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Oslo Innovation Scoreboard 2006

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Preface

This is the 3rd Innovation Scoreboard for the Oslo Region, made by NIFU STEP for Oslo Teknopol. The scoreboard has been created and modified according to the methods used by the European Regional Innovation Scoreboard 2006 (2006 RIS)[1] to generate a Revealed Regional Summary Innovation Index (RRSII) for the Oslo Region. The index locates local innovation leaders by taking into account both the region's relative performance within the EU and the region's relative performance within the country.

We would like to thank Pål Børing, Anders Ekeland, Eric Iversen and Tore Sandven at NIFU STEP - Studies of innovation, research and education for generating data and for contributing to this report, and Oslo Teknopol for the opportunity to work in this project. A special thanks to Hugo Hollanders at MERIT for adjusting the European regional database in a way that we easily could implement the Norwegian figures and data. This report has been written by Nils Henrik Solum of NIFU STEP and Morten Fraas (project leader, now working for Oslo Teknopol).

Oslo, September 2008

Per Hetland
Director

Helge Godø
Research director

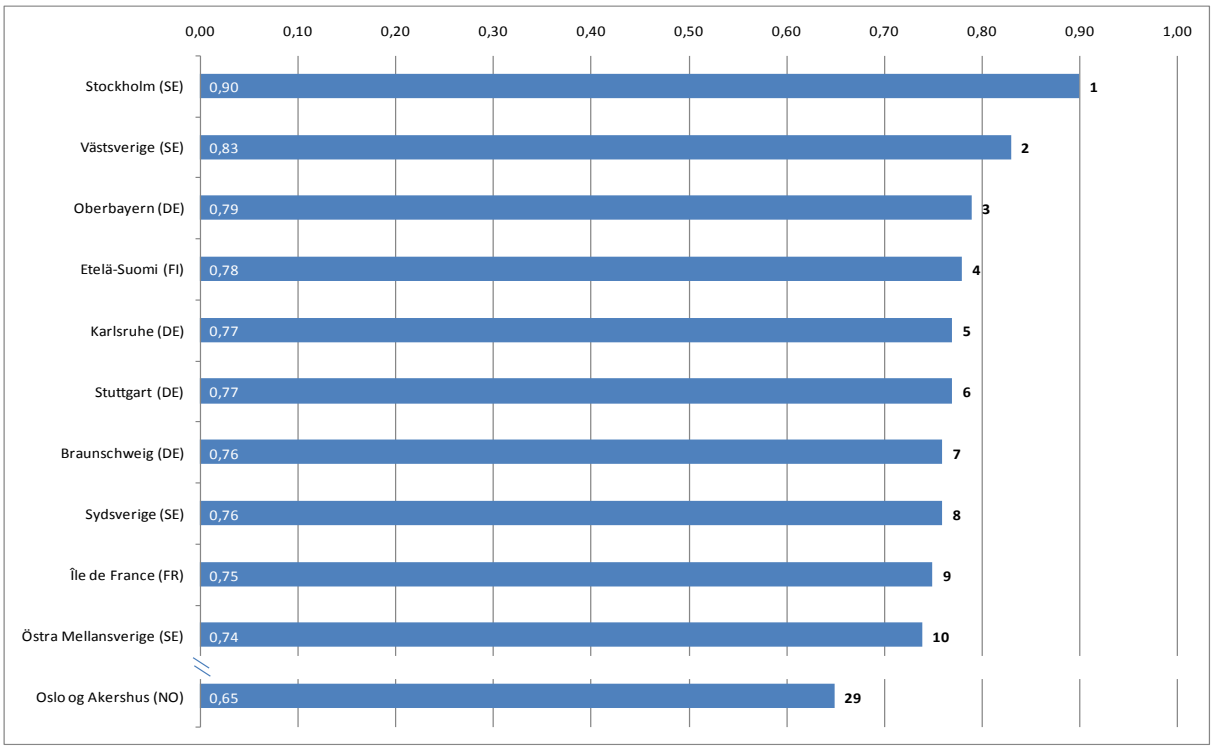
[1] A report from the European Commision's 'European Trend Chart on Innovation'. www.cordis.lu

Contents

Summary

This is the third edition of the Oslo Innovation Scoreboard (OIS)[2]. The Scoreboard for the Oslo Region (Oslo and Akershus) is specially made by NIFU STEP for Oslo Teknopol to generate a Revealed Regional Summary Innovation Index (RRSII) for the Oslo Region. The main objective of this report is to present the results of our calculation of the RRSII index for the Oslo Region. The innovation scoreboard index is an indication of the potential for economic growth in this region, and not about economic performance in itself. The index has been created and modified according to the methods used by the European Regional Innovation Scoreboard 2006 (2006 RIS). The index locates local innovation leaders by taking into account both the region's relative performance within the EU and the region's relative performance within the country.

For 2006, the RRSII score is 0.65. This puts the Oslo Region at a 29th place on the ranking of 'local innovation leaders' among European regions[3] and within the top 15% most innovative regions in Europe.



While the Oslo region has dropped from 6th to 29th place, compared to the last Oslo Innovation Scoreboard (2004), this does not give a correct impression of actual developments because the indicator has been redefined in a way that does not impact equally on all regions. Concurrently, looking at the individual indicator values used in the 2006 survey over the five year period from 2000-2004, the rank of the Oslo/Akershus region is rather constant from year to year. Another structural component that contributes to the reduction in rank of the Oslo/Akershus region between the two versions of this report, is the exclusion of the CIS data, a range of indicators where the region scored relatively well in the 2004 panel. Consequently, these factors suggest that the drop in rank is mainly a result of the redefinition of the indicator measure itself, and only to a small extent a result of a relative decline within innovation capabilities.

[2] For the two first editions see Fraas (2003) and (2004)

[3] The RRSII is a normalized index, which ranges between 0 (last region) and 1 (best region).

That said, there are factors that do impact negatively in the indicator value itself. Looking at the specific indicators, we see that business expenditure on R&D (BERD) for the Oslo/Akershus region has been reduced both in absolute value, as well as relatively, compared to the total Norwegian BERD.

Taken by itself, the result of the Oslo region seems more than satisfactory, but the scores are modest compared to countries (and regions) that Norwegian performance often is measured against. Regions in our two Scandinavian neighbors and the north-western European countries - Finland, the UK, the Netherlands, and Germany all score higher, and also regions from Eastern Europe, such as Praha (CZ), are catching up and surpassing Norwegian regions. Another point of interest is that there is a rather similar pattern of quite accentuated regional differences within most countries. In other words similarities within innovation capabilities are stronger between regions across national borders than within each nation.

Introduction

This is the Third Innovation Scoreboard for the Oslo Region, made by NIFU STEP for Oslo Teknopol. This scoreboard has been created and modified according to the methods used by the European Regional Innovation Scoreboard 2006 (2006 RIS)[4] to generate a Revealed Regional Summary Innovation Index (RRSII) for the Oslo Region (Oslo/Akershus). The indicator may be seen as a measure of the potential innovative capabilities of a region compared to other regions in Europe. It consists of measures on seven aspects of the "knowledge economy":

- Human Resources in Science and Technology
- Participation in life-long learning
- Public R&D expenditures
- Business R&D expenditures
- Employment in medium-high and high-tech manufacturing
- Employment in high-tech services
- EPO patents.

It is **not** an index on the economic performance of the regions included.

Because Norway is not a EU-member, and for this reason not included in the European Commission's version of this regional index report, we have implemented Eurostat's methodology on Norwegian data in order to compare the Oslo Region with other regions throughout Europe (EU25).

The purpose of the project

This report compares the innovation performance of the Oslo Region with other EU regions at a NUTS 2 level. This is done for all the 25 Member States in the publication from the '2006 European Regional Innovation Scoreboard (2006 RIS)'. Compared to the 'Oslo Innovation scoreboard 2004'[5], the numbers of regions have increased from 173 to 208 (not including the Oslo region) and the number of indicators used has decreased from 13 to 7. Some new indicators have also been introduced. The ranking of local leaders are based on the RRSII index (Revealed Regional Summary Innovation Index).

This index locates local innovation leaders by taking into account both the region's relative performance within the EU and the region's relative performance within the country.

Regional innovation performance

The primary aim of this project is to develop a comparative set of indicators that are used in the European Regional Innovation Scoreboard, consisting of the 7 indicators referred to below and which frame the RRSII index for the Oslo Region[6].

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[4] Hollanders, H. (2006*): European regional innovation scoreboard (2006 RIS)*, MERIT, Maastricht, 2006

[5] Fraas, M. (2004): *Oslo Innovation Scoreboard 2004*, STEP-report 04/04.

[6] In 2004 this index consisted of 13 and in 2002 this index consisted of 7 indicators.

