characterized by scarce understanding and it does not yet exist a national framework for its evaluation. Aim of this paper is to shed light on this policy instrument. Through an assessment of the scientific and technological performances of Italian regions and their industrial specialization/concentration patterns, the variety of Italian regional innovation systems is verified. Basing on this variety it is possible to better understand the economic rationale for TDs' establishment based on two different approaches: one founded on existing patterns of industrial and technological specialization (mainly northern regions) with more promising future paths, the other one based on considerations of regional development (southern regions). Those different approaches lead to different policy implications as suggested in the final part of the paper.

Key words: Innovation, Regional Innovation Systems, Technological Districts, Clusters, Italian Regions.

JEL Codes: O18, O32, O38, O52, R12

1. Introduction

The huge economic literature on the topic suggests that innovation requires policy interventions. The most common argument providing the rationale for policy intervention is the neo-classical notion of market failures related to the nature of knowledge as public good[1]. Neo-classical models converge to the conclusion that private investments, whatever the market structure is, are under provided compared to social optimum[2]. Public intervention is therefore required in order to let the market determine the social optimal quantity of R&D.

Many aspects of the innovation process are missing in the above perspective. The evolutionary approach aims at addressing those deficiencies defining innovation as the introduction of technological and organizational changes (new products, new production processes and new forms of economic organizations) in contexts characterized by non stationarity and strong uncertainty, emphasising the importance of learning and selection, the dynamism of evolutionary patterns, the essential role of firms[3]. In this framework the rationale for policy intervention lies in the solutions of trade-offs between variety and selection[4] and the policy-maker is characterized by bounded rationality and strong uncertainty.

For our purposes it is also useful to consider the wide literature on spatial agglomeration of innovative activities. The Italian experience of industrial districts[5] has renewed the Marshallian emphasis on social and institutional factors for the agglomeration of economic activities. This emphasis has been transferred into the field of innovation highlighting the advantages in terms of knowledge spillovers deriving from spatial concentration of innovative activities[6]. The attention to national innovation systems[7] has therefore been

[1] Nelson, 1959; Arrow, 1962.
[2] Arrow, 1962; Demsetz, 1969; Dasgupta and Stiglitz, 1980; Tirole, 1989.
[3] Nelson and Winter, 1982; Freeman, 1987; Dosi, 1988.
[4] Metcalfe, 1994.
[5] Becattini, 1987; Bellandi, 1982.
[6] Krugman, 1991; Acs, Audretsch and Feldman, 1992; Feldman, 1994; Anselin, Varga and Acs, 1997; Porter, 1998.
[7] Lundvall, 1992; Nelson, 1993; Edquist, 1997.

paralleled by an increasing consideration of regional innovation systems[8] and regions are increasingly becoming the leading actors of their own innovation policies.

In line with this theoretical framework[9] the Italian Ministry of Research through the Italian National Programme for Research 2005-2007 has fostered the creation of high-tech systemic aggregations of firms, universities, laboratories at regional level, encouraging regions to develop their own regional innovation strategies and promoting the competitiveness of territorial systems through the cooperation between public and private actors[10].

This instrument is quite recent in Italy. It is still characterized by scarce understanding and it does not yet exist a national framework for its evaluation.

Aim of this paper is to shed light on this policy instrument trying to understand the economic rationale for TDs establishment.

The paper is organized as follows. This first section, having introduced the subject, briefly summarizes the relevant literature on the topic.

The second section provides a statistical analysis covering the years 2001 and 2005 of the Italian regional innovation systems using a set of indicators grouped into three categories: the first one measures the levels of regional specialization and concentration in the sectors chosen for TDs implementation; the second one refers to science and technology indicators measuring the technological endowment and performances of the regions; the third one measures some economic dimensions i.e. entrepreneurship and financial resources considered important[11] for the support of innovation.

In the third section we present four synthetic indices able to summarize the outcomes of the previous analysis concerning: 1) regional specialization; 2) scientific-technological performances; 3) economic environment; 4) specialization/innovation (given by the combination of the previous three). Basing on the outcomes of this analysis, regions have been classified into four groups.

Policy implications and likely evolutionary paths are outlined for each group.

[8] Cooke et al., 1997; Asheim and Isaksen, 2002.
[9] Etzkowitz and Leydesdorff, 2000.
[10] The list of the TDs established in Italy by MIUR is provided in table 2A of the Annex.
[11] Kortum and Lerner, 1998; Hall, 2002; Bresnahan and Gambardella, 2004.

2. Assessing Italian regional innovation systems

In order to assess regional innovation systems, we have defined the set of indicators reported in table 1A in the Annex. They are available for all the 20 Italian regions.

They can be grouped into three categories according to their characteristics:

1. Indicators focused on the sectors of specialization of TDs.
2. Science & Technology indicators.
3. Indicators of economic environment .

2.1 Indicators focused on the sectors of specialization of TDs.

In the first group we include absolute and relative specialization and concentration indices plus EPO patents corresponding to indicators identified by numbers 1,2,3 in table 1A.

Concentration of certain economic activities in certain areas/regions and specialization of certain areas/regions in certain sectors represent an important indicator widely used in the literature[12] to identify a regional agglomeration of economic activities.

2.1.1 Sectors of specialization

In order to calculate indicators focused on TD's sectors of specialization we need to set a correspondence between TDs' sectors of specialization and sectors of economic activity as defined in the Ateco classification used by Istat to group the economic activities in Italy and corresponding to NACE Rev 1.1.

According to the Italian PNR 2002 and PNR 2005-2007, TDs must specialize in a technological sector considered strategic for the economic and technological development of the country. Table 3A reported in the Annexes sets a correspondence between regional TDs and the technology fields they have chosen to specialize in.

The next step is to set a correspondence between TD's sectors of specialization and Ateco/Nace Rev 1.1. classification[13]. This operation implies some critical issues since Ateco/Nace Rev 1.1. classification reflects traditional sectors, while it is quite difficult to capture new technology fields. Nevertheless the use of the most disaggregated level (5 digits) allows us to refine the groupings of economic activities in order to cover technology

[12] Ellison and Glaeser, 1997; Sforzi,1997; Puga, 1999; Signorini, 2000; Maggioni, 2002; Combes and Overman, 2003; Iuzzolino, 2005.

[13] For data related to 2001, Ateco 1991 in force until 2002 is considered. Differences between the two classifications have been taken into account.

fields as best as possible. Whenever this operation was not feasible, we considered the nearest application sectors of the specific technology, since vertical linkages are relevant in the context of agglomeration of innovative activities[14].

The correspondence between technology fields and Ateco/NACE Rev.1.1 is reported in table 4A of the Annexes[15].

2.1.2 Specialization indices

In order to calculate specialization indices we have used data on employment and firms sourced by Istat using Ateco/NACE Rev.1.1 (5 digits).

In order to measure the level of specialization of each region in the specified sector we have used indices of relative and absolute specialization.

The absolute specialization index measures the share of the industry ‘i’ in the region ‘r’ with respect to the total of manufacturing industry in the region ‘r’:

$$Spec_r^i = \frac{X_r^i}{\sum_i X_r^i} = \frac{X_r^i}{X_r^{MAN}} \qquad [1]$$

where ‘MAN’ is the total of the manufacturing industry and ‘X’ measures the number of firms and the number of employees.

The specialization location quotient is a relative measure of specialization. It compares the level of specialization of the region ‘r’ in the industry ‘i’ with the level of specialization of the nation ‘NAT’ in the industry ‘i’ through the following formula:

$$SLQ_r^i = \frac{\dfrac{X_r^i}{X_r^{MAN}}}{\dfrac{X_{NAT}^i}{X_{NAT}^{MAN}}} \qquad [2]$$

[14] Krugman, 1991; Porter, 1998.

[15] Correspondences for biotechnology for health for ICT and for nanotechnologies have been defined following a two-step approach: a) using Eurostat, Unit F4 ‘Education, science and culture statistics’, *Patent classifications and technology areas* to set correspondences between technologies (ICT and bio) and patent codes (for nanotechnologies we used Igami and Okazaki, 2007); b) defining correspondences between technologies (identified through patent codes) and economic activities (Ateco/Nace Rev.1.1.) basing on Schmoch U., Laville F.,Patel P. and Frietsch R, 2003; Verspagen B., Morgastel T., Slabbers M., 1994 (MERIT concordance).

2.1.3 Concentration Indices

In order to calculate concentration indices we have used data on employment and firms sourced by Istat using Ateco/NACE Rev.1.1 (5-digit). In order to measure the level of concentration of each region in the specified sector we have used indices of relative and absolute concentration.

