



**European Committee  
of the Regions**

# **The future of industry in Europe**

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# Table of Contents

- Executive Summary .....1**
- 1. Industry in Europe and its regions.....3**
  - 1.1 Industry in the European regions: an overview .....5
  - 1.2 Trade specialisation and attractiveness of European regions ..... 10
  - 1.3 Workers in industry ..... 16
  - 1.4 Innovation in industry .....23
- 2. The future of traditional industries and industries of the future: the evolving reality of industry in a global context .....27**
  - 2.1 Towards a new vision for a future oriented EU industrial policy .....27
  - 2.2 The changing role of industry in the global economy ..... 31
- 3. Key challenges for European industry and their territorial implications .45**
  - 3.1 Designing the pattern of industrial specialisation .....46
  - 3.2 Enhancing industrial enterprise efficiency in the use of inputs ..... 51
  - 3.3 Supporting industrial enterprises to become more market connected .....53
  - 3.4 Adapt institutional capabilities to new industrial challenges..... 56
- 4. How LRAs are responding to the challenges.....59**
  - 4.1 LRAs designing the pattern of industrial specialisation ..... 60
  - 4.2 LRAs supporting industrial enterprise efficiency for using inputs ..... 69
  - 4.3 LRAs supporting industry become more market connected..... 75
  - 4.4 LRAs adopting solutions to be more responsive to industrial enterprise needs..... 78
- 5. Conclusions and recommendations ..... 81**
- Annex 1. Maps and figures .....85**
- Annex II. Methodology .....113**
- Annex III. References .....123**
- Annex IV. Main findings, recommendations and policy options (Power Point presentation).....131**



# List of abbreviations

CoR	Committee of the Regions
EC	European Commission
EPO	European Patent Office
ESPON	European Observation Network, Territorial Development and Cohesion
ET 2020	Education and Training 2020
EU	European Union
EU15	Austria (AT), Belgium (BE), Denmark (DK), Finland (FI), France (FR), Germany (DE), Greece (EL), Ireland (IE), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT), Spain (ES), Sweden (SE), United Kingdom (UK)
EU13	Bulgaria (BG), Croatia (HR), Cyprus (CY), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Malta (MT), Poland (PL), Romania (RO), Slovakia (SK), Slovenia (SI)
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IoT	Internet of Things
KIT	Knowledge, Innovation, Territory
LRA	Local Regional Authorities
NEET	Not in Education, Employment or Training
NUTS	Nomenclature of Units for Territorial Statistics
OECD	Organisation for Economic Co-operation and Development
OSCE	Organisation for Security and Co-operation in Europe
R&D	Research and Development
RDTI	Research, Development, Technology and Innovation
RIS3	Research and Innovation Strategy for Smart Specialisation



# Executive Summary

This study analyses the key challenges for Local and Regional Authorities (LRAs) in developing a long-term, structured industrial policy, with a global view. The policy should promote structural change and raise the industrial contribution to GDP to the 20% target set by the European Commission (EC) in December 2014.

New means of production incorporate a mix of processes located in both high-cost and low-cost countries and are based on a wide range of factors enabled by technological developments. Significant changes in consumption are increasingly driven by individual needs which are more sensitive to social and environmental aspects. Together these require a more flexible, hybrid and servitisation-oriented industrial paradigm.

The way LRAs can guide this shift strictly depends on their ability to combine strengths in traditional sectors with innovative trajectories of industrial development in dynamic new sectors. Faced with a growing complexity of industrial challenges, LRAs are called on to design and implement a systemic industrial policy coordinated with national and EU level policies, pulled by vision and pushed by competition.

The report is structured as follows:

- **Chapter 1** presents an overview of the current situation of industry in European Union (EU) regions. It describes trends of industrial specialisation in regions, the key characteristics of industrial enterprises, trade specialisation in EU regions and their capacity to attract foreign direct investments (FDI). It then focuses on key characteristics of the industrial labour force, such as the role of education and labour productivity. It also offers an analysis of regional industrial capacity to innovate and invest in R&D. Finally, the chapter investigates the regional institutional framework, by looking at the quality of government and infrastructure.
- **Chapter 2** reviews the future of regional industrial specialisation in the EU. Firstly is a review of the industrial policy vision of the EC, looking at key industrial sectors on which European institutions are concentrating policy strategy. The chapter then focuses on the future role of industry in the global economy, by looking at the expected changing trends in both supply and demand. Finally, by looking at key variables, the chapter

analyses the potential future direction of industrial specialisation in EU regions.