Table 1 Indicator definitions

Indicator	Numerator	Denominator	Interpretation	Norwegian adjustment
Human Resources in Science and Technology – Core (% of population)	Number of persons who have successfully completed education at the third level in a S&T field of study and who are employed in a S&T occupation	Total population as defined in the European System of Accounts (ESA 1995[7])	A rapidly changing economic environment and a growing emphasis on the knowledge-based economy have seen mounting interest in the role and measurement of skills. Meeting the demands of the new economy is a fundamental policy issue and has a strong bearing on the social, environmental and economic well-being of the population. Data on Human Resources in Science and Technology (HRST) can improve our understanding of both the demand for, and supply of, science and technology personnel – an important facet of the new economy.	**We have only figures for 2003 and 2004, but based on the average increase in the higher education within S&T for 2000-2002 and the tendency we have extrapolated the figures for this indicator. (source: register data[8])**
Participation in life-long learning per 100 population aged 25-64)	Number of persons involved in lifelong learning	Reference population is all age classes between 25 and 64 years inclusive	A central characteristic of a knowledge economy is continual technical development and innovation. Individuals need to continually learn new ideas and skills or to participate in life-long learning. All types of learning of valuable, since it prepares people for "learning to learn". The ability to learn can then be applied to new tasks with social and economic benefits.	**We have used total figures for Norway, due to lack of regional figures. (source: EUROSTAT - European Innovation Scoreboard – Technical paper)**
Public R&D expenditures (% of GDP)	Difference between GERD (Gross domestic expenditure on R&D) and BERD (Business enterprise expenditure on R&D)	Gross domestic product as defined in the European System of Accounts (ESA 1995)	R&D expenditure represents one of the major drivers of economic growth in a knowledge-based economy. As such, trends in the R&D expenditure indicator provide key indications of the future competitiveness and wealth of the EU. Research and development spending is essential for making the transition to a knowledge-based economy as well as for improving production technologies and stimulating growth.	**(source: Science and Technology Indicators for Norway for R&D figures - Statistics Norway for GDP)**
Business R&D expenditures (% of GDP)	All R&D expenditures in the business sector (BERD)	Gross domestic product as defined in the European System of Accounts (ESA 1995)	The indicator captures the formal creation of new knowledge within firms. It is particularly important in the science-based sector (pharmaceuticals, chemicals and some areas of electronics) where most new knowledge is created in or near R&D laboratories.	**(source: Science and Technology Indicators for Norway for R&D figures - Statistics Norway for GDP)**
Employment in medium-high and high-tech manufacturing (% of total workforce)	Number of employed persons in the medium-high and high-tech manufacturing sectors. These include chemicals (NACE24), machinery (NACE29), office equipment (NACE30), electrical equipment (NACE31), telecommunications and related equipment (NACE32), precision instruments (NACE33), automobiles (NACE34) and aerospace and other transport (NACE35)	Total workforce includes all manufacturing and service sectors	The share of employment in medium-high and high technology manufacturing sectors is an indicator of the manufacturing economy that is based on continual innovation through creative, inventive activity. The use of total employment gives a better indicator than using the share of manufacturing employment alone, since the latter will be affected by the hollowing out of manufacturing in some countries.	**(source: register data)**
Employment in high-tech services (% of total workforce)	Number of employed persons in the high-tech services sectors. These include post and telecommunications (NACE64), information technology including software development (NACE72) and R&D services (NACE73)	Total workforce includes all manufacturing and service sectors.	The high technology services both provide services directly to consumers, such as telecommunications, and provide inputs to the innovative activities of other firms in all sectors of the economy. The latter can increase productivity throughout the economy and support the diffusion of a range of innovations, in particular those based on ICT.	**(source: register data)**
EPO patents per million population	Number of patents applied for at the European Patent Office (EPO), by year of filing. The national distribution of the patent applications is assigned according to the address of the inventor	Total population as defined in the European System of Accounts (ESA 1995)	The capacity of firms to develop new products will determine their competitive advantage. One indicator of the rate of new product innovation is the number of patents. This indicator measures the number of patent applications at the European Patent Office.	**For this indicator we have used patent applications that are assigned according to the address of the applier and not the inventor, but the tendency should be the same. (source: NIFU STEP and European Patent Office data)**

Source: RIS 2006 [9]

Method

The methodology has been significantly changed from the previous versions and the 2006 report. The main changes are along three dimensions; a) the weighting between national and European indicators, b) the composition of the indicator and c) the number of regions.

The changes will be commented on below in this chapter, but for a detailed review of the changes, please see Annex 2 in this report[10].

[7] Eurostat, 1995 European System of Accounts (ESA).

[8] Register data: In Norway, each individual and each organization (enterprise; establishment) has unique identification numbers, which is used in a variety of administrative and statistical registers. The main administrative registers used are population registers, taxation registers, social security registers, registers of building and dwellings, business and examination registers.

[9] Hollanders, H. (2006)

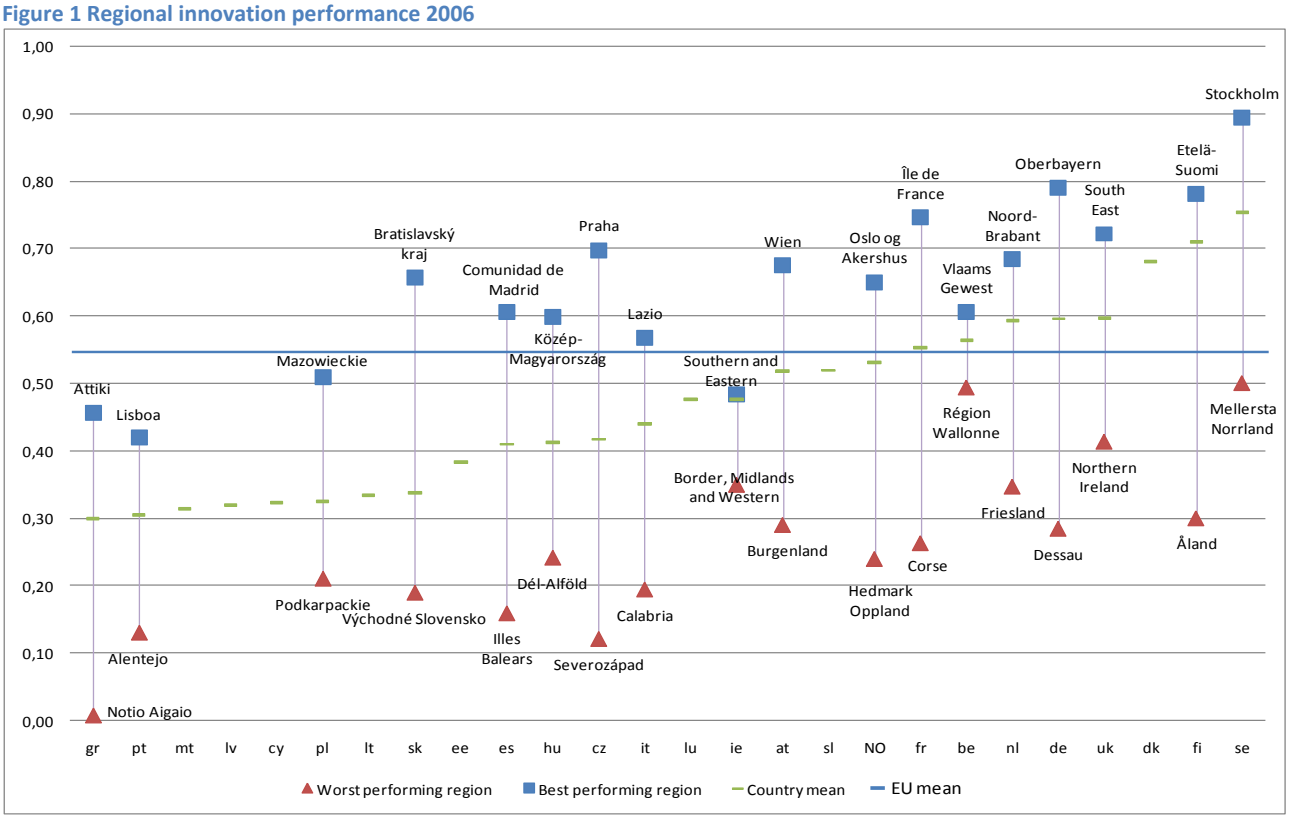
NUTS 2 classification has been used for determining the level of regional analysis. The NUTS classification does entail problems for analyzing the innovative capabilities of regions. First there are large discrepancies in the size of regions (in terms of population and economic output), both within regions and between countries. This may create anomalies, such that a small region can do comparatively well on a given indicator because of a single innovative firm or public research institute being based there. Second, some countries have very few regions. This places these regions at a disadvantage in identifying the leading regions. A country like France with 22 regions has a higher probability of turning out a leading region for one or more indicators than a country such as Belgium with only 3 regions.

Please note that it is not possible to compare the results of the 2004 and 2006 Oslo Innovation Scoreboard in a straight forward matter, due to the changes in the methodology. It should also be noted that large differences in **rank** for each region is mainly a result of the changes in methodology, and not necessarily due to changes of the *actual* innovation capabilities of the region.

Regional innovation performance

Countries are ranked according to their average regional innovation performance as measured by the RRSII and the result is shown in Figure 1. For each country, Figure 1 shows the best and worst performing region. The Swedish region Stockholm is overall the best performing region, the Greek region Notio Aigaio is overall the worst performing region.

Figure 1 Regional innovation performance 2006

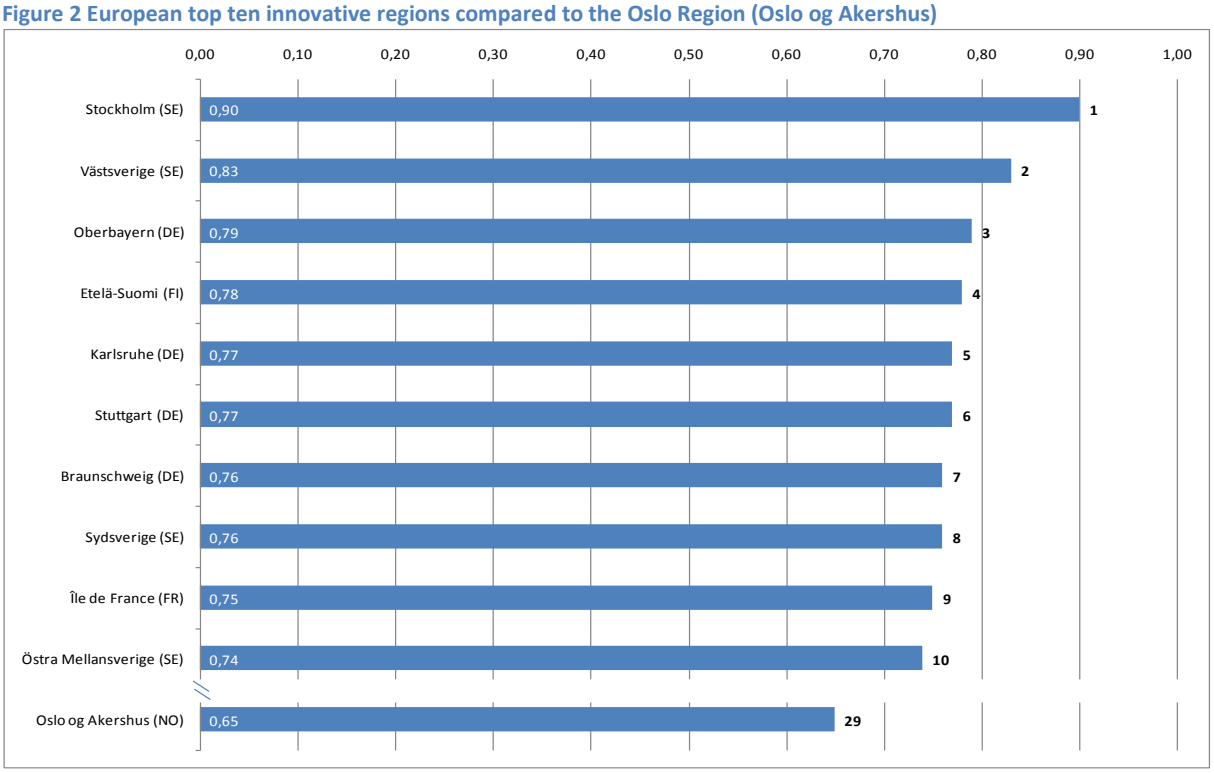


Compared to the EU members states' regional innovation performance, Norway (or more precisely the average score across Norwegian regions) rates as number nine out of 26 nations, just below the EU mean.