The absolute concentration index measures the share of the region 'r' on the national total in the industry 'i':

$$Conc_r^i = \frac{X_r^i}{\sum_r X_r^i} = \frac{X_r^i}{X_{NAT}^i} \qquad [3]$$

where 'NAT' is the national total and 'X' measures the number of firms and the number of employees.

The concentration location quotient is a relative measure of concentration. It compares the level of concentration of the industry 'i' in the region 'r' with the level of concentration of the total manufacturing activity ('MAN') for the same region 'r' in the overall nation ('NAT') using the following formula:

$$CLQ_r^i = \frac{\dfrac{X_r^i}{X_{NAT}^i}}{\dfrac{X_r^{MAN}}{X_{NAT}^{MAN}}} \qquad [4]$$

It allows us to compare the weight of a region on the national total in a specified sector 'i' with respect to the weight of the same region on the national total in the total manufacturing .

It can be noted that the specialization location quotient calculated through formula [2] and the concentration location quotient calculated through formula [4] are identical.

2.1.4 Patterns of specialization/concentration: main results

For each technology field and for all the Italian regions we have calculated absolute and relative specialization and concentration indices related to number of firms and number of employees for the years 2001[16] and 2005[17]. We have summarized the results of this analysis through the use of maps highlighting, for each technology field, the Italian regions

[16] Source: Italian Census on Industry and Services, 2001.
[17] Source: Asia database (2005) provided by Istat.

with relative specialization/concentration indices for number of firms and employees higher than 1.

For each technology field a map of Italy is presented where:

- regions hosting DT specialized in that field are highlighted through a circle;
- regions with SLQ-CLQ in terms of firms for that field higher than 1 are highlighted through a striped pattern;
- regions with SLQ-CLQ in terms of employees for that field higher than 1 are highlighted with triangles.

Regions where the three marks are contemporaneously present are those where relative indices of specialization/concentration for the specific field both for firms and for employees are higher than 1 and, at the same time, hosting a DT specialized in that field. This would be the best situation.

The analysis is carried out in two years (2001 and 2005) to highlight main changes occurred in the period or the stability in the relative positions.

Aerospace in Italy

Figure 1: 2001

Figure 2: 2005

In 2005 there are many regions (9) presenting a relative specialization index for number of firms in aerospace higher than 1. At the same time there are 4 regions with a relative index of specialization for employees higher than 1. The intersection between those two groups is represented by three regions Lazio, Campania and Piemonte with Campania and Lazio having a relative specialization index for firms higher than 2. If we cross-check this information with the absolute index of concentration we find that in 2005 Campania, Lazio and Piemonte are included in the first four regions in the ranking of absolute concentration both in terms of firms and in terms of employees proving to be the most relevant regions in this sector for the country. It appears therefore quite reasonable to establish a TD specialized in aerospace in one of those regions and in fact it has been established in Lazio, while the TD established in Campania, even if not specialized in aerospace, is devoted to specific applications of nanotechnology and new materials to the aerospace sector and relies on large and important aerospace firms.

Biotechnology for health in Italy

Figure 3: 2001

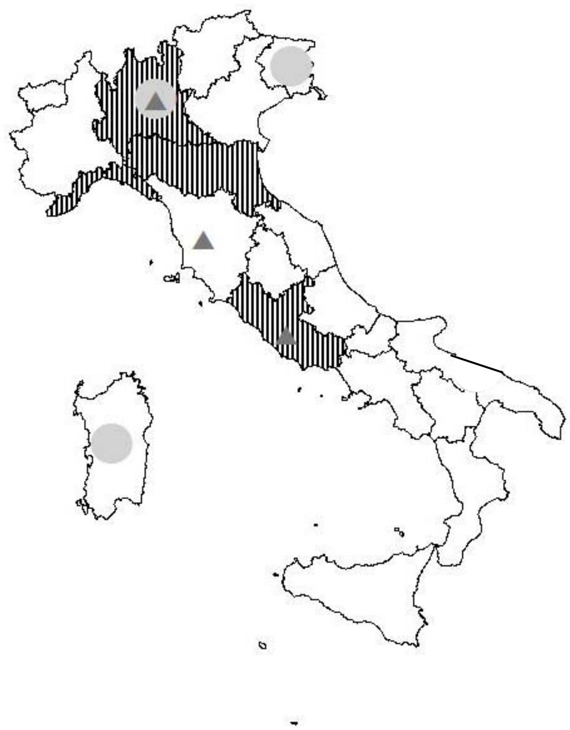
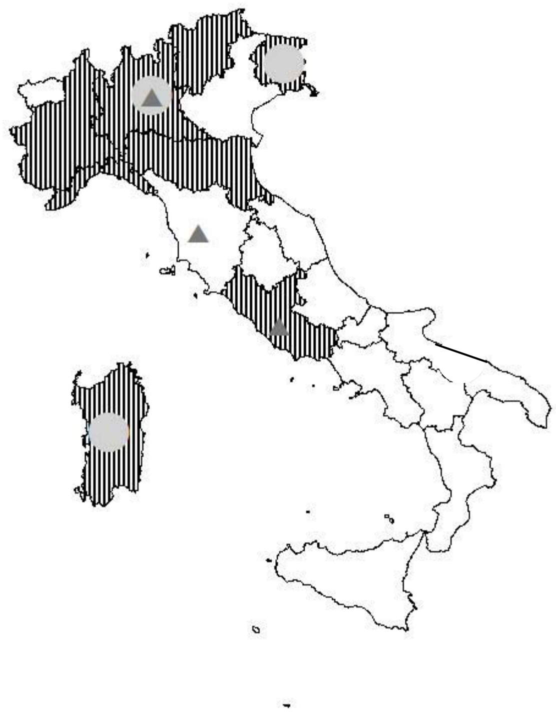


Figure 4: 2005



There are many regions (8 in 2005) presenting a relative specialization index for number of firms in biotechnology sector higher than 1. At the same time there are 3 regions with a relative index of specialization for employees higher than 1: Lombardia and Lazio have both higher than 1. If we cross-check this information with the absolute index of concentration, we find that Lombardia is the leading region both in terms of firms and in terms of employees proving to be the most relevant region in this sector for the country. It is therefore reasonable the choice to locate here a TD specialized in biotechnology. Among the other three regions hosting TDs specialized in biotechnology for health, we find that FVG and Sardegna present a LQ in terms of firms higher than 1. They however do not represent an important slice of the Italian activity in this field especially in terms of employees for the prevalence of SMEs.

Biotechnology for food in Italy

Figure 5: 2001

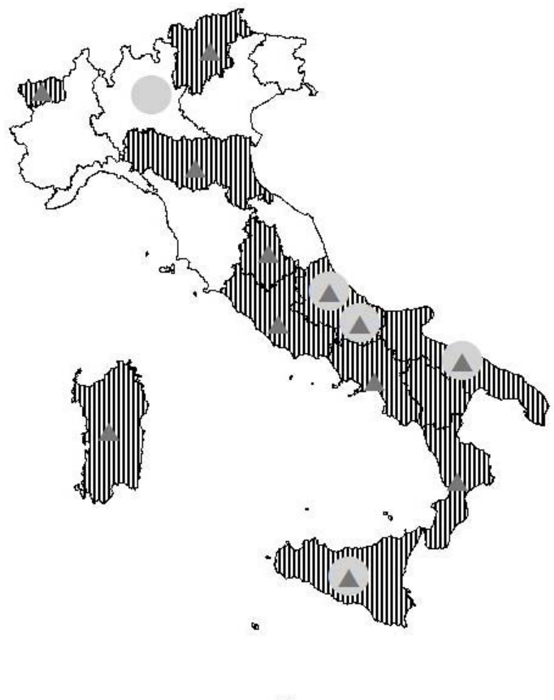


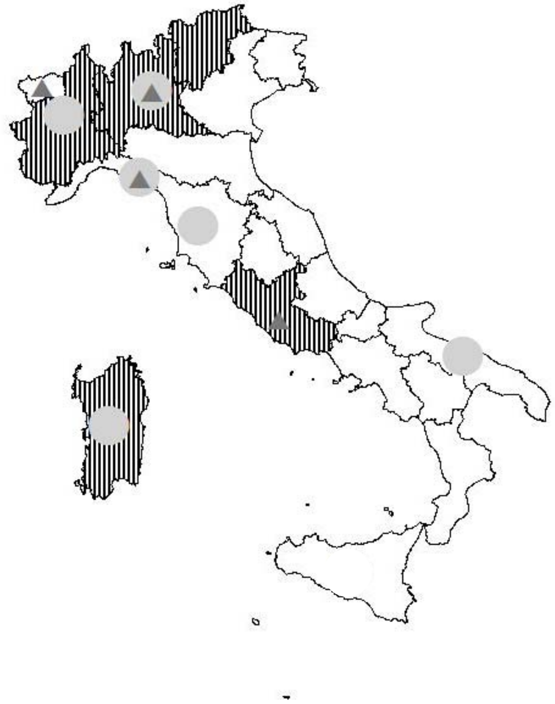
Figure 6: 2005

There are many regions (14 in 2005: more than half the total) presenting a relative specialization index for number of firms in the food manufacturing sector higher than 1. The highest values are of Calabria, Molise, Sardegna and Sicilia. Approximately the same regions have a relative index of specialization for employees higher than 1. Their performances are partly due to the poverty of the industrial structure of many southern regions. If we cross-check this information with the absolute index of concentration, we find that Lombardia is the leading region both in terms of firms and in terms of employees. And in fact this region hosts a TD specialized in biotechnology including biotechnologies for food and for zoo-techniques. Among the other three regions hosting TDs specialized in biotechnology for food, we find that Puglia and Sicilia represent an important part of the Italian food industry. On the contrary Abruzzo and Molise, being small regions, do not count much in the national total of the industry.