- **Chapter 3** analyses the key challenges for LRAs in designing and implementing an industrial policy in the evolving industrial landscape. It explores the challenges faced by LRAs in designing the pattern of specialisation, the enhancement of industrial enterprise efficiency in the use of inputs, support for industrial enterprises to become more globally connected and the adaptation of institutional capabilities to the new industrial challenges.
- **Chapter 4** describes how LRAs are responding to the challenges identified in Chapter 3, by looking at current approaches and strategies. This chapter includes case examples from EU territories.
- **Chapter 5** summarises the main policy conclusions of the report and presents key recommendations for LRAs.
- **Annex I** contains the maps and figures used in Chapter 1 and Chapter 2.
- **Annex II** presents the methodology used for the analysis carried out in Chapter 1 and Chapter 2 and the main data sources.
- **Annex III** contains references to the studies, reports and academic research used in the report.
- **Annex IV** presents the slides in Power Point containing the main findings, recommendations and policy options.



# 1. Industry in Europe and its regions

In recent years the European Commission has put more emphasis on the importance of the real economy and strong industry as an engine of economic growth and employment<sup>1</sup>. According to its policy vision, the target for the contribution of industry to GDP by 2020 has been raised to 20%<sup>2</sup>.

A strong industrial base is perceived as fundamental for Europe's economic recovery and competitiveness. Some figures highlight the current significance of industry in generating growth and job opportunities, in Europe industry<sup>3</sup>:

- in terms of value added, makes up 17.3% of European GDP (2015)<sup>4</sup>;
- attracts 80% of private research and innovation<sup>5</sup>;
- employs 23.6% of European workers and, for each additional job in manufacturing, creates 0.5-2 jobs in other sectors<sup>6</sup>;
- accounts for over 80% of Europe's exports, generating a €365 billion surplus in the trade of manufactured products<sup>7</sup>;
- has a high domestic content of manufacturing exports, at around 85% of value added and more sophistication and complexity than goods exported by many other economies<sup>8</sup>;

Moreover, the EU is a major producer of new knowledge in Key Enabling Technologies (KETs). Products based on industrial biotechnology or advanced materials have higher technology content than competing North American or East Asian products<sup>9</sup>.

However, although industry still provides a significant contribution to the European economy, this share has steadily declined<sup>10</sup>. Industry's share of gross value added has followed this declining path in all western European countries

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<sup>1</sup> European Commission (2010a); European Commission (2014a); European Commission (2014b).

<sup>2</sup> European Commission (2014a), p.23.

<sup>3</sup> According to NACE Rev. 2, the definition of industry in this study includes Mining and quarrying (B); Manufacturing (C); Electricity, gas, steam and air conditioning supply (D); Water supply, sewerage, waste management and remediation (E). See Table A.2 in Annex II.

<sup>4</sup> According to Eurostat nama\_10\_a10.

<sup>5</sup> European Commission (2014a), p.1.

<sup>6</sup> European Commission (2014a), p.1, based on Rueda-Cantuche, José M., Sousa, N., Andreoni, V. and Arto, I. "The Single Market as an engine for employment growth through the external trade", Joint Research centre, IPTS, Seville, 2012.

<sup>7</sup> European Commission (2014a), p.1.

<sup>8</sup> European Commission (2014c), p.12.

<sup>9</sup> European Commission (2013a), p.3.

<sup>10</sup> Value added over European GDP was 21% in 1995 and 18% in 2005.

in the 2000s. The only exception is Germany, where this proportion has remained more or less unchanged. In the EU-13<sup>11</sup>, this trend is less remarkable. Although the declining importance of industry can be explained by a stronger contribution to GDP growth of the service sector, in some countries this trend can also be attributed to deteriorating international competitiveness.

On one hand, most European countries are moving to the **tertiary sector of the economy**. This is not a surprising economic phenomenon, since the normal pattern of economic development is from agriculture to industry and from industry to services<sup>12</sup>. All countries considered as developed followed this pattern and, with a few exceptions such as India, developing countries are following the same path. Looking at the pattern in the last twenty years<sup>13</sup>, the contribution of value added of services to GDP in the EU increased from 61.4% in 1995 to 66.1% in 2015, while that of industry declined from 21% to 17.3% in the same period. In some Member States such as the United Kingdom, the Netherlands and France, value added services share over GDP has reached more than 70%.