[10] The annex 2 is an exerpt from the European report, for full details, their technical descriptions, the consequences for calculating the indicators and how to interpret the result, please see "Methodology in the European Regional Innovation Scoreboard" (Hollander, H (2006): European regional innovation scoreboard).

This is slightly higher than the country rank of 14 (out of these 26) in the *European Innovation Scoreboard*[11]. Within Norway, Oslo/Akershus is the most innovative region, placed overall within the top 15% with a rank of 29th and an indicator value of 0,65 (See Annex 1 for a total ranking of regions).

Figure 2 European top ten innovative regions compared to the Oslo Region (Oslo og Akershus)



The ranking of both Norway and Oslo/Akershus is rather high, but the scores are modest if compared to countries (and regions) that Norwegian performance often is measured against, such as our two Scandinavian neighbors and the north-western European countries - Finland, the UK, the Netherlands, and Germany. Another point of interest though, is that the patterns of regional differences are rather similar, and quite accentuated, within most countries.

Regions can be classified into different groups using hierarchical clustering. These groups are indicated in Annex 1. The Top-10 performing regions are Stockholm in Sweden, followed by Västsverige (SE), Oberbayern (DE), Etelä-Suomi (FI), Karlsruhe (DE), Stuttgart (DE), Braunschweig (DE), Sydsverige (SE), Île de France (FR) and Östra Mellansverige (SE). As expected from the *European Innovation Scoreboard* country performance, regions from EU15 countries dominate the best performing regions with 45 regions in the Top-50 and 94 regions in the Top-100. From the new member states regions, we find Praha (CZ) on rank 15, Bratislavský kraj (SK) on rank 27, Közép-Magyarország (HU) on rank 35, Slovenia on rank 65 and Mazowieckie (PL) on rank 67.

While the Oslo region has dropped from 6th to 29th place, compared to the last Oslo Innovation Scoreboard (2004), this does not give a correct impression of actual developments since the indicator has been redefined in a way that does not impact equally on all regions. Concurrently, looking at the *individual* indicator values used to calculate the composite indicator value in the 2006 survey over the five year period from 2000-2004, the rank of the Oslo/Akershus region is rather constant from year to year. One other structural component that contributes to the reduction in rank of the Oslo/Akershus region between the two versions of this report, is the exclusion of the CIS data, a range of indicators where the region scored

[11] European Innovation Scoreboard (2006): *Comparative Analysis of Innovation Performance.* MERIT 2006.

relatively well in the 2004 panel. Both these factors suggest that the drop in rank mainly is a result of the redefinition of the indicator measure itself, and only to a small extent a result of a relative decline within innovation capabilities.

Table 1 comparing the 2004 and 2006 results, shows that the reduced indicator result is partly due to the redefinition of the indicator measure itself. On average the indicator values are 14% lower than in 2004.

Table 2 Regional innovation performance 2004 – 2006

Region (Country)	Rank (2004)	Indicator (2004)	Rank (2006)	Indicator (2006)	Change
Stockholm (SE)	1	1,00	1	0,90	-10
Uusimaa (Helsinki FI)*	2	0,97	4	0,78	-20
Oberbayern (DE)	3	0,95	3	0,79	-17
Noord-Brabant (NL)	4	0,90	20	0,68	-24
South East (UK)	5	0,87	12	0,72	-17
Oslo og Akershus (NO)	6	0,82	29	0,65	-21
Île De France (FR)	7	0,82	9	0,75	-9
Stuttgart (DE)	8	0,80	6	0,77	-4
Wien (AT)	9	0,79	24	0,68	-14
Eastern (UK)	10	0,76	17	0,69	-9

** Etelä-Suomi (FI) comprises the Helsinki region in 2006*

Looking at the specific indicators, there is one more factor that seems to contribute to a reduction in the indicator values for Oslo/Akershus. BERD, or business expenditure on R&D has been reduced both in absolute value as well as relatively compared to the total Norwegian BERD. While the total figure has grown 4% between 2001 and 2004, the corresponding result for Oslo/Akershus is a decrease in business expenditure on R&D of more than 8 per cent.

Figure 3 Regional innovation performance within Norway

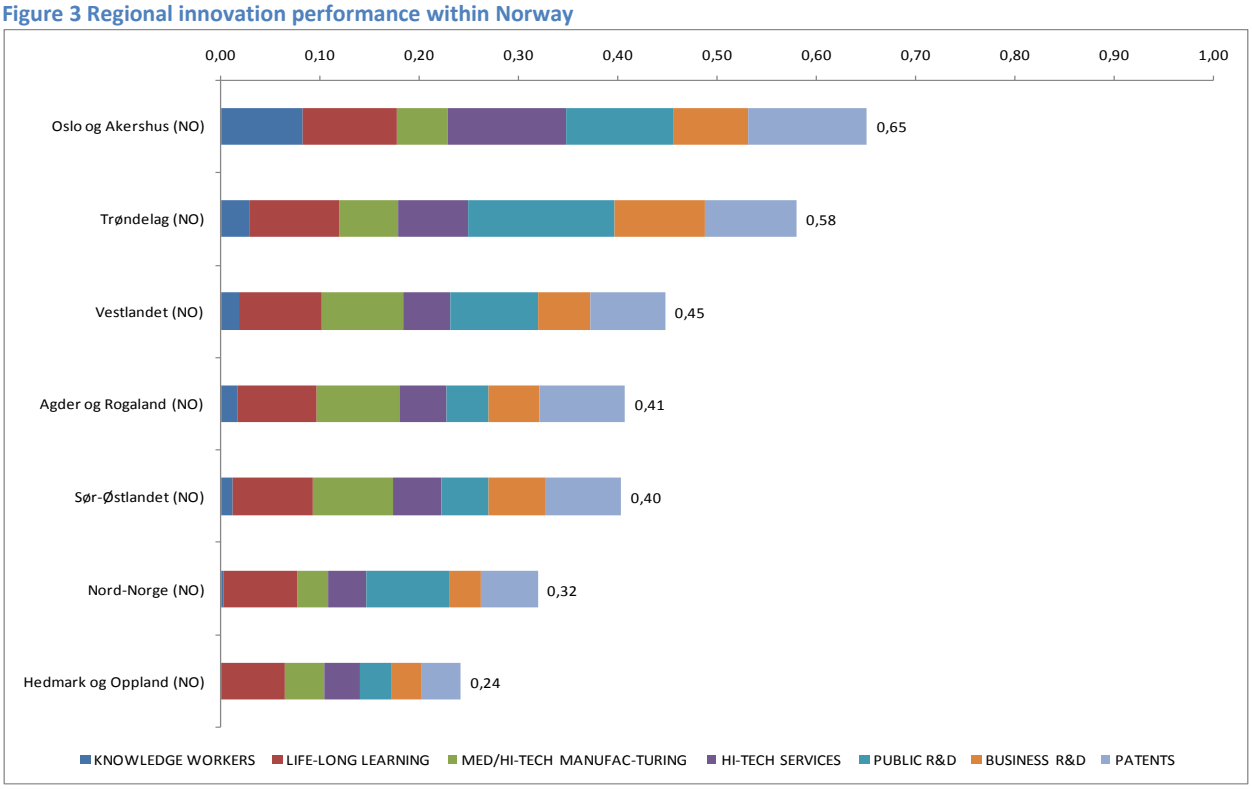


Figure 3 displays the composition of the regional innovation performance within the Norwegian regions. Compared to the other regions, Oslo and Akershus scores high in the categories “Knowledge workers” and “hi-tech services” and not too well on “med/hi-tech manufacturing”. This result is not unexpected with the industrial structure of the region in mind; “The Oslo region ranks high on innovation in Europe and has a

service-based economy with more than eighty per cent employed in the private and public service sectors"[12]. Regarding the other regions, there is perhaps one other development that merits special mentioning; Northern Norway is no longer the lowest ranked Norwegian region. Hedmark and Oppland now ranks lowest, and the explanation is that the exclusion of CIS indicators influences unfavorably on this region while having the opposite effect for Northern Norway. At the same time, BERD also contributes in opposite directions for both regions, an increase in Northern Norway concurs with a reduction of business R&D expenditure in Hedmark and Oppland for the years covered in the statistics.

Annex 3 summarizes the regional innovation performance and the relative contribution of each of the indicators for each region for which sufficient data is available. These graphs can be used to identify relative strengths and weaknesses. For example, Stockholm's relative weakness is in medium-high and high-tech manufacturing and Braunschweig's relative strength is in business R&D. These graphs can also be used to compare a region's performance with "neighboring" regions or other regions in the same group of regions.

Concluding remarks

We have assembled all the data for the set of indicators needed to calculate the RRSII (Revealed regional summary innovation index) for the Oslo Region, which have enabled us to compare the regional innovation performance across the 25 EU members, the Oslo Region and other Norwegian regions. The index is calculated according to the European Regional Innovation Scoreboard 2006 (2006 RIS)[13].

The main result is that within Norway, Oslo and Akershus is the most innovative region. Compared to all EU-25 and other Norwegian regions, Oslo and Akershus is placed within the top 15% innovative regions with a rank of 29th out of 215.