ICT in Italy

Figure 7: 2001

Figure 8: 2005



There are five regions in 2005 presenting a relative specialization index for number of firms in ICT higher than 1. At the same time there are four regions with a relative index of specialization for employees higher than 1. At the intersection between the two groups there are Lazio and Lombardia (in 2001 there was also Piemonte). If we cross-check this information with the absolute index of concentration, we find that Lombardia is the leading region both in terms of firms and in terms of employees proving to be one of the most relevant regions in this sector also for the country. It is therefore a reasonable choice to locate here a TD specialized in ICT. Among the regions hosting TDs specialized in ICT, we find that Piemonte as well as having location quotient for firms higher than 1, is the fifth Italian region for absolute concentration in terms of firms and the third one in terms of employees. In addition, until 2001, Piemonte had also a LQ for employees higher than 1. Therefore this is a region where it appears quite reasonable to locate an ICT district. Toscana is the sixth region for number of firms and for number of employees in terms of absolute concentration. In terms of location quotient it is below 1. Within the region an important ICT district is present in the area near Pisa, not apparent from our statistics that are at regional level, while the phenomenon is relevant at provincial level. Liguria and Sardegna represent a small share of Italian ICT industry, but they have the location quotient higher than 1 respectively for employees and number of firms. The real question arises for Puglia that does not present either location quotients higher than 1 or relevant concentration indices. The choice must be probably seen as a tool to promote economic development in southern regions through fostering such pervasive technology as the ICT. Even if the most suitable regions where to establish an ICT district are Lombardia and Piemonte, it is also true that, precisely for the nature of the ICT strictly interconnected with economic development and with the promotion of other high technologies as well as with Lisbon targets, it seems a reasonable strategy to establish many districts in this field even in those regions not endowed with pre-existent developed sectors.

Mechatronics in Italy

Figure 9: 2001

Figure 10: 2005

Only northern regions present a relative specialization index for number of firms in mechatronics higher than 1. Among them the highest value belongs to ER. At the same time there are 3 regions with a relative index of specialization for employees higher than 1:

only one of them (Basilicata) is in the south of Italy. If we cross-check this information with the absolute index of concentration, we find that ER is the second region for absolute concentration of firms and the third one for absolute concentration of employees. Presenting all the required characteristics, it is therefore the best choice to locate a TD specialized in mechatronics. Liguria has the location quotient for firms higher than 1. This represents an improvement compared with 2001. The region represents a small fraction of the Italian total of the sector in terms of absolute concentration. It can appear reasonable to choose mechatronics as one possible field of specialization of the TD in this region for its continuity with the regional industrial structure that underwent a phase of restructuring in the last years. The real questions arise for Umbria and Puglia that do not present either location quotients higher than 1 or relevant concentration indices.

Nanotechnology (vertically linked sectors) in Italy

Figure 11: 2001

Figure 12: 2005

Only northern regions present a relative specialization index for number of firms in the sectors of application of nanotechnologies higher than 1. At the same time there are 3 regions with a relative index of specialization for employees higher than 1: two of them are in the north, while one (Lazio) is in the centre. If we cross-check this information with the absolute index of concentration, we find that Lombardia is the first region for absolute concentration of firms and the second one for employees and Veneto is the second region in terms of firms and the fourth one in terms of employees. Those two regions together have industrial fields for nanotechnology applications of extraordinary importance. It is therefore a quite reasonable choice to locate here TDs specialized in nanotechnology. Among the other regions hosting TDs specialized in nanotechnology, Campania is sixth for absolute concentration of firms and seventh for employees. It is specialized in new materials and it is based eminently on the excellence of private laboratories belonging to large firms. If we consider nanotechnology per se[18] (instead of the application sectors), the photography we get is not really different. Lombardia, Piemonte, Lazio and Veneto lead the Italian ranking in terms of absolute concentration of firms, while Campania, Umbria, Puglia and Sicilia remain in the middle of it. In Sicilia the excellence in the micro and nano-devices where the region is specialized has been stimulated by ST Microelectronics, but, being the company legally based in Agrate Brianza (Lombardia), the situation in this region may be considered underestimated. Puglia has important research laboratories, but it has not a strong industrial tissue where those technologies may find application.

Transports (maritime)and logistics in Italy

Figure 13: 2001

Figure 14: 2005

[18] Nanotec IT and Airi, (2006), Second Italian Nanotechology Census, Airi.

There are 8 regions in 2005 with relative specialization indices for number of firms in maritime transports and logistics higher than 1. Among them Liguria presents the highest value. At the same time there are 7 regions with a relative index of specialization for employees higher than 1: they correspond with the former except for Puglia. This is in line with the geographical distribution of the main ports and maritime facilities in Italy. If we cross-check this information with the absolute index of concentration, we find that Liguria is the second region for absolute concentration of firms and for employees. The other two regions hosting TDs specialized in maritime transports and logistics have different focuses: on maritime manufacturing Sicilia that is the eighth region for absolute concentration of firms and employees, on logistic services Calabria that would strengthen Gioia Tauro port through the action of the district, but still represents a small fraction of the sector in Italy. The choices by Calabria and Sicilia appear reasonable if we take into account, together with existing infrastructures and industry, also the geographical advantages of the two regions.

2.1.5 European patents per sector: main results

Statistics for patents have been calculated for the sectors considered in table 2 on the basis of IPC[19] codes. Correspondence between technology fields and IPC codes is reported in table 5A of the Annexes.

Concerning aerospace, Lazio the only region that hosts a TD specialized in aerospace, is the third Italian region for number of patents per million inhabitants and the second for their absolute total number. In terms of million of inhabitants it is abundantly above the national average. This confirms that Lazio can be considered a reasonable choice to establish an aerospace TD.

Among the regions that host biotechnology TDs, Lombardia is the only one that is definitely above the Italian average both in 2001 and 2003 and has produced a relevant total number of patents in absolute terms. It is confirmed as the leading Italian region in biotechnology. The regions hosting TDs specialized in biotechnology for food show very low values for biotechnology patents (except for Sicilia). It can be considered reasonable since biotechnology for food is more involved with traditional food sectors.

[19] International Patent Classification, eighth edition, entered into force on January 1st 2006.

Among the regions that host ICT TDs, Piemonte and Lombardia are the best performers in terms of patents. Beyond being definitely above the Italian average both in 2001 and 2003 they have produced the highest number of patents in this technology field confirming their leading position in the ICT sector and the choice to establish TDs in those regions. Liguria also performs above the Italian average. The other regions hosting TDs specialized in ICT are below the Italian average for production of patents. There are however some differences: Toscana, even if below the average in relative terms, has produced a high number of total patents in absolute terms, while Puglia and Sardegna lag definitely behind.

As for mechatronics, Emilia Romagna that hosts a TD specialized in this technology field, ranks first among the other Italian regions both in 2001 and 2003 in terms of number of patents per million inhabitants. In absolute terms it is the second region behind Lombardia. Those data confirm the leadership of ER in the mechanical sector and the choice to establish a TD specialized in mechatronics. Liguria, Umbria and Puglia, hosting TDs specialized in mechatronics, rank below the Italian average with Liguria not far from the Italian benchmark and Umbria performing better than Puglia. The latter presents a number of patents per million inhabitant equal to one fifth of the Italian average in 2001. Therefore Liguria performs quite better than Puglia in relative terms, while, in absolute terms, the two regions produce a similar number of patents in 2001 with the gap becoming wider in 2003. Umbria performs better than Puglia in relative terms, but being a small region, in absolute terms, is far from Puglia's values in 2001 and quite near in 2003.