The shift of the economy to the tertiary sector is positive when the service sector is an important engine of innovative activities and spillovers for other sectors. For example, business services such as consultancy, design and marketing play an increasing role as production inputs, including in terms of consultancy, design and marketing, contributing to different degrees both upstream and downstream along the value chain of the industrial process<sup>14</sup>. However, the **productivity of services affecting the performance of industry strictly depends on the framework conditions, such as the role of the internal market and regulatory systems**. For example, inappropriate labour or product market regulation can dampen innovation and inhibit the uptake of information and communication technology (ICT)<sup>15</sup>. Administrative burden, barriers to trade and investment, price controls and costs for starting up a company can negatively impact the performance of services and any spillover effect on other sectors. An inefficient transport and logistical system can impede industrial sectors from becoming effectively integrated in global value chains<sup>16</sup>.

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<sup>11</sup> Bulgaria (BG), Croatia (HR), Cyprus (CY), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Malta (MT), Poland (PL), Romania (RO), Slovakia (SK), Slovenia (SI).

<sup>12</sup> Dasgupta and Singh (2006); Nickell, Redding and Swaffield (2008); Matsuyama (2009); Rodrik (2015).

<sup>13</sup> Eurostat provides statistics from 1995.

<sup>14</sup> ECSIP Consortium (2014), p.18.

<sup>15</sup> ECSIP Consortium (2014), p.15.

<sup>16</sup> European Parliament (2014), p.38.

A more challenging problem for the European industrial area is **increasing international competition from developing countries**, not only in traditional industry, but also in the highest value-added and dynamic manufacturing sectors. The comparative advantage of labour cost in these emerging economies can have major negative consequences:

- it can push European enterprises to de-localise production with consequent declining employment and job opportunities for European workers;
- international demand can substitute European industrial products with lower-price products;
- foreign direct investments (FDI) can be displaced from Europe to emerging areas.

These effects can be amplified with an inadequate policy to re-allocate European industry in the most advanced sectors, or in the presence of higher energy prices and obstacles to basic inputs which increase production costs.

The next sections will analyse the current situation of industry in EU regions, in order to understand not only the potential industrial pattern of specialisation in the near future for local and regional economies but also to identify the key challenges Local Registration Authorities (LRAs) face to enhance and exploit the process of re-industrialisation.

## 1.1 Industry in the European regions: an overview

### *Key findings:*

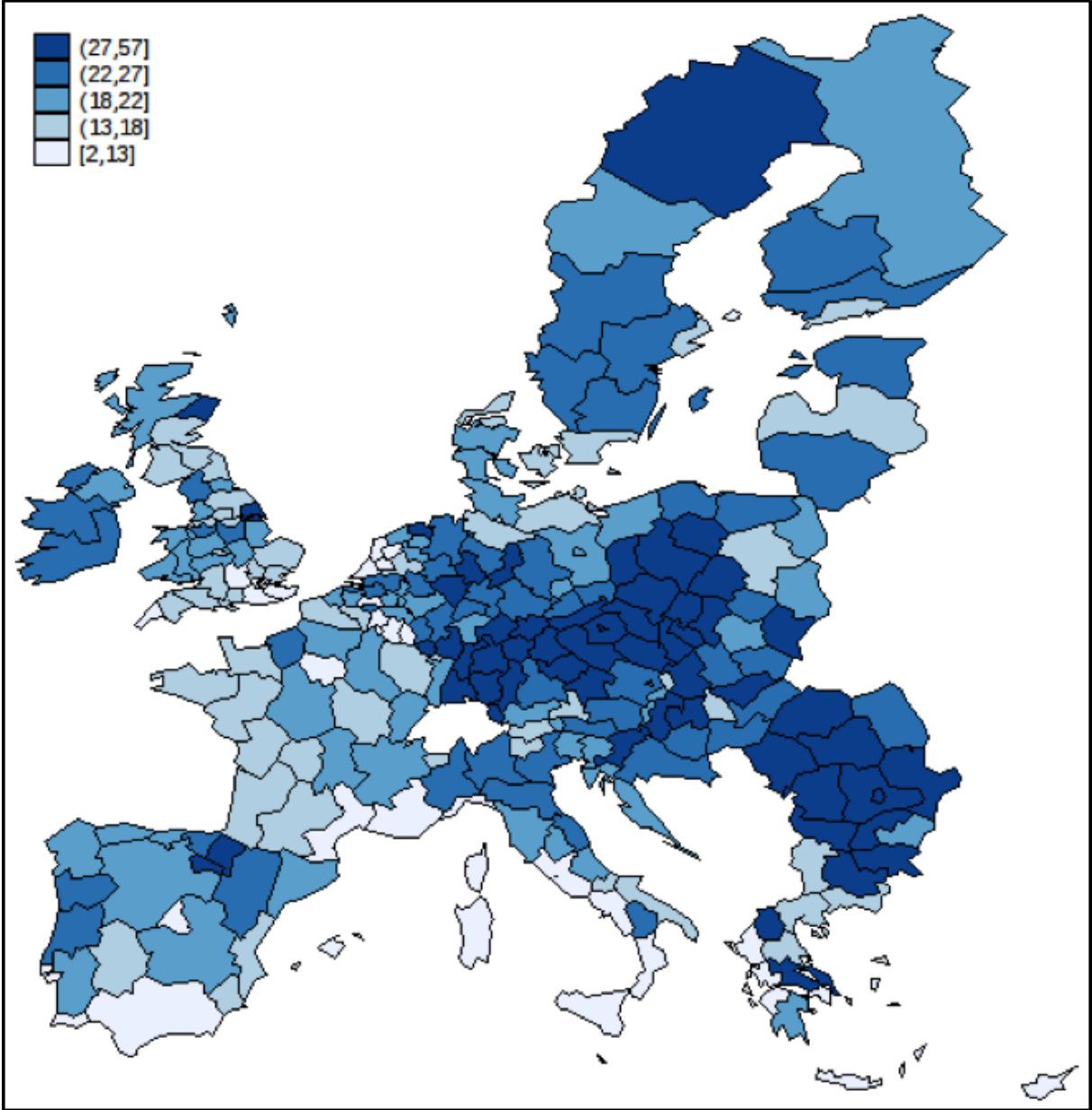
- The value added contribution of industry excluding construction to EU-28 GDP was 17.3% in 2015, following a steady decrease since the mid-1990s;
- In recent decades, industrial production has been relocated eastward towards new member countries and emerging peripheral regions in central Europe;
- Regions from the EU-13 have more industrial growth than those in the EU-15 and have responded better to the crisis;
- A common trend towards the tertiary sector is affecting most European regions;
- The net business population<sup>17</sup> growth for industry was generally negative across European regions with obvious consequences for job creation and destruction;
- Industrial enterprises are agglomerated in clusters especially in Italy, Germany and Spain and, in the EU-13, Poland and the Czech Republic.