[12] Oslo - The Knowledge Region, Oslo Teknopol, [online] http://www.oslo.teknopol.no/English/MainMenu/Invest-and-work-in-Oslo/Welcome-to-Oslo/

[13] Hollanders, H. (2006).

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Oslo Teknopol (online): Oslo - The Knowledge Region, Oslo Teknopol, [online], http://www.oslo.teknopol.no/English/MainMenu/Invest-and-work-in-Oslo/Welcome-to-Oslo/

SSB (2000-2004): Register data.

Annex 1. Regional ranking of innovation performance 2006

Rank	Region (Country)	value
1	Stockholm (SE)	0,90
2	Västsverige (SE)	0,83
3	Oberbayern (DE)	0,79
4	Etelä-Suomi (FI)	0,78
5	Karlsruhe (DE)	0,77
6	Stuttgart (DE)	0,77
7	Braunschweig (DE)	0,76
8	Sydsverige (SE)	0,76
9	Île de France (FR)	0,75
10	Östra Mellansverige (SE)	0,74
11	Berlin (DE)	0,74
12	South East (UK)	0,72
13	Tübingen (DE)	0,72
14	Manner-Suomi (FI)	0,71
15	Praha (CZ)	0,70
16	Darmstadt (DE)	0,69
17	Eastern (UK)	0,69
18	Dresden (DE)	0,69
19	Köln (DE)	0,69
20	Noord-Brabant (NL)	0,68
21	Denmark (DK)	0,68
22	Pohjois-Suomi (FI)	0,68
23	Mittelfranken (DE)	0,68
24	Wien (AT)	0,68
25	Utrecht (NL)	0,66
26	Rheinhessen-Pfalz (DE)	0,66
27	Bratislavský kraj (SK)	0,66
28	Länsi-Suomi (FI)	0,65
29	**Oslo og Akershus (NO)**	**0,65**
30	Freiburg (DE)	0,63
31	Midi-Pyrénées (FR)	0,61
32	Comunidad de Madrid (ES)	0,61
33	Vlaams Gewest (BE)	0,61
34	Rhône-Alpes (FR)	0,60
35	Közép-Magyarország (HU)	0,60
36	London (UK)	0,59
37	Flevoland (NL)	0,59
38	South West (UK)	0,58
39	**Trøndelag (NO)**	**0,58**
40	Zuid-Holland (NL)	0,58
41	Gelderland (NL)	0,58
42	Noord-Holland (NL)	0,58
43	Steiermark (AT)	0,58
44	West Midlands (UK)	0,57
45	Leipzig (DE)	0,57
46	Lazio (IT)	0,57
47	Norra Mellansverige (SE)	0,57
48	Övre Norrland (SE)	0,57
49	East Midlands (UK)	0,57
50	Schwaben (DE)	0,56
51	Gießen (DE)	0,56
52	Hannover (DE)	0,56
53	Alsace (FR)	0,55
54	Unterfranken (DE)	0,55
55	Hamburg (DE)	0,55
56	Oberpfalz (DE)	0,55
57	Pais Vasco (ES)	0,55
58	North West (UK)	0,54
59	Småland med öarna (SE)	0,54
60	Limburg (NL) (NL)	0,53
61	Thüringen (DE)	0,53
62	Bremen (DE)	0,53
63	Groningen (NL)	0,52
64	Région de Bruxelles-Capitale (BE)	0,52
65	Slovenia (SI)	0,52
66	Overijssel (NL)	0,52
67	Mazowieckie (PL)	0,51
68	Bretagne (FR)	0,51
69	Franche-Comté (FR)	0,51
70	Mellersta Norrland (SE)	0,50
71	Région Wallonne (BE)	0,49
72	Itä-Suomi (FI)	0,49
73	Lombardia (IT)	0,49
74	Yorkshire and The Humber (UK)	0,49
75	Piemonte (IT)	0,49
76	Düsseldorf (DE)	0,49
77	Provence-Alpes-Côte d'Azur (FR)	0,49
78	Comunidad Foral de Navarra (ES)	0,48
79	Southern and Eastern (IE)	0,48
80	North East (UK)	0,48
81	Luxembourg (Grand-Duché) (LU)	0,48
82	Wales (UK)	0,48
83	Emilia-Romagna (IT)	0,47
84	Cataluña (ES)	0,47
85	Tirol (AT)	0,47
86	Brandenburg (DE)	0,47
87	Centre (FR)	0,46
88	Attiki (GR)	0,46
89	Picardie (FR)	0,46
90	Chemnitz (DE)	0,46
91	Scotland (UK)	0,45
92	Aragón (ES)	0,45
93	Schleswig-Holstein (DE)	0,45
94	**Vestlandet (NO)**	**0,45**
95	Oberösterreich (AT)	0,45
96	Languedoc-Roussillon (FR)	0,44
97	Liguria (IT)	0,44
98	Friuli-Venezia Giulia (IT)	0,44
99	Saarland (DE)	0,44
100	Oberfranken (DE)	0,44
101	Aquitaine (FR)	0,44
102	Vorarlberg (AT)	0,43
103	Jihovýchod (CZ)	0,43
104	Střední Cechy (CZ)	0,43
105	Kärnten (AT)	0,43
106	Arnsberg (DE)	0,43
107	Toscana (IT)	0,43
108	Detmold (DE)	0,43
109	Pays de la Loire (FR)	0,42
110	Umbria (IT)	0,42
111	Lisboa (PT)	0,42
112	Abruzzo (IT)	0,42
113	Halle (DE)	0,42
114	Auvergne (FR)	0,42
115	Limousin (FR)	0,42
116	Northern Ireland (UK)	0,41
117	Niederbayern (DE)	0,41
118	Trier (DE)	0,41
119	Salzburg (AT)	0,41
120	Münster (DE)	0,41
121	Haute-Normandie (FR)	0,41
122	Kassel (DE)	0,41
123	Basse-Normandie (FR)	0,41
124	**Agder og Rogaland (NO)**	**0,41**
125	**Sør-Østlandet (NO)**	**0,40**
126	Lorraine (FR)	0,40
127	Veneto (IT)	0,40
128	Drenthe (NL)	0,38
129	Estonia (EE)	0,38
130	Koblenz (DE)	0,38
131	Lüneburg (DE)	0,38
132	Mecklenburg-Vorpommern (DE)	0,37
133	Niederösterreich (AT)	0,37
134	Bourgogne (FR)	0,36
135	Comunidad Valenciana (ES)	0,36
136	Zeeland (NL)	0,36
137	Marche (IT)	0,35
138	Border, Midlands and Western (IE)	0,35
139	Malopolskie (PL)	0,35
140	Castilla y León (ES)	0,35
141	Friesland (NL)	0,35
142	Magdeburg (DE)	0,35
143	Jihozápad (CZ)	0,34
144	Severovýchod (CZ)	0,34
145	Nord - Pas-de-Calais (FR)	0,34
146	Poitou-Charentes (FR)	0,34
147	Galicia (ES)	0,34
148	Lithuania (LT)	0,33
149	Közép-Dunántúl (HU)	0,33
150	Cyprus (CY)	0,32
151	Champagne-Ardenne (FR)	0,32
152	Weser-Ems (DE)	0,32
153	**Nord-Norge (NO)**	**0,32**
154	Latvia (LV)	0,32
155	Malta (MT)	0,31
156	Střední Morava (CZ)	0,31
157	Poludniowo-Zachodni (PL)	0,31
158	Campania (IT)	0,31
159	Centro (PT) (PT)	0,31
160	Åland (FI)	0,30
161	Lódzkie (PL)	0,29
162	Slaskie (PL)	0,29
163	Burgenland (AT)	0,29
164	Región de Murcia (ES)	0,29
165	Basilicata (IT)	0,29
166	Dessau (DE)	0,29
167	Lubelskie (PL)	0,27
168	Pólnocny (PL)	0,27
169	Cantabria (ES)	0,27
170	Kentriki Makedonia (GR)	0,27
171	Molise (IT)	0,27
172	Principado de Asturias (ES)	0,27
173	Stredné Slovensko (SK)	0,27
174	Corse (FR)	0,26
175	Andalucia (ES)	0,26
176	Valle d'Aosta/Vallée d'Aoste (IT)	0,26
177	Západné Slovensko (SK)	0,26
178	Pólnocno-Zachodni (PL)	0,26
179	Észak-Alföld (HU)	0,26
180	Kriti (GR)	0,26
181	Dél-Dunántúl (HU)	0,26
182	Nyugat-Dunántúl (HU)	0,25
183	Sicilia (IT)	0,25
184	Észak-Magyarország (HU)	0,25
185	Dél-Alföld (HU)	0,24
186	Moravskoslezko (CZ)	0,24
187	**Hedmark og Oppland (NO)**	**0,24**
188	La Rioja (ES)	0,23
189	Dytiki Ellada (GR)	0,23
190	Canarias (ES)	0,23
191	Sardegna (IT)	0,23
192	Puglia (IT)	0,22
193	Norte (PT)	0,22
194	Podkarpackie (PL)	0,21
195	Calabria (IT)	0,20
196	Východné Slovensko (SK)	0,19
197	Algarve (PT)	0,19
198	Ipeiros (GR)	0,19
199	Sterea Ellada (GR)	0,17
200	Extremadura (ES)	0,17
201	Castilla-la Mancha (ES)	0,17
202	Illes Balears (ES)	0,16
203	Alentejo (PT)	0,13
204	Anatoliki Makedonia, Thraki (GR)	0,13
205	Severozápad (CZ)	0,12
206	Peloponnisos (GR)	0,10
207	Thessalia (GR)	0,10
208	Dytiki Makedonia (GR)	0,07
209	Voreio Aigaio (GR)	0,04
210	Notio Aigaio (GR)	0,01
211	Ionia Nisia (GR)	
212	Provincia Autonoma Bolzano-Bozen (IT)	
213	Provincia Autonoma Trento (IT)	
214	Swietokrzyskie (PL)	
215	Podlaskie (PL)	

Annex 2. Notes on methodology

This entire chapter (Annex 2) is an excerpt from the *2006 European regional innovation scoreboard* and is included since it gives an extensive explanation of the construction of the indicator values and changes in the methodology.[14]