Among the regions hosting TDs specialized in nanotechnology Lombardia and Veneto are above the Italian average for number of patents per million inhabitants in the application sectors of nanotechnologies. Lombardia is the leader of the ranking both in terms of relative and absolute terms in 2001 and in 2003. Veneto is the fourth region in 2001 and the third one in 2003 for absolute number of total patents. All the other regions hosting TDs specialized in nanotechnology are below the Italian average of patents per million inhabitants. Sicilia and Campania show similar values both in relative and absolute terms presenting a significant number of total patents. Umbria is positioned above Sicilia and Campania in relative terms, but being a smaller region, it does not produce a similarly high number of total patens. Puglia ranks among the last regions in relative terms.

For maritime transports the region presenting an undisputable leadership both in terms of patents per million inhabitants and in total number in 2001 and in 2003 is Liguria that hosts a TDs specialized in maritime transport. The other two regions hosting TDs specialized in maritime transport and logistic services are Calabria and Sicilia. While the latter, being also devoted to manufacture of ships, vessels and related equipment shows in 2003 an above average value of patents per million inhabitants, ranking fourth for absolute number of total patents, Calabria is mainly focused on the logistics related services. Therefore data on manufacturing patents do not cover the specialization of Calabria's TD.

It is possible to conclude that for almost all the technology fields considered, exception made for biotechnology for food, the situation emerging from the analysis on patents is quite coherent with the analysis on specialization and concentration patterns of firms and employees carried out in § 2.1.4.

2.2 Science and Technology indicators

In order to measure the potential of each region in science and technology activities we will complement the analysis with statistical data related to scientific and technological activities.

Tables 6A and 7A report the regional values of the indicators listed in table 1A from number 4 to number 11 referred to 2001 and 2005.

From the analysis of science and technology (S&T) indicators emerges the leadership of some excellent regions (Piemonte, Lombardia, ER, Toscana, Lazio) while others lag behind (VDA, Calabria, Molise).

2.3 Indicators of Economic Environment

In this section we consider indicators concerning entrepreneurship and the availability of financial funds (in particular venture capital). Even if those indicators are not directly related to innovation, they however give us information about the conditions that favour it[20].

Tables 8A and 9A report the regional values of the indicators listed in table 1A from number 12 to number 15 referred to 2001 and 2005.

From the analysis of economic environmental indicators, the leadership of some excellent regions (Lombardia, Piemonte, Lazio, Toscana, ER) is confirmed, other regions do emerge

[20] Kortum and Lerner, 1998; Hall, 2002; Bresnahan and Gambardella, 2004.

(FVG and Sardegna), while the lagging behind are almost the same (VDA, Molise, Basilicata, Calabria) with the addition of Sicilia.

3. Defining synthetic indicators

In order to summarize the outcomes of the above analysis, we group together the indicators provided in the previous analysis in order to build a synthetic measure able to provide an overall picture of the situation of the different regional contexts in terms of innovation and specialization.

First of all we calculate an index for each of the three groups of indicators defined in the previous section. Thereafter we calculate a single summary index grouping together all the statistical indicators used in the analysis.

Our methodology for the calculus of synthetic indicators is based on two steps:

1. standardization of the indicators provided in § 2;
2. calculus of the synthetic indicators.

Step 1: standardization

The process of standardization is required since indicators provided have varied units of measurement. We re-scale values in order to keep them varying within the identical range for each indicator (from 0 for the minimum to 1 for the maximum) using the following formula:

$$i_{Rk} = \frac{\left(I_{Rk} - Min[I_k]\right)}{\left(Max[I_k] - Min[I_k]\right)} \qquad [5]$$

Where 'i_{Rk}' is the re-scaled value of the indicator 'k' for region 'R', *Min*[I_k] is the minimum value measured by the indicator 'k' among all the Italian regions and *Max*[I_k] is the maximum value measured by the indicator 'k' among all the Italian regions.

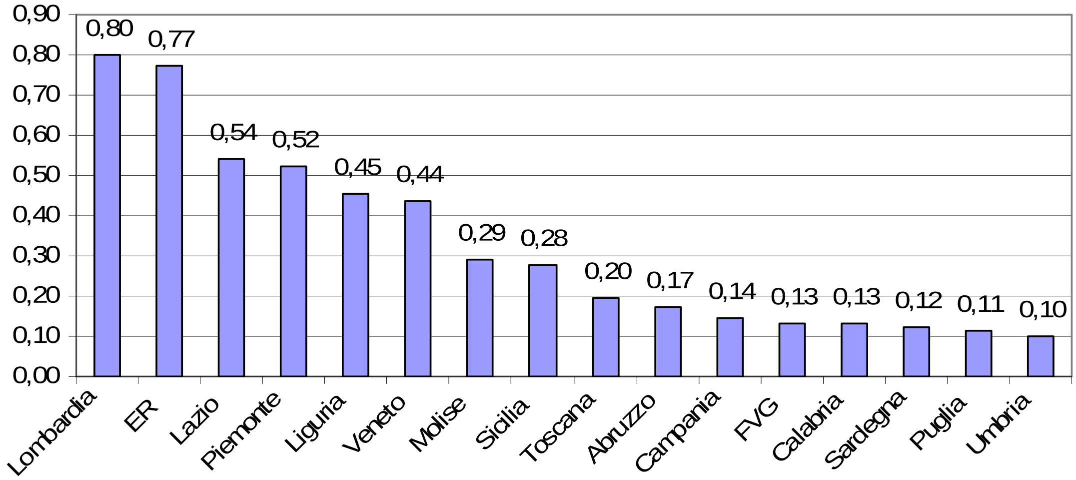
Step 2: calculus of synthetic indicators

Synthetic indicators are obtained by using a simple average from standardized values of key indicators as obtained from the previous step.

3.1 Synthetic Index of Specialization (SIS)

The first synthetic index is built on indicators focused on the sectors of specialization of the TDs. Therefore it reflects the coherence between TDs' specialization choices and the actual patterns of specialization and concentration in the regions of location. It has been calculated for the years 2001 and 2005. In the following figure 15 we report the results for 2005.

Figure 15: Synthetic Index of Specialization (SIS) - 2005

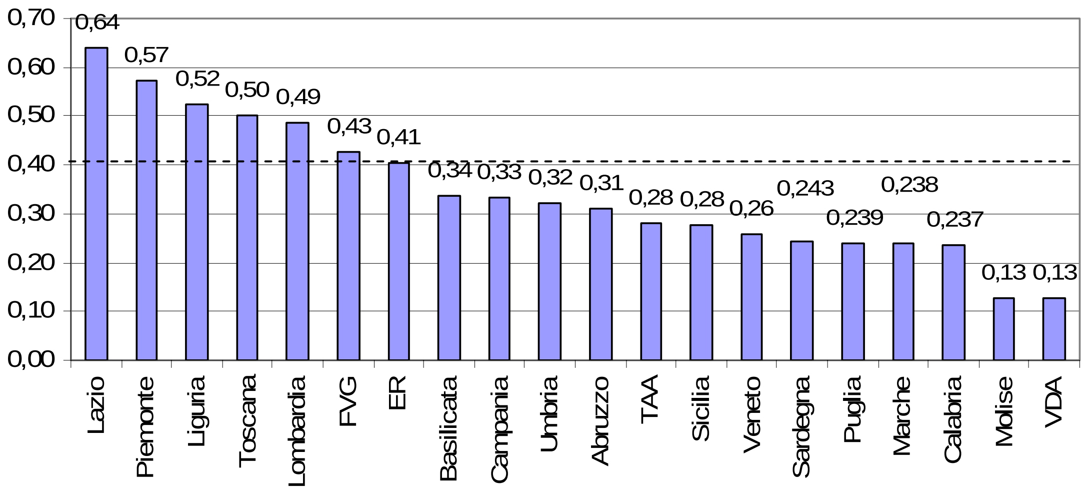


3.2 <u>Synthetic Index of Science and Technology (SIST)</u>

The second synthetic index is built on science and technology indicators and reflects the performance of the innovative regional contexts in terms of science and technology activities.

It has been calculated for the years 2001 and 2005. In the following figure 16 we report the results for 2005. The dotted line represents the Italian average equal to 0,41 for 2005.