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<sup>17</sup> Number of enterprise births minus the number of enterprise deaths over number of active enterprises. See Table A.1 for additional detail.

Industry is a thriving sector in the world economy, with its value added still contributing to almost 27.7% of world GDP in 2014<sup>18</sup>. The sector accounts for 80% of Europe’s exports and private innovation whilst **the value added contribution of industry excluding construction to EU-28 GDP was 17.3% in 2015**, although this has been shrinking from a 21% share in 1995.

**Figure 1.1: Industry share of total value added by region (% , 2013)**

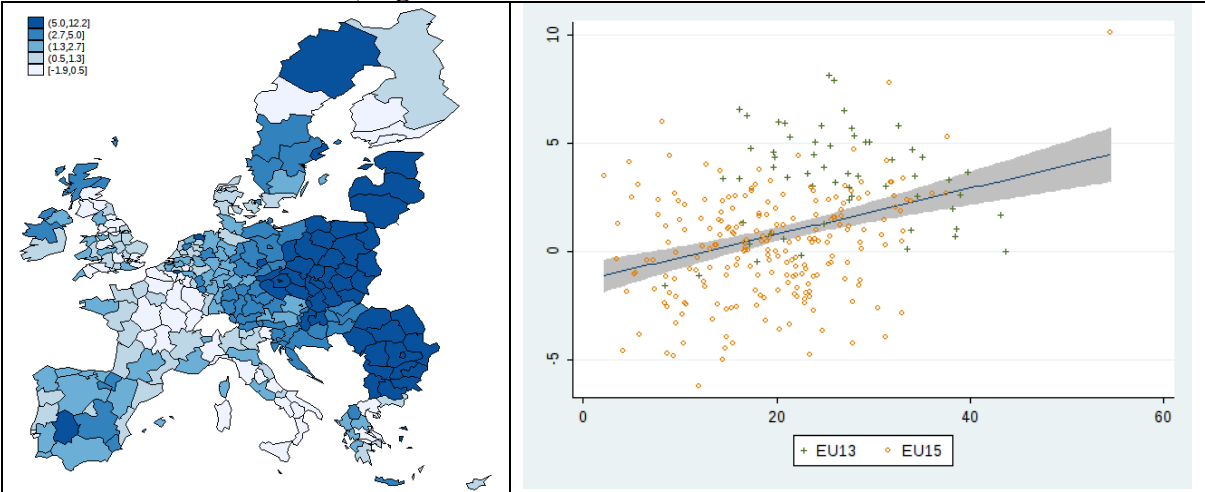


Source: own calculation based on Eurostat (see Annex II for detail)

<sup>18</sup> World Development Indicators, World Bank.