3. Methodology

The 2003 RIS used a composite indicator - the Revealed Regional Summary Innovation Index (RRSII) - to locate *local* leaders by taking into account both the region's relative performance within the EU and the region's relative performance within the country[15]. Building upon the methodology used in the 2003 RIS, two indexes are calculated of which a weighted mean is taken for the Revealed Regional Summary Innovation Index (RRSII):

RNSII (Regional National Summary Innovation Index) - The average of the re-scaled relative to the country mean indicator values:

$$RNSII_{jkt} = \frac{1}{m}\sum_{j=1}^{m} x^{n}_{ijkt} \text{ , where } x^{n}_{ijkt} = \frac{\sqrt[p]{\left(\frac{X_{ijkt}}{X_{ikt}}\right)} - \sqrt[p]{\underset{\forall k,\forall t}{Min}\left(\frac{X_{ijkt}}{X_{ikt}}\right)}}{\sqrt[p]{\underset{\forall k,\forall t}{Max}\left(\frac{X_{ijkt}}{X_{ikt}}\right)} - \sqrt[p]{\underset{\forall k,\forall t}{Min}\left(\frac{X_{ijkt}}{X_{ikt}}\right)}}$$

RE

USII (Regional European Summary Innovation Index - The average of the re-scaled relative to the EU25 mean indicator values:

$$REUSII_{jkt} = \frac{1}{m}\sum_{j=1}^{m} x^{eu}_{ijkt} \text{ , where } x^{eu}_{ijkt} = \frac{\sqrt[p]{\left(\frac{X_{ijkt}}{X_{iEU25t}}\right)} - \sqrt[p]{\underset{\forall k,\forall t}{Min}\left(\frac{X_{ijkt}}{X_{iEU25t}}\right)}}{\sqrt[p]{\underset{\forall k,\forall t}{Max}\left(\frac{X_{ijkt}}{X_{iEU25t}}\right)} - \sqrt[p]{\underset{\forall k,\forall t}{Min}\left(\frac{X_{ijkt}}{X_{iEU25t}}\right)}}$$

wh

ere X_{ijkt} is the value of indicator *i* for region *j* in country *k* and time *t* and *m* is the number of indicators for which regional data are available, X_{ikt} is the country average for indicator *i* for country *k* at time *t*, and $X_{iEU\,25t}$ is the EU25 average for indicator *i* at time *t*. The maximum and minimum values for each indicator are determined over the full 5 year period. In the re-scaling process a power-root transformation has been

[14] Hugo Hollanders, 2006 European regional innovation scoreboard (2006 RIS), MERIT, Maastricht, 2006

[15] The RRSII was designed to pinpoint 'local leaders'. Regions in highly performing countries will always look more favourable when compared directly to regions from less performing countries.

applied to correct for possible problems of outliers and skewed data distributions[16]. For Human resources, public R&D, business R&D, medium/high-tech manufacturing employment and high-tech services employment a square-root transformation has been used (with *p* equal to 2 in the formulas above). For life-long learning and EPO patents a double-square-root transformation has been used (with *p* equal to 4 in the formulas above). Both composite indicators are only calculated when data are available for at least 6 indicators.

Both RNSII and REUSII are re-scaled to fit the [0,1] range for each year before entering the RRSII calculation:

$$\overline{RNSII}_{jkt} = \frac{(RNSII_{jkt} - \min_{\forall k}(RNSII_{jkt}))}{(\max_{\forall k}(RNSII_{jkt}) - \min_{\forall k}(RNSII_{jkt}))}$$

$$\overline{REUSII}_{jkt} = \frac{(REUSII_{jkt} - \min_{\forall k}(REUSII_{jkt}))}{(\max_{\forall k}(RNEUSII_{jkt}) - \min_{\forall k}(REUSII_{jkt}))}$$

The RRSII is then calculated as the weighted average of the re-scaled values for RNSII and REUSII:

$$RRSII_{jkt} = \tfrac{3}{4} * \overline{REUSII}_{jkt} + \tfrac{1}{4} * \overline{RNSII}_{jkt}$$

Identifying local leaders reduces the influence of those indicators for which a country has an above average performance. Peaks for indicators for which the country performs well above the EU mean are thus adjusted downwards; peaks for indicators for which the country performs well below the EU mean are thus adjusted upwards. The RRSII will thus increase the composite indicator value for leading regions in lagging countries: local leaders become more visible.

5. Changes in methodology

Between 2002 and 2006, the methodology of calculating the composite innovation index has changed. Table 6 summarizes these changes. The 2002 RIS used the most 'simple' methodology, data were not transformed nor re-scaled and both the national and European component received an equal weights. The 2003 RIS introduced the re-scaling of the indicators and also included 5 indicators from the 2nd Community Innovation Survey (CIS). The 2006 RIS introduces the transformation of the data, with a square root transformation for 5 indicators and a double-square root transformation for 2 indicators. The 2006 RIS uses a smaller weight for the national component of ¼ only. Another change has been the division by the country average respectively the EU25 average in the calculation of the national respectively European component.

Due to these changes in the methodology of calculating the RRSII, one needs to be careful comparing the results between the 2002, 2003 and 2006 RIS. As illustrated in Table 7, a region's rank can change significantly over time due to these changes. Two cases are highlighted, Noord-Brabant and Comunidad De

[16] Nardo, M. M. Saisana, A. Saltelli and S. Tarantola (EC/JRC), A. Hoffman and E. Giovannini (OECD), Handbook On Constructing Composite Indicators: Methodology And User Guide, OECD Statistics Working Paper (http://www.olis.oecd.org/olis/2005doc.nsf/LinkTo/std-doc(2005)3).

Madrid. Noord-Brabant is showing a large drop in rank, from 3 in 2002 and 4 in 2003 to 20 in 2006. Comunidad de Madrid shows a drop from 9 in 2002, to 13 and 2003 and 31 in 2006.

Table 6. Changes in methodology over time

	2002 RIS	2003 RIS	2006 RIS
Transformation of the data	No	No	Square root transformation for 5 indicators, double-square root transformation for 2 indicators
Re-scaling of the data	No	'MinMax'	'MinMax'
Indicator weights	Equal	0.5 for CIS indicators, 1 for other indicators	Equal
RNSII	$\left(\frac{100}{m}\right)*\sum_{i}^{m}\frac{X_{ijk}}{X_{ik}}$	$\sum_{j=1}^{m} x_{ijk}^{n}$ where $x_{ijk}^{n}=\frac{X_{ijk}-Min(X_{jik})}{Max(X_{ijk})-Min(X_{ijk})}$	$\sum_{j=1}^{m} x_{ijk}^{n}$ where $x_{ijk}^{n}=\frac{\sqrt[p]{\left(\frac{X_{ijk}}{X_{ik}}\right)}-\sqrt[p]{\underset{\forall k}{Min}\left(\frac{X_{ijk}}{X_{ik}}\right)}}{\sqrt[p]{\underset{\forall k}{Max}\left(\frac{X_{ijk}}{X_{ik}}\right)}-\sqrt[p]{\underset{\forall k}{Min}\left(\frac{X_{ijk}}{X_{ik}}\right)}}$
REUSII	$\left(\frac{100}{m}\right)*\sum_{i}^{m}\frac{X_{ij}}{EU_{i}}$	$\sum_{j=1}^{m} x_{ijk}^{eu}$ where $x_{ijk}^{eu}=\frac{X_{ijk}-Min(X_{ij})}{Max(X_{ij})-Min(X_{ij})}$	$\sum_{j=1}^{m} x_{ijk}^{eu}$ where $x_{ijk}^{eu}=\frac{\sqrt[p]{\left(\frac{X_{ijk}}{X_{i,EU25}}\right)}-\sqrt[p]{\underset{\forall k}{Min}\left(\frac{X_{ijk}}{X_{i,EU25}}\right)}}{\sqrt[p]{\underset{\forall k}{Max}\left(\frac{X_{ijk}}{X_{i,EU25}}\right)}-\sqrt[p]{\underset{\forall k}{Min}\left(\frac{X_{ijk}}{X_{i,EU25}}\right)}}$
Weight of national component (φ)	½	½	¼

Where *Xijk* is the value of indicator i for region j in country k, *X ik* is the value of indicator i for country k, *X i,EU*25 is the value of indicator i for the EU and m is the number of indicators for which regional data are available.

Table 7 Effect of changes in methodology on the ranking of regions

2002 RIS		Rank	RRSII	2003 RIS		Rank	RRSII	2006 RIS		Rank	RRSII
Stockholm	SE	1	225	Stockholm	SE	1	1.00	Stockholm	SE	1	0.90
Uusimaa (Suuralue)	FI	2	208	Uusimaa (suuralue)	FI	2	0.97	Västsverige	SE	2	0.83
Noord-Brabant	**NL**	**3**	**191**	Oberbayern	DE	3	0.95	Oberbayern	DE	3	0.79
Eastern	UK	4	161	**Noord-Brabant**	**NL**	**4**	**0.90**	Etelä-Suomi	FI	4	0.78
Pohjois-Suomi	FI	5	161	South East	UK	5	0.87	Karlsruhe	DE	5	0.77
Île De France	FR	6	160	Île De France	FR	6	0.82	Stuttgart	DE	6	0.77
Bayern	DE	7	151	Stuttgart	DE	7	0.80	Braunschweig	DE	7	0.76
South East	UK	8	150	Wien	AT	8	0.79	Sydsverige	SE	8	0.76
Comunidad De Madrid	**ES**	**9**	**149**	Eastern	UK	9	0.76	Île de France	FR	9	0.75
Baden-Württemberg	DE	10	146	Karlsruhe	DE	10	0.75	Östra Mellansverige	SE	10	0.74
Wien	AT	17	126	Southern and Eastern	IE	11	0.74	South East	UK	12	0.73
Vlaams Gewest	BE	21	112	**Comunidad De Madrid**	**ES**	**13**	**0.72**	Praha	CZ	15	0.70
Lombardia	IT	22	112	Bruxelles/Brussels	BE	14	0.71	**Noord-Brabant**	**NL**	**20**	**0.68**
Southern And Eastern	IE	31	108	Lombardia	IT	22	0.67	Wien	AT	24	0.68
Lisboa E Vale Do Tejo	PT	49	94	Attiki Aigaio	EL	29	0.61	Bratislavský kraj	SK	27	0.66
Attiki Aigaio	EL	50	93	Lisboa e Vale do Tejo	PT	30	0.60	**Comunidad de Madrid**	**ES**	**31**	**0.61**
								Vlaams Gewest	BE	32	0.61
								Közép-Magyarország	HU	34	0.60
								Lazio	IT	44	0.57
								Mazowieckie	PL	65	0.51
								Southern and Eastern	IE	78	0.48
								Attiki Aigaio	EL	86	0.46
								Lisboa e Vale do Tejo	PT	108	0.42