Figure 16: Synthetic Index of Science and Technology (SIST) - 2005

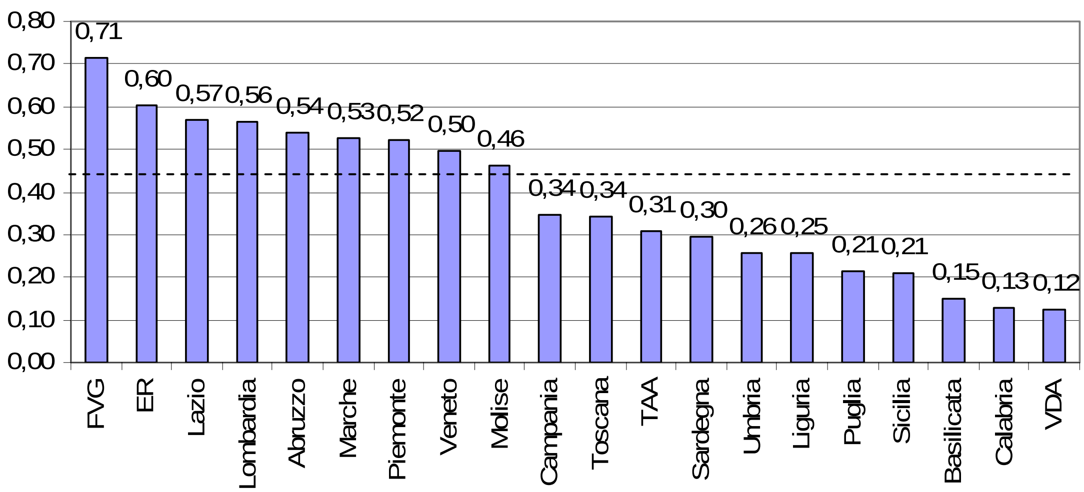


3.3 Synthetic Index of Economic Environment (SIEE)

The third synthetic measure reflects the conditions that may favour innovation grouping together the indicators of financial funds availability and of entrepreneurship.

It has been calculated for the years 2001 and 2005. In the following figure 17 we report the results for 2005. The dotted line represents the Italian average equal to 0,45 for 2005.

Figure 17: Synthetic Index of Economic Environment (SIEE) – 2005

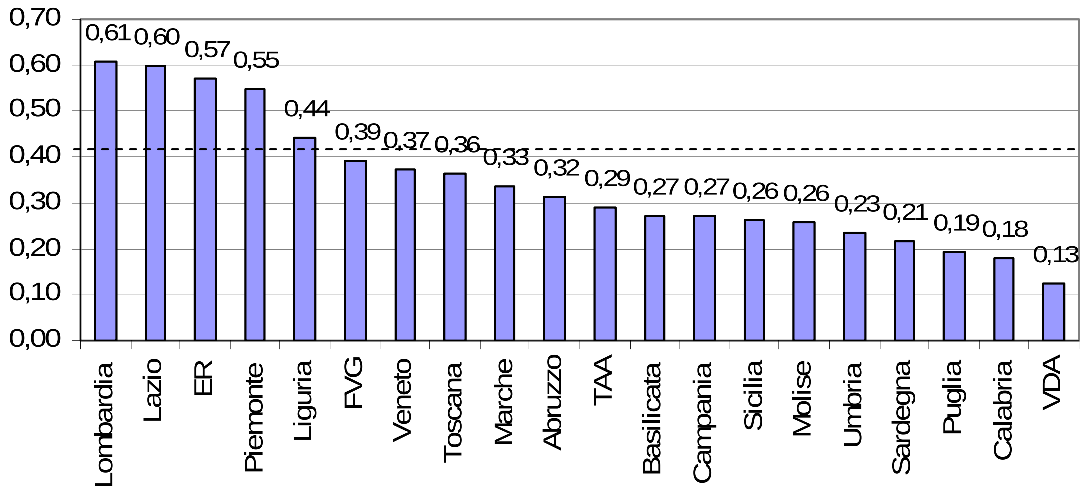


3.4 Synthetic Index of Innovation and Specialization (SIIS)

Finally the global index, being the combination of all the indicators analysed in section 2 , reflects simultaneously all the three dimensions: specialization, S&T activities and economic environment.

It has been calculated for the years 2001 and 2005. In the following figure 18 we report the results for 2005. The dotted line represents the Italian average[21] equal to 0,42 for 2005.

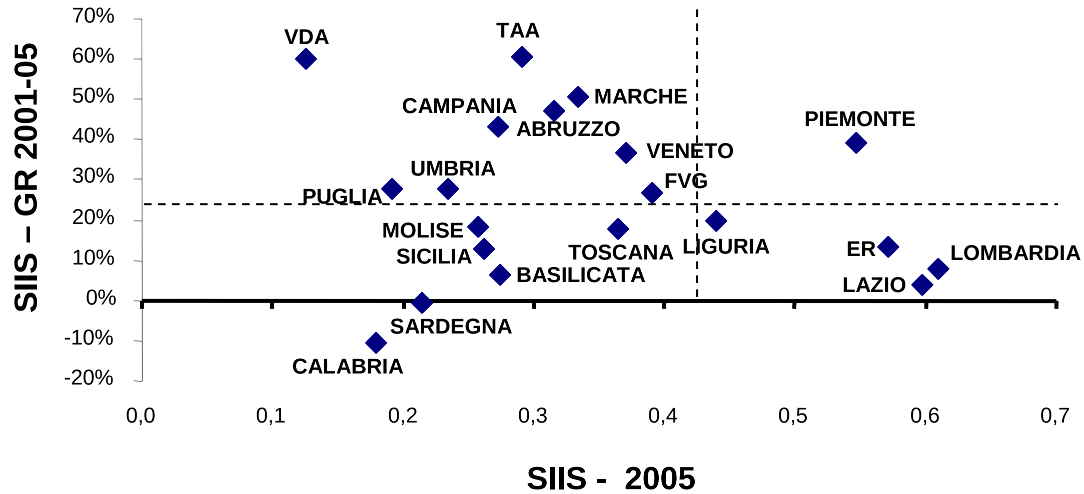
Figure 18: Synthetic Index of Innovation and Specialization (SIIS) – 2005



In figure 19 we have combined the level of SIIS in 2005 with its growth rate. The dotted lines represent the Italian averages both in terms of the absolute value of the summary index and in terms of its growth rate.

[21] Italian average has been calculated taking into account only indicators of the second and third group.

Figure 19: Synthetic Index of Innovation and Specialization (SIIS): level (2005) and trend



4. Classifying regional innovation systems: policy implications for TDs

Figure 20 groups Italian regional innovation systems according to their level of SIIS performance in 2005 and its growth rate 2001-2005.

High/average/low performers are classified according to their position compared to the Italian average of SIIS level (represented by the dotted line in figure 19). Average performers are defined as those regions whose SIIS level is not more than 15% lower than the Italian average.

High growth/low growth regions are classified according to their position compared to the Italian average growth (represented by the dotted line in figure 19).

Figure 20: Classification of Italian Regional Innovation Systems

	Low SIIS	Average SIIS	High SIIS
High Growth	Marche, Abruzzo, Campania, Umbria, TAA, Puglia, VDA	FVG Veneto	Piemonte
Low Growth	Basilicata, Sicilia, Molise, Sardegna, Calabria	Toscana	Lombardia, Lazio, ER, Liguria

From the analysis of figure 20 it is possible to outline different policy implications and to delineate forecast of likely future paths for TDs based on the different types of regional innovation systems underlying them.

I) Leading regions

This group includes regions characterized by high levels of SIIS and high growth rates (in the right-top side of the matrix: the only region being Piemonte) or by high levels of the index and low growth rates (in the right-bottom side of the matrix: Lombardia, Lazio, ER, Liguria).

Establishing TDs in the consolidated leading regions independently from their rates of growth presents good opportunities to create international champions thanks to agglomeration economies and to the favourable conditions for innovation. Since the index includes also specialization/concentration indicators, it is possible to conclude that the choices of TDs' specializations fit with the industrial profiles of those regions and with their weight on the national total. Going on with investments in those regions is meaningful from the policy maker point of view.

II) Average performing regions

Are those regions presenting an absolute level of SIIS index slightly below the average (not exceeding 15% below the Italian average of 0,42 in 2005). They can be characterized by higher than the average growth rates (FVG and Veneto) or by lower than the average growth rates (Toscana).

Establishing TDs in the average regions may trigger agglomeration economies. This is more likely for the more dynamic regions (FVG and Veneto). It makes sense going on investing in those regions provided an heavy financial commitment and a strong institutional setting .

III) Catching-up regions

This group in the left-top quadrant of the matrix is the most numerous. Regions belonging to this group (Marche, Abruzzo, Campania, Umbria, TAA, Puglia, VDA) are characterized by higher than average levels of growth, but lower levels of the absolute index.

Establishing TDs in those regions could produce good results in the sense that technological poles may contribute to regional technological and economic development and to reduce the gap with more advanced regions. It seems however unlikely that those TDs may evolve into international technological champions. Investing in those regions may make sense for the policy maker in terms of regional equilibrium targets.

IV) Lagging behind regions

Regions belonging to this group (Basilicata, Sicilia, Molise, Sardegna, Calabria) located in the left-bottom quadrant of the matrix are characterized by lower than the average levels of SIIS and lower growth rates.