The geography of European industry was initially defined around the ‘blue banana’<sup>19</sup> but has quickly changed, **with an eastward relocation towards new member countries and emerging regions in central Europe in the last few decades.** Industry makes up a large proportion of the latter’s total added value, so they are in the top quintile in Figure 1.1 and include, for example, Ditiki Makedonia and Sterea Ellada in Greece, and eastern regions like Lubuskie and Opolskie in Poland, Yugoiztochen and Yuzhen Tsentralen in Bulgaria, Eszak-Magyarország in Hungary, as well as Sud-Vest Oltenia in Romania. However, their share of total EU industrial production remains low. On the contrary, some heavily industrialised regions in the EU-15 contribute also to a high share of European industrial production. They are in the top quintile in both Figures 1.1 and 1.2. These include Stuttgart, Arnsberg, Karlsruhe, Tübingen, Braunschweig, Freiburg, Rheinhessen-Pfalz, Schwaben in Germany, northern Italy, Groningen in the Netherlands, Oberösterreich in Austria, Pais Vasco in Spain, as well as Śląskie in Poland.

**Figure 1.3: Industry value added growth (by region, % yearly average change, 2002-2014), left side. Industry value added average yearly growth 2008-2014 vs. industry value added share in 2008, right side**



Source: own calculation based on Eurostat (see Annex II for detail)

In terms of industrial growth (Figure 1.3), **regions from the EU-13 perform better than those in the EU-15**, with the noticeable exception of Germany (Oberbayern, Oberpfalz, Leipzig, and Sachsen-Anhalt) and Northern Sweden (Ovre Norrland). Moreover, industry in **regions from the EU-13, in particular those in Poland, Romania, Bulgaria, and Baltic new Member States, seems to have responded better to the crisis.** Since 2008, value added growth for

<sup>19</sup> This refers to the almost continuous corridor where Europe’s industrial heartland has been traditionally located, from North-West England to Northern Italy though Benelux, Western Germany and Eastern France. See Brunet (1989) and Hospers (2003).

industry has been more significant in regions from EU-13 countries than in EU-15 countries. However, overall, more industrialised regions had a higher share of value added from industry in their local economies in 2008. **A common trend towards the tertiary sector is in fact affecting most European regions,** with a few noticeable exceptions in Poland (Lubuskie and Dolnoslaskie) and Germany (Leipzig and Oberbayern) as shown in Figure 1.4. In many cases, especially in some of the EU-15 (West Midlands and Outer London-South in the United Kingdom, France-Comté and Lorraine in France, Southern Italy) industry value added diminished in nominal terms or grew moderately from 2002 to 2014 while services performed better on average.