Figure 2 Changes in rankings explained: Noord-Brabant and Comunidad De Madrid

Noord-Brabant

Weighting of national and European composite indicators	RE-SCALING OF THE DATA			
	YES		NO	
	TRANSFORMATION OF THE DATA		TRANSFORMATION OF THE DATA	
	YES	NO	YES	NO
Φ = 1 / 2	19	12	14	**4**
Φ = 1 / 3	22	14	20	5
Φ = 1 / 4	20	13	23	5

1. Re-scaling leads to lower rank of 8 spots when data are not transformed (φ=1/4). Re-scaling leads to a higher rank of 3 spots when data are transformed (φ=1/4).
2. Transformation leads to lower rank of about 7 spots when data are re-scaled (φ=1/4) and to a lower rank of 18 spots when data are not re-scaled (φ=1/4).
3. Weighting has only a small impact on ranking when data are re-scaled.

Comunidad de Madrid

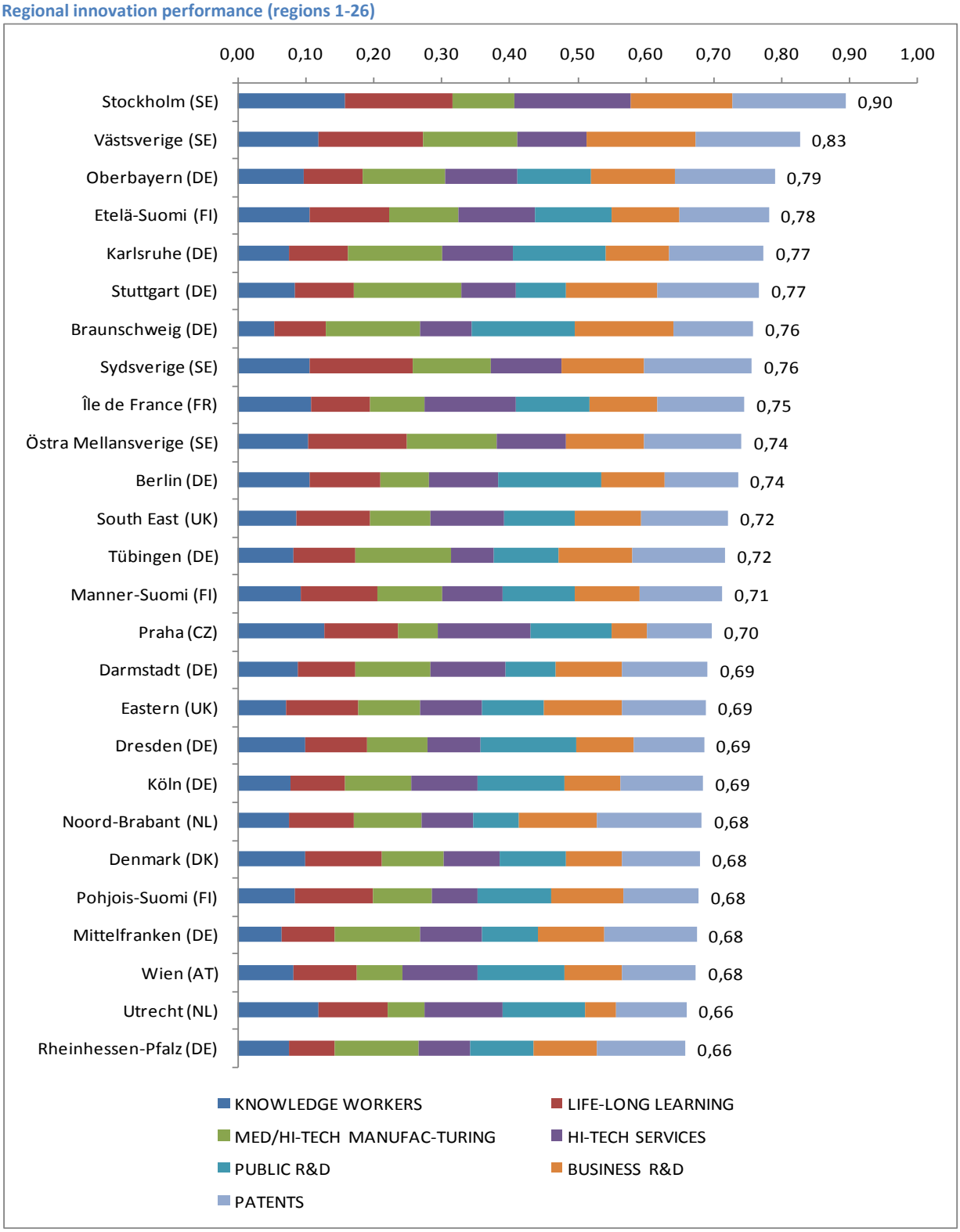
Weighting of national and European composite indicators	RE-SCALING OF THE DATA			
	YES		NO	
	TRANSFORMATION OF THE DATA		TRANSFORMATION OF THE DATA	
	YES	NO	YES	NO
Φ = 1 / 2	22	**20**	19	30
Φ = 1 / 3	30	30	25	40
Φ = 1 / 4	31	32	26	49

1. Re-scaling leads to lower rank of 5 spots when data are transformed (φ=1/4). Re-scaling leads to a higher rank of 17 spots when data are not transformed (φ=1/4).
2. Transformation has almost no impact on ranking when data are re-scaled (φ=1/4). Transformation leads to a higher rank of about 23 spots when data are not re-scaled (φ=1/4).
3. Weighting leads to lower rank of 9 spots when the national component receives a weight of 25% instead of 50% when data are re-scaled and transformed.

For Noord-Brabant, it is both the introduction of the re-scaling of data and the transformation of the data that causes a severe drop of about 16 spots in the region's rank between 2002 and 2006 (Figure 2). Changes in the weighting of the national component has almost no impact on the rank of this region. For Comunidad De Madrid, transforming the data has almost no impact on the ranking of the region once the data have been re-scaled. Re-scaling the data leads to an drop of 5 spots once the date have been transformed. For Comunidad De Madrid it is primarily the change in the weight of the national component which has the biggest impact on the rank of the region. Decreasing this weight from 50% to 25% will lead to a drop of about 19 spots in 2006.

Annex 3. The contribution of each indicator to the RRSII

Regional innovation performance (regions 1-26)



Regional innovation performance (regions 27-52)