Group membership may disguise different situations. If there is a strong commitment by the policy maker as in Sardegna and Calabria, TDs may become instruments to promote technological and economic development in the involved regions to contrast the core-periphery concentration patterns and to mitigate regional disparities. In this case, targets and strategies of the policy maker may be similar with those outlined in the previous group. If the commitment by the policy maker is low and interventions are not properly followed up and monitored, the risk is to waste public resources. When agglomeration economies do not work and innovation virtuous paths are not enabled, the establishment of TDs may result in abysmal failures. This policy instrument can not therefore be considered the proper solution to foster regional development and other policies should be taken into consideration.

5. Conclusions

After having assessed the scientific and technological performances of Italian regional systems of innovation and their industrial specialization/concentration patterns with respect to some specific technological fields, it is possible to conclude that Italy presents a variety of regional situations with very different degrees of technological and industrial development. As the analysis suggests, establishing TDs in Italian regions should take into account those differences, elaborating differentiated paths and objectives.

The solution, implemented by Italian MIUR, has been to leave the initiative to the regional level. One of the main outcomes of this regional approach is the different attitude between northern and southern regions. While in the former, TDs have been implemented and developed following existing patterns of industrial and technological specialization with the objective to attain international standing and competitiveness, for the latter, considerations of regional development, sometimes dangerously near to welfarism, seem having prevailed and far less ambitious objectives have been defined.

Innovation policies need differentiated approach to properly work, but whenever institutional commitment shows to be inadequate, the risk of a policy failure is particularly marked for those regional contexts characterized by low innovative performances and low

growth rates. The institutional commitment shown by the regions in establishing TDs and its influence on their likely evolutionary paths has been subject of another work.
Even a differentiated regional approach should therefore be coupled with a strict, mid-term monitoring procedure in order to avoid abysmal failures and wasting of public money.
A possible path of future research will be to apply the analysis of industrial specialization and concentration patterns to a different level of analysis (instead of a regional basis, a provincial one).

Annexes

Table 1A: A system of indicators for regional innovation systems

Indicator	Data source	Years
1.a Specialization index (firms): absolute and relative	Database “Asia” 2005 Istat Census 2001	2001 2005
1.b Specialization index (employees): absolute and relative	Database “Asia” 2005 Istat Census 2001	2001 2005
2.a Concentration index (firms): absolute and relative	Database “Asia” 2005 Istat Census 2001	2001 2005
2.b Concentration index (employees): absolute and relative	Database “Asia” 2005 Istat Census 2001	2001 2005
3. EPO patents (per million inhabitants and total number)	Eurostat: S&T Database	2001 2003
4. Public R&D as % of GDP	ISTAT: Statistics on R&D in Italy ISTAT: Regional Accounts	2001 2005
5. Business Expenditure on R&D (BERD) as % of GDP	ISTAT: Statistics on R&D in Italy ISTAT: Regional Accounts	2001 2005
6. Public R&D employees as % of total employees	ISTAT: Statistics on R&D in Italy ISTAT: Regional Accounts	2001 2005
7. Business R&D employees as % of total employees	ISTAT: Statistics on R&D in Italy ISTAT: Regional Accounts	2001 2005
8. S&T graduates[22] as % of total graduates	Italian Ministry of University and Research (MIUR): statistical office	2001 2005
9. R&D laboratories[23] as % of total service sector (excluding wholesale and retail trade)	Database “Asia” 2005 Istat Census 2001	2001 2005
10. EU Research Projects[24] per million employees	CORDIS database ISTAT: Regional Accounts	2001 2005
11. TBP receipts[25] as % of GDP	UIC (Italian Exchange Office) ISTAT: Regional Accounts	2001 2005
12. VC funding as % of GDP	AIFI; PriceWaterhouse & Coopers: Statistics on Private Equity and Venture Capital in Italy	2001 2005
13. VC Projects as % of total employees	AIFI; PriceWaterhouse & Coopers: Statistics on Private Equity and Venture Capital in Italy	2001 2005
14. New registered firms[26] as % of total active firms	Unioncamere: Database Movimprese	2001 2005
15. Yearly rate of growth of active firms	Unioncamere: Database Movimprese	2001 2005

[22] S&T fields of study are identified according to OECD definition (OECD, 2007, *Science, Technology and Industry Scoreboard 2007).*

[23] Firms with Ateco/NACE Rev.1.1. codes 73100 and 74301.

[24] EU projects belonging to V or VI Framework Programme. Projects have been attributed to a region when a regional institution is involved either as coordinator or as normal participant.

[25] Trade in technics and industrial R&D performed abroad. Trademarks have not been considered.

[26] We have considered the following economic sections according to Ateco classification: D: Manufacturing (from 15000 to 37999); I: Transports and TLC (from 60000 to 64999); J: Financial services (from 65000 to 67999) and K: Services (from 70000 to 74999).

Table 2A: Italian Technological Districts (TDs): an overall framework at November 2007

Region	TD	Sector	Coordinating agency	Protocol Agreement	Framework Programme	Public funding (million €)	Private funding (million €)
Piemonte	Torino Wireless	ICT	Torino Wireless Foundation	11/12/2001	30/05/2003	52,5	30
Lombardia	Biotechnologies	Biotechnologies	Lombardia Region	22/12/2003	22/03/2004	26	22
	ICT	ICT		22/12/2003	19/07/2004	24	22
	Advanced Materials	Advanced Materials		22/12/2003	19/07/2004	40	34
Veneto	Nanotech	Nanotechnologies	Veneto Nanotech	17/12/2002	17/03/2004	42	26
FVG	CBM	Molecular Biotechnologies	CBM	21/11/2003	05/10/2004	36,5	29,5
Liguria	SIIT	Intelligent Integrated Systems	SIIT	27/09/2004	28/09/2005	44,5	36
ER	Hi-Mech	Advanced Mechanics	ASTER	09/12/2003	13/05/2004	50	50
Toscana	ICT & Security	ICT & Security	Toscana Region	-	29/04/2005	7,5	NA
Umbria	TD Umbria (DTU)	Materials, Nanotechnologies, Mechatronics	Umbria Region	-	28/02/2006	49	49
Lazio	DTA	Aerospace	FILAS	05/05/2004	30/06/2004	60	40
Abruzzo	Food safety and quality*	Food safety and quality	Consortium for food quality and security	-	22/12/2005	9	3
Molise	Mina*	Agro-industry	MINA	-	NA	6,5	5
Campania	IMAST*	Polimeryc Materials	IMAST	17/07/2003	09/03/2005	50,5	20
Puglia	Dhitec*	Nanotechnologies and ICT	Dhitec	16/02/2000	28/04/2005	20	18
	Dare*	Agro-industry	DARE	16/02/2000	28/04/2005	15	11
	Medis*	Mechatronics		16/02/2000	28/04/2005	7	-
Basilicata	TeRN*	Hydro-geological and seismic risks	TERN	-	NA	6	2
Calabria	R&D Log*	Logistics and Transport	R&D Log	19/10/1999	03/08/2005	18	17

	Culture and Innovation*	Cultural heritage preservation	Culture and Innovation	19/10/1999	03/08/2005	11,5	10,5
Sicilia	Micro and Nano-systems*	Micro and Nano-systems	-	13/09/1999	14/06/2005	11	9
	Agro-bio and Eco-fishing*	Agro-bio and Eco-fishing	-	13/09/1999	14/06/2005	42	27 %
	Maritime Transports*	Maritime Transports	-	13/09/1999	14/06/2005	8,5	3
Sardegna	Biomedicine / ICT*	Biomedicine / ICT	CPR	-	27/05/2005	34	26,5

* CIPE del. N° 17/2003

Source: Our elaboration from various sources (among them the following internet sites: http://www.miur.it/; http://www.ricercaitaliana.it/distretti.htm; http://www.riditt.it/page.asp?page=networks_districts; http://www.distretti-tecnologici.it/home.htm; http://www.adite.it/; http://www.sviluppoitalia.it/.).

Table 3A: Regional TDs and their technology fields of specialization

Technology fields	**Regions**
Aerospace	a) Lazio
Biotechnology for health	a) Lombardia b) FVG c) Sardegna
Biotechnology for food (food and agro-industry applications) and advanced techniques for food production and security.	a) Lombardia b) Abruzzo c) Molise d) Puglia e) Sicilia
Information and Communication Technologies (ICT)	a) Piemonte b) Lombardia c) Liguria d) Toscana e) Puglia f) Sardegna
Mechatronics	a) Liguria b) Emilia Romagna (ER) c) Umbria d) Puglia
Nanotechnology	a) Lombardia b) Veneto c) Umbria d) Campania e) Puglia f) Sicilia
Transport (Maritime) & Logistics	a) Liguria b) Calabria c) Sicilia

Source: our elaboration on MIUR Strategic Guidelines for Research and on regional TDs websites.