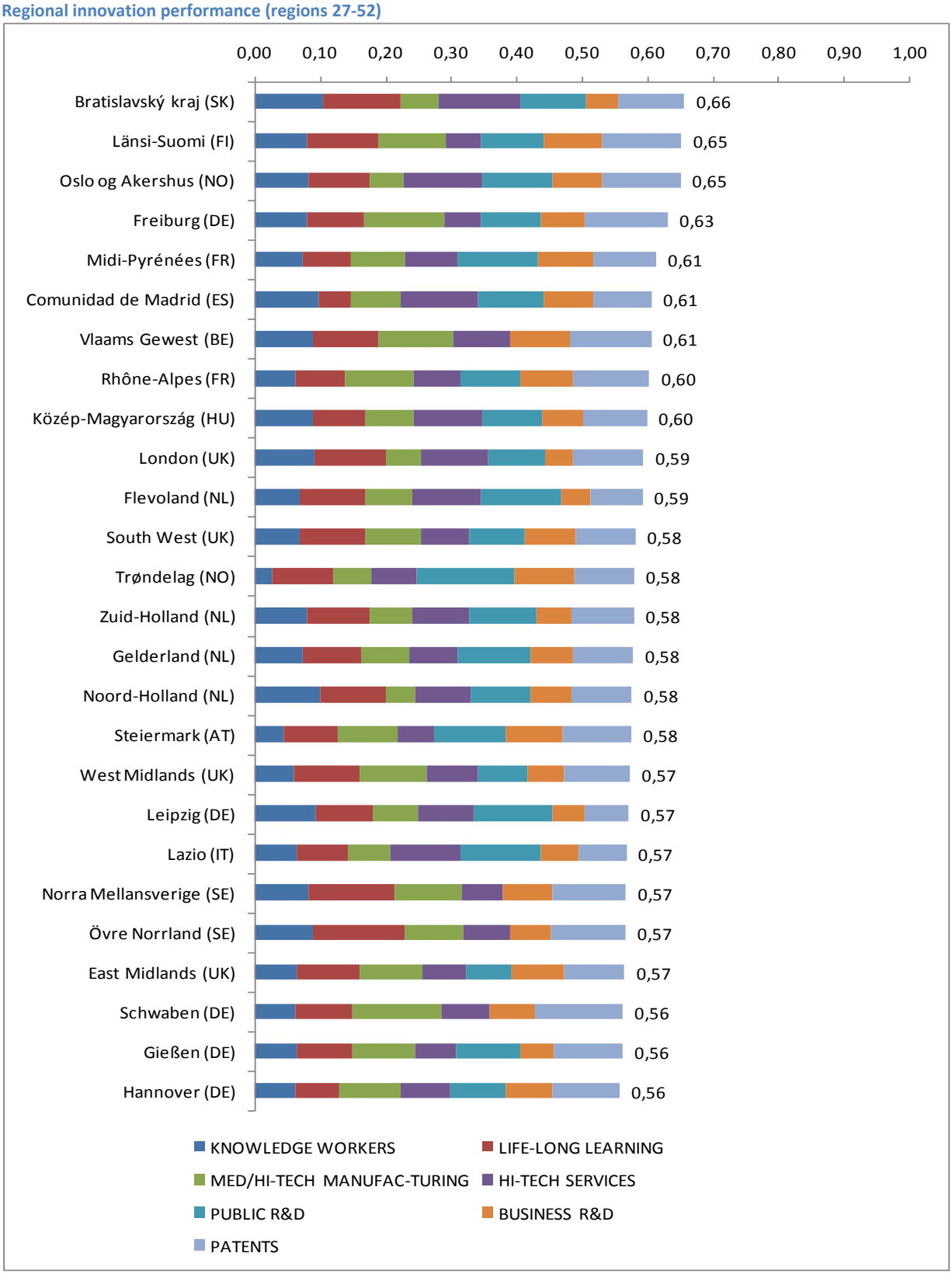
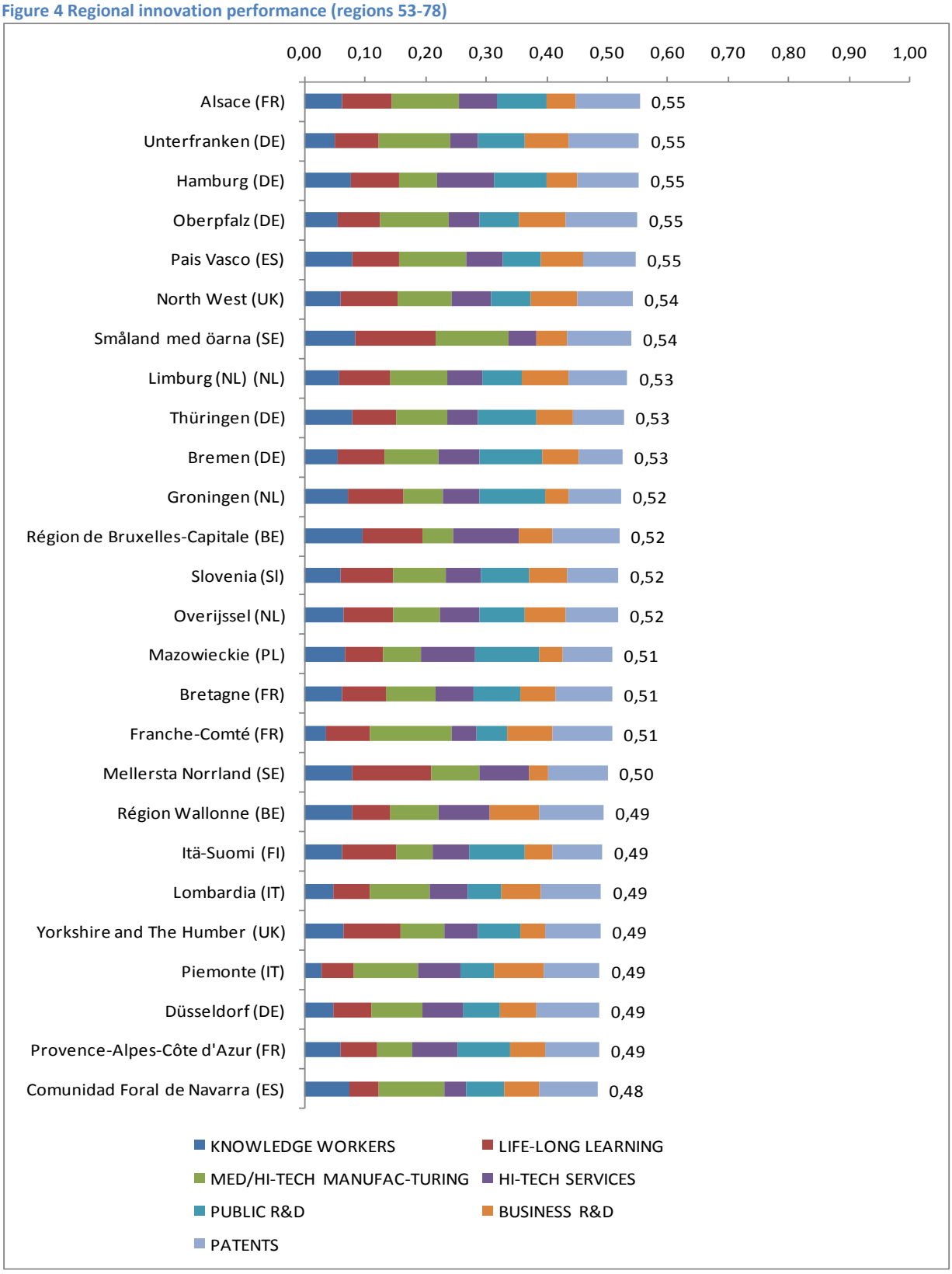
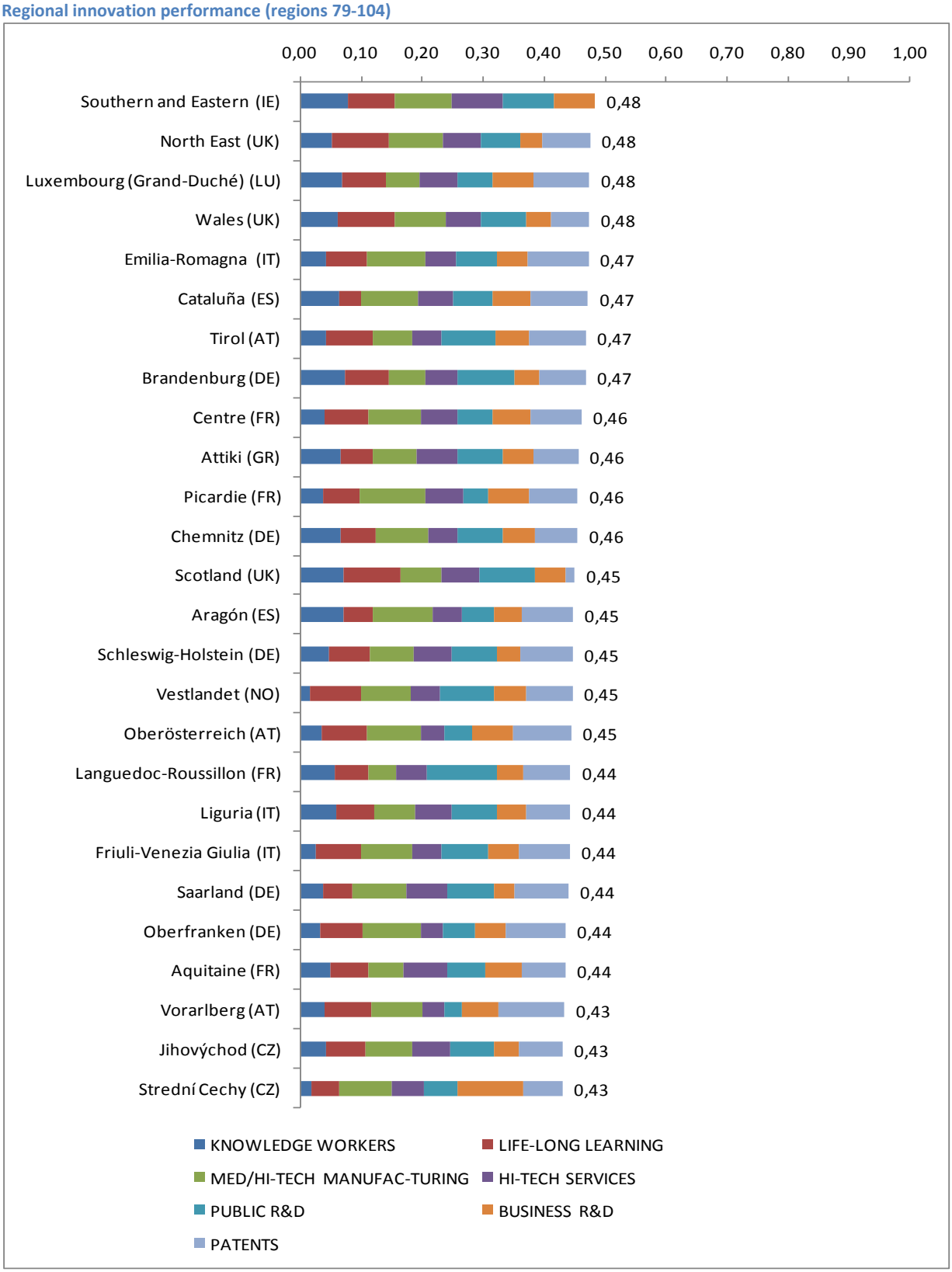


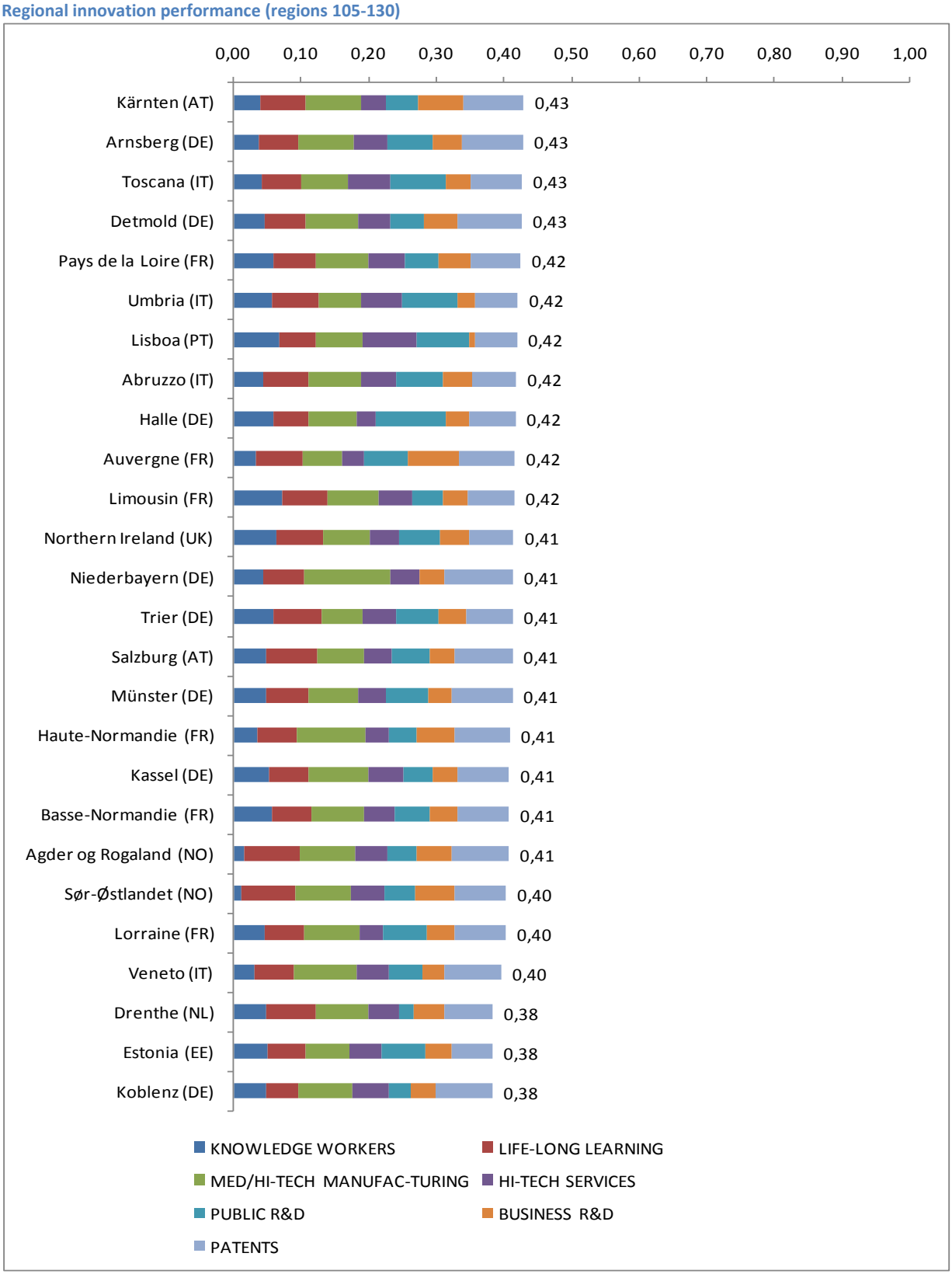
Figure 4 Regional innovation performance (regions 53-78)



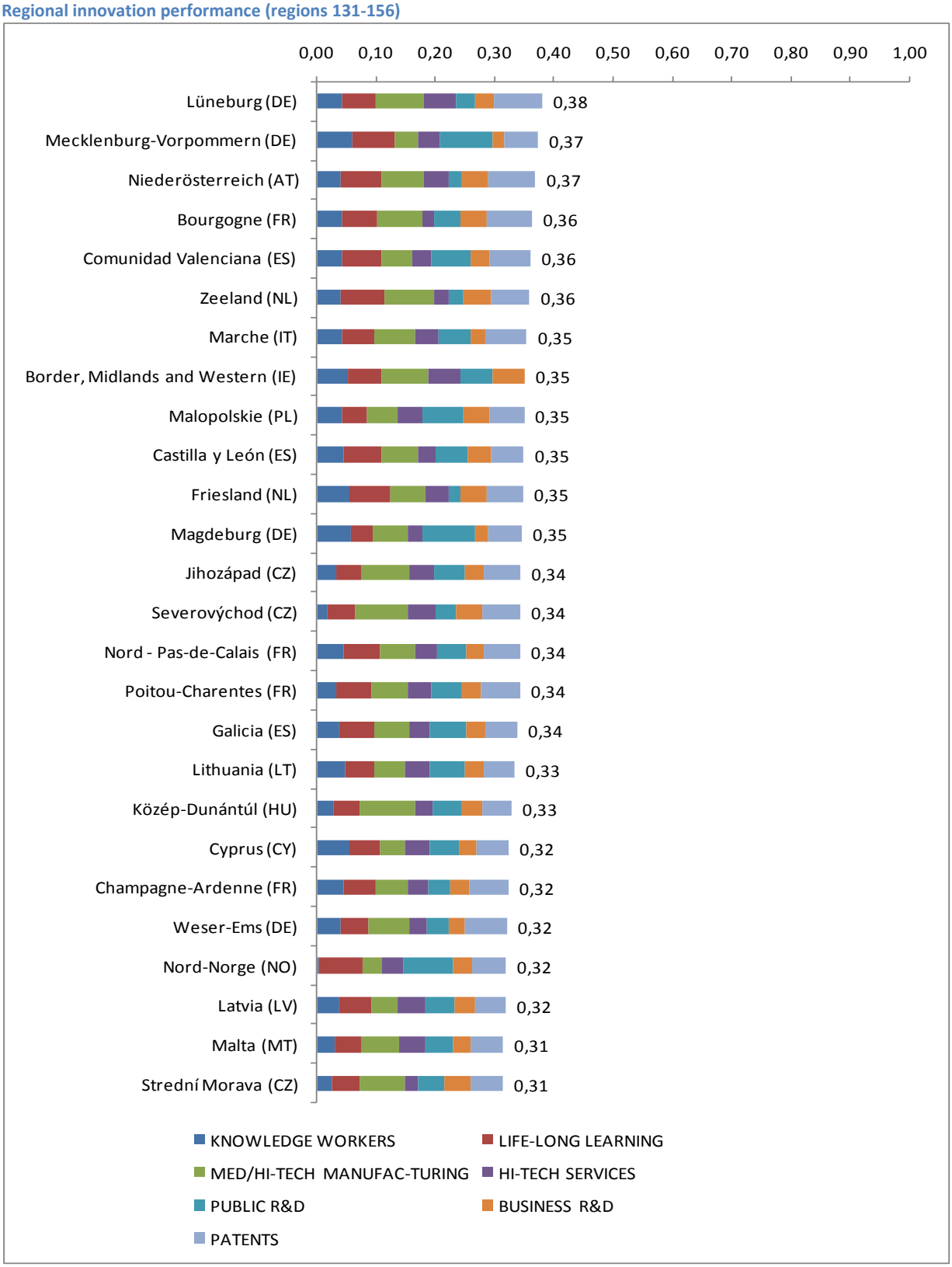
Regional innovation performance (regions 79-104)



Regional innovation performance (regions 105-130)



Regional innovation performance (regions 131-156)



Regional innovation performance (regions 157-182)

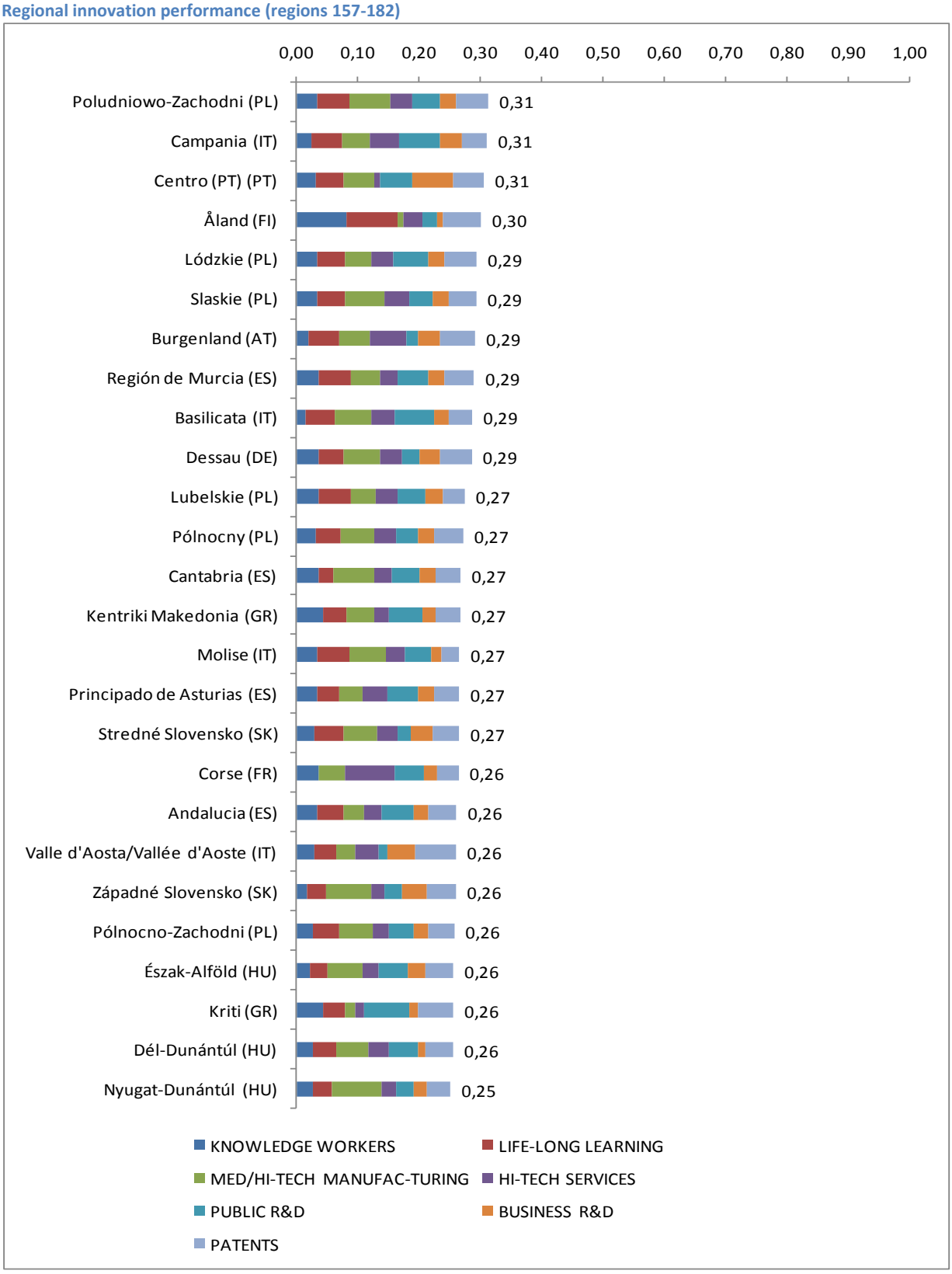


Figure 5 Regional innovation performance (regions 183-208)