Table 4A: Correspondence between technology fields and Ateco/NACE Rev.1.1

Technology field	Ateco/NACE Rev.1.1
Aerospace	35.3 Manufacture of aircraft and spacecraft
Biotechnology for health	24.14 Manufacture of other organic basic chemicals
	24.41 Manufacture of basic pharmaceutical products
	24.42 Manufacture of pharmaceutical preparations
	24.66.1 Manufacture of other organic chemical products obtained through fermentation
	33.1 Manufacture of medical and surgical equipment and orthopaedic appliances
	33.2 Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment
Biotechnology for food	15 Manufacture of food products and beverages
ICT	29.24.2 Manufacture of balances and machinery for sales and distribution
	29.24.5 Automatic machinery for measuring, packaging, wrapping
	29.56.4 Manufacture of industrial robot
	30.0 Manufacture of office machinery and computers
	31.3 Manufacture of insulated wire and cable
	32.1 Manufacture of electronic valves and tubes and other electronic Components
	32.20.1 Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
	32.20.2 Manufacture of electric appliances for TLC
	32.3 Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods
	33.2 Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment
	33.3 Manufacture of industrial process control equipment
	33.40.3 Manufacture of optical elements and fibers
	33.40.4 Manufacture of optical precision instruments
	33.40.5 Manufacture of photographic equipment
	64.2 Telecommunications
	72 Computer and related activities
Mechatronics	29.1 Manufacture of machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines
	29.21.1 Manufacture of furnaces and furnace burners
	29.22.1 Manufacture of lifting and handling equipment
	29.23.1 Manufacture of non-domestic cooling and ventilation equipment
	29.24.1 Manufacture of material for not electric welding
	29.24.2 Manufacture of balances and machinery for sales and distribution
	29.24.3 Manufacture of other general purpose machinery
	29.24.4 Manufacture of machinery for chemical and oil plants
	29.24.5 Automatic machinery for measuring, packaging, wrapping

	29.31.1 Manufacture of agricultural tractors	
	29.32.1 Manufacture of other agricultural and forestry machinery	
	29.4 Manufacture of machine-tools	
	29.5 Manufacture of other special purpose machinery	
	29.71 Manufacture of electric domestic appliances	
	33.20.1 Manufacture of electric instruments and appliances for measuring	
	33.20.2 Manufacture of instruments and appliances for measuring, checking, testing including meters	
	33.20.3 Manufacture of instruments and appliances for navigating and other purposes including hydrology and meteorology tools.	
	33.20.4 Manufacture of instruments and appliances for drawing, computation and precision tools	
	33.3 Manufacture of industrial process control equipment	
	34.10 Manufacture of motor vehicles	
	34.30 Manufacture of parts and accessories for motor vehicles and their engines	%
	35.20.1 Manufacture of railway locomotives and rolling stock	
	35.20.2 Manufacture of tramway locomotives and rolling stock	
	35.41 Manufacture of motorcycles	
Nanotechnology	24.1 Manufacture of basic chemicals	
	24.3 Manufacture of paints, varnishes and similar coatings, printing ink and mastics	
	24.4 Manufacture of pharmaceuticals, medicinal chemicals and botanical products	%
	24.5 Manufacture of soap and detergents, cleaning and polishing preparations,perfumes and toilet preparations	
	24.66 Manufacture of other chemical products	
	25.2 Manufacture of plastic products	
	26.1 Manufacture of glass and glass products	
	26.23 Manufacture of ceramic insulators and insulating fittings	
	26.24 Manufacture of other technical ceramic products	
	26.26 Manufacture of refractory ceramic products	
	26.8 Manufacture of other non-metallic mineral products	
	27.3 Other first processing of iron and steel and production	
	27.4 Manufacture of basic precious and non-ferrous metals	
	28.40 Forging, pressing, stamping and roll forming of metal; powder Metallurgy	
	28.51 Treatment and coating of metals	
	29.14 Manufacture of bearings, gears, gearing and driving elements	
	29.42 Manufacture of machine-tools for metallurgy	
	29.51 Manufacture of machinery for metallurgy	
	30.0 Manufacture of office machinery and computers	
	31.40 Manufacture of accumulators, primary cells and primary batteries	
	31.5 Manufacture of lighting equipment and electric lamps	
	32.1 Manufacture of electronic valves and tubes and other electronic Components	
	32.20.1 Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy	
	32.20.2 Manufacture of electric appliances for TLC	

	33.1 Manufacture of medical and surgical equipment and orthopaedic Appliances
	33.2 Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment
	33.3 Manufacture of industrial process control equipment
	33.40.3 Manufacture of optical instruments and fibers
	33.40.4 Manufacture of optical precision instruments
	33.40.5 Manufacture of photographic equipment
Transports (Maritime) and Logistics	35.1 Building and repairing of ships and boats
	61.1 Sea and coastal water transport
	63.11.2 Cargo handling for water transport
	63.12 Storage and warehousing
	63.22 Other supporting water transport activities
	63.4 Activities of transport agencies

Source: our elaboration on Ateco/Nace Rev.1.1 classification.

Table 5A: Correspondence between technology fields and IPC[27]

Technology field	IPC
Aerospace	B64 Aicraft, Aviation, Cosmonautics
Mechatronics	B06 Generating or transmitting mechanical vibrations in general
	B23 Machine tools; metal-working not otherwise provided for
	B24 Grinding; polishing
	B30 Presses
	B60 Vehicles in general
	B61 Railways
	B65 Conveying; packing; storing; handling thin or filamentary material
	B66 Hoisting; lifting; hauling
	B67 Opening or closing bottles, jars or similar containers; liquid handling
	D01 Natural or artificial threads or fibres; spinning
	D02 Yarns;mechanical finishing of yarns or ropes; warping or beaming
	D03 Weaving
	D04 Braiding; lace-making; knitting; trimmings; non-woven fabrics
	D05 Sewing; embroidering; tufting
	E01 Construction of roads, railways, or bridges
	F01 Machines or engines in general; engine plants in general; steam engines
	F02 Combustion engines;hot-gas or combustion-product engine plants
	F03 Machines or engines for liquids; wind, spring, weight, or miscellaneous motors; producing mechanical power or a reactive propulsive thrust, not otherwise provided for
	F04 Positive-displacement machines for liquids; pumps for liquids or elastic fluids
	F15 Fluid-pressure actuators; hydraulics or pneumatics in general
	F16 Engineering elements or units; general measures for producing and maintaining effective functioning of machines or installations; thermal insulation in general
	F17 Storing or distributing gases or liquids
	F21 Lighting
	F22 Steam generation
	F23 Combustion apparatus; combustion processes
	F24 Heating; ranges; ventilating
	F25 Refrigeration or cooling; combined heating and refrigeration systems; heat pump systems; manufacture or storage of ice; liquefaction or solidification of gases
	F26 Drying
	F27 Furnaces; kilns; ovens; retorts
	F28 Heat exchange in general
	G01 Measuring; testing
	G05 Controlling; regulating
	G07 Checking devices
	G08 Signalling

[27] The correspondences of biotechnology and ICT with IPC codes are defined by the Statistical Office of the European Union and are not reported in the above table.

Nanotechnology	A61 Medical or veterinary science; hygiene
	B01 Physical or chemical processes or apparatus in general
	B21 Mechanical metal-working without essentially removing material; punching metal
	B23 Machine tools; metal-working not otherwise provided for
	B29 Working of plastics; working of substances in a plastic state in general[28]
	B32 Layered products
	C01 Inorganic chemistry
	C02 Treatment of water, waste water, sewage, or sludge
	C03 Glass; mineral or slag wool
	C04 Cements; concrete; artificial stone; ceramics; refractories
	C07 Organic chemistry
	C08 Organic macromolecular compounds; their preparation or chemical working-up; compositions based thereon
	C09 Dyes; paints; polishes; natural resins; adhesives; miscellaneous compositions; miscellaneous applications of materials
	C12 Biochemistry; beer; spirits; wine; vinegar; microbiology; enzymology; mutation or genetic engineering
	C22 Metallurgy; ferrous or non-ferrous alloys; treatment of alloys or non-ferrous metals
	C23 Coating metallic material; coating material with metallic material; chemical surface treatment; diffusion treatment of metallic material; coating by vacuum evaporation, by sputtering, by ion implantation or by chemical vapour deposition, in general; inhibiting corrosion of metallic material or incrustation in general
	C30 Crystal growth
	G01 Measuring; testing
	G02 Optics
	G06 Computing; calculating; counting
	G11 Information storage
	H01 Basic electric elements
Transports (maritime) and Logistics	B63 Ships or other waterborne vessels; related equipment

Source: our elaboration on IPC – 8th edition.

[28] This is the only category not present in the OECD study. It has been added because some TDs involved in nanotechnologies are specialized in polymeric materials and plastics.

Table 6A: Regional Science and Technology Indicators – Year 2001

Region	Public R&D (% GDP)	BERD (% GDP)	Public R&D employees (% Tot Empl)	Business R&D employees (% Tot Empl)	S&T Graduates (% tot graduates)	R&D laboratories (% service)	European projects (per million employees)	TBP Receipts (% GDP)
Piemonte	0,33%[a]	1,40% [a]	0,21%	0,70% [a]	32,30%	0,69%	106,66	0,1447%
VDA	-	-	0,12%	-	-	0,48%	65,68	0,0000%
Lombardia	0,32%	0,84%	0,23%	0,43%	30,03%	0,65%	98,67	0,2382%
TAA	0,34%	0,21%	0,21%	0,18%	19,87%	0,63%	56,62	0,0056%
Veneto	0,29%	0,30%	0,22%	0,19%	29,91%	0,67%	42,23	0,0384%
FVG	0,67%	0,54%	0,45%	0,25%	18,97%	1,06%	89,72	0,0294%
Liguria	0,54%	0,39%	0,37%	0,32%	32,46%	1,01%	154,56	0,0263%
ER	0,50%	0,62%	0,35%	0,38%	23,15%	0,79%	74,57	0,0374%
Toscana	0,70%	0,36%	0,44%	0,18%	28,65%	1,04%	125,09	0,0683%
Umbria	0,64%	0,15%	0,51%	0,11%	18,03%	1,06%	54,13	0,0188%
Marche	0,35%	0,20%	0,22%	0,13%	16,39%	0,93%	27,75	0,0154%
Lazio	1,47%	0,50%	1,00%	0,27%	22,38%	0,64%	142,97	0,1784%
Abruzzo	0,45%[b]	0,33% [b]	0,32%	0,19% [b]	21,45%	1,03%	31,33	0,0066%
Molise	-	-	0,21%	-	6,21%	1,24%	16,56	0,0030%
Campania	0,65%	0,29%	0,45%	0,14%	25,55%	0,87%	44,58	0,0087%
Puglia	0,38%[c]	0,12%	0,28%	0,07%	18,40%	0,84%	22,48	0,0077%
Basilicata	-	0,11% [d]	0,27%	0,04% [d]	51,26%	1,76%	32,51	0,0085%
Calabria	-	-	0,21%	-	39,09%	0,74%	12,72	0,0014%
Sicilia	0,66%	0,19%	0,44%	0,07%	25,60%	1,08%	24,61	0,0059%
Sardegna	0,61%	0,05%	0,39%	0,04%	23,37%	1,03%	34,99	0,0247%
ITALY	**0,55%**	**0,53%**	**0,37%**	**0,27%**	**25,79%**	**0,79%**	**78,77**	**0,0957%**

a: This value includes also VDA data;
b: This value includes also Molise data;
c: This value includes also Basilicata and Calabria data;
d: This value includes also Calabria data

Source: our elaboration on various sources (see table 1A)

.

Table 7A: Regional Science and Technology Indicators – Year 2005

Region	Public R&D (% GDP)	BERD (% GDP)	Public R&D employees (% Tot Empl)	Business R&D employees (% Tot Empl)	S&T Graduates (% tot graduates)	R&D laboratories (% service)	European projects (per million employees)	TBP Receipts (% GDP)
Piemonte	0,32%	1,41%	0,25%	0,70%	29,77%	0,74%	94,52	0,1100%
VDA	0,06%	0,24%	0,08%	0,23%	-	0,44%	82,10	0,0033%
Lombardia	0,27%	0,87%	0,25%	0,47%	30,14%	0,65%	65,28	0,1755%
TAA	0,45%	0,25%	0,35%	0,19%	23,03%	0,65%	79,48	0,0043%
Veneto	0,28%	0,30%	0,23%	0,23%	26,78%	0,58%	34,61	0,0590%
FVG	0,62%	0,54%	0,50%	0,32%	19,61%	0,92%	88,84	0,0428%
Liguria	0,55%	0,67%	0,39%	0,41%	30,88%	0,89%	140,15	0,0565%
ER	0,45%	0,72%	0,39%	0,46%	23,00%	0,77%	51,84	0,0585%
Toscana	0,73%	0,36%	0,52%	0,20%	24,34%	0,89%	103,27	0,1469%
Umbria	0,58%	0,20%	0,52%	0,13%	16,46%	1,05%	58,86	0,0215%
Marche	0,32%	0,25%	0,26%	0,16%	20,92%	0,78%	45,06	0,0195%
Lazio	1,27%	0,54%	1,01%	0,30%	22,28%	0,65%	141,93	0,1212%
Abruzzo	0,54%	0,49%	0,38%	0,30%	12,18%	1,02%	33,82	0,0116%
Molise	0,35%	0,11%	0,29%	0,12%	3,31%	0,73%	16,75	0,0057%
Campania	0,68%	0,43%	0,46%	0,19%	24,52%	0,84%	40,33	0,0133%
Puglia	0,48%	0,18%	0,36%	0,10%	21,34%	0,93%	23,74	0,0048%
Basilicata	0,33%	0,20%	0,25%	0,08%	44,26%	1,49%	18,40	0,0014%
Calabria	0,34%	0,03%	0,26%	0,02%	30,07%	1,29%	9,21	0,0031%
Sicilia	0,57%	0,21%	0,46%	0,12%	23,70%	0,96%	21,65	0,0033%
Sardegna	0,53%	0,04%	0,43%	0,03%	22,59%	0,94%	26,35	0,0153%
ITALY	**0,52%**	**0,58%**	**0,41%**	**0,31%**	**24,65%**	**0,76%**	**65,30**	**0,0843%**

Source: our elaboration on various sources (see table 1A).

Table 8A: Indicators of Economic Environment – Year 2001

Region	Amount of VC funding (% GDP)	N° of VC projects (per million employees)	New registered firms (% active firms)	Firms' rate of growth (2001 on 2000)
Piemonte	0,03%	9,37	6,20%	2,09%
VDA	0,00%	0,00	6,52%	2,08%
Lombardia	0,38%	21,26	5,78%	2,70%
TAA	0,11%	6,29		4,93%
Veneto	0,01%	8,63	6,79%	3,57%
FVG	0,12%	60,39	6,21%	2,03%
Liguria	0,05%	6,00	6,23%	2,18%
ER	0,27%	23,88	6,91%	3,07%
Toscana	0,09%	14,94	7,77%	2,34%
Umbria	0,01%	8,12	6,20%	3,40%
Marche	0,20%	18,99	6,18%	3,54%
Lazio	0,02%	5,50	7,75%	4,73%
Abruzzo	0,00%	7,83	7,37%	3,47%
Molise	0,00%	8,28	7,37%	6,75%
Campania	0,02%	2,82	6,71%	0,73%
Puglia	0,00%	3,00	6,91%	4,13%
Basilicata	0,00%	0,00	6,32%	3,52%
Calabria	0,01%	11,13	7,84%	8,35%
Sicilia	0,02%	2,00	6,65%	3,26%
Sardegna	0,01%	8,33	8,47%	5,20%
ITALY	**0,15%**	**16,38**	**6,64%**	**3,06%**

Source: our elaboration on various sources (see table 1A).

Table 9A: Indicators of Economic Environment– Year 2005

Region	Amount of VC funding (% GDP)	N° of VC prpojects (per million employees)	New registered firms (% active firms)	Firms' rate of growth (2005 on 2004)
Piemonte	0,34%	5,62	5,74%	1,61%
VDA	0,00%	0,00	5,18%	0,28%
Lombardia	0,37%	18,56	5,00%	1,82%
TAA	0,02%	4,08	4,95%	2,40%
Veneto	0,35%	11,54	5,00%	1,73%
FVG	0,44%	37,31	5,14%	1,46%
Liguria	0,00%	1,54	4,99%	2,03%
ER	0,31%	17,93	5,74%	1,80%
Toscana	0,04%	10,87	5,95%	0,77%
Umbria	0,05%	2,68	4,93%	1,71%
Marche	0,33%	8,45	5,63%	1,65%
Lazio	0,15%	5,52	6,35%	2,71%
Abruzzo	0,04%	5,97	6,31%	3,12%
Molise	0,00%	0,00	5,99%	3,37%
Campania	0,01%	1,68	6,09%	1,59%
Puglia	0,01%	1,53	4,87%	1,62%
Basilicata	0,01%	4,60	4,04%	1,68%
Calabria	0,01%	1,53	4,41%	1,18%
Sicilia	0,00%	0,00	4,47%	2,28%
Sardegna	0,01%	8,23	5,04%	1,85%
ITALY	**0,21%**	**9,62**	**5,37%**	**1,77%**

Source: our elaboration on various sources (see table 1A).

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