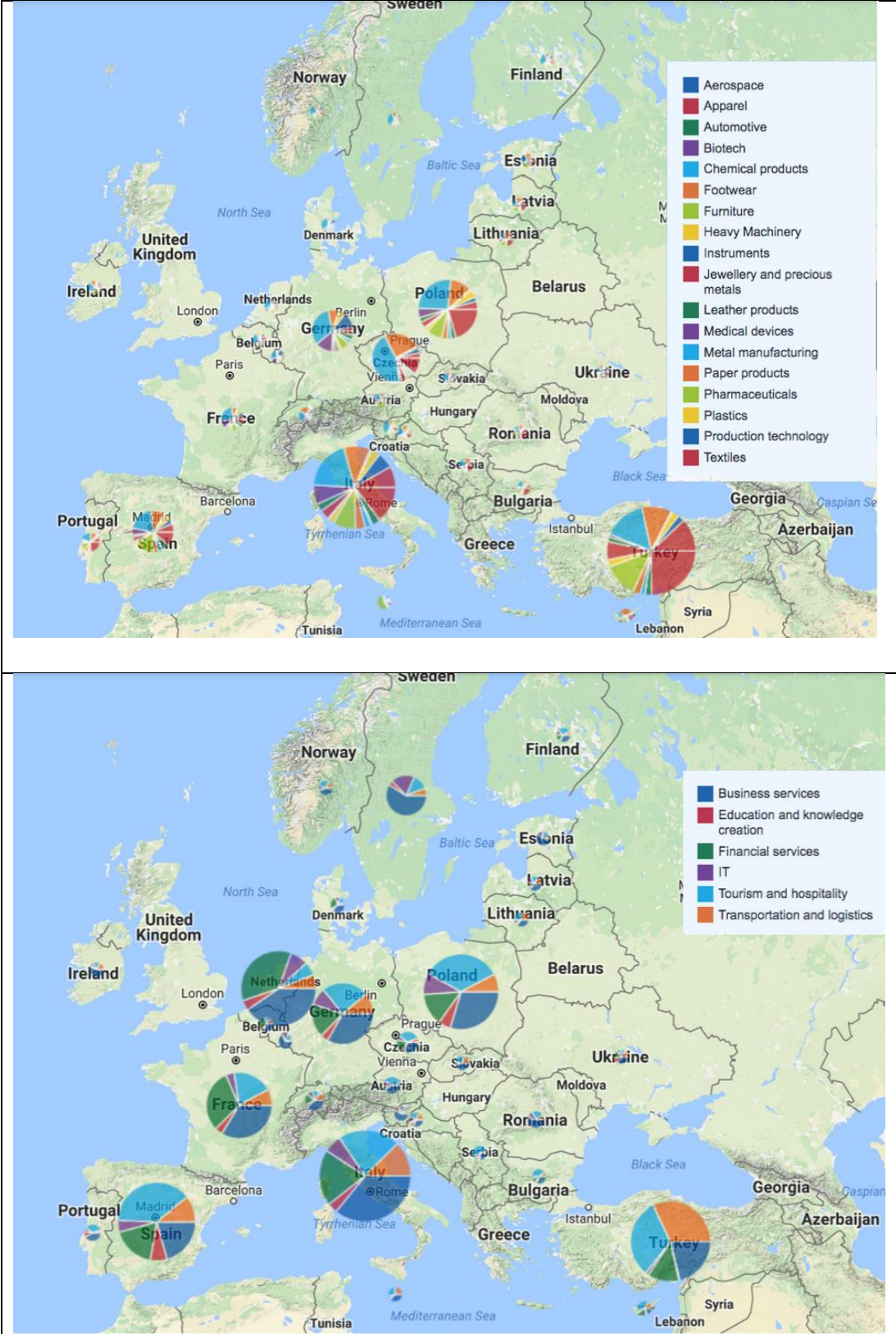
In terms of industrial enterprises, the availability of regional level data is limited<sup>20</sup>. In 2014, the EU-28 had around 26 million active enterprises<sup>21</sup>, with nearly 143 million employees. The highest number of active enterprises was in Italy (3.9 million), followed by France (3.4 million), Spain (2.9 million), Germany (2.8 million) and the United Kingdom (2.2 million). Over the seven years around the crisis, from 2008 to 2014, industry in Europe suffered. **The number of industrial enterprises fell during the period with obvious consequences for job creation and destruction.** As highlighted in Figure 1.5, while western and central regions saw a decline in their net business population, some eastern regions (Praha and Stredni Cechy in the Czech Republic, Sud-Muntenia and Nord-Vest in Romania) experienced high growth, where the number of new industrial firms exceeded those closing. It is worth noting that in the majority of cases more industrial enterprises closed than opened and only the upper two quintiles refer to positive growth. In addition, most of the new industrial enterprises are large, especially in eastern countries and eastern Spain.

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<sup>20</sup> Data is only available for 102 NUTS2 regions in only 13 countries (Austria, Bulgaria, the Czech Republic, Denmark, Spain, Finland, Croatia, Hungary Italy, Lithuania, Portugal, Romania, Slovakia). See Annex II for detail.

<sup>21</sup> The figure is based on 27 Member States and estimates of missing Greece data. See Annex II for detail.

Figure 1.6: Clusters in EU Member States by enterprises (2011)



Source: clusterobservatory.eu

Regarding the clusters<sup>22</sup> in industrial sectors (Figure 1.6), the greatest concentration of enterprises is in Italy, Germany and Spain, while in the EU-13 there are significant clusters in Poland and the Czech Republic. Some countries such as Italy, Germany, Spain and Poland also have strong enterprise agglomerations in service activities, especially business services. In other countries, where enterprises are less concentrated in industrial clusters, there is strong clustering in service activities, as in France, the Netherlands and Sweden.

## 1.2 Trade specialisation and attractiveness of European regions

### ***Key findings:***

- High-income regions on average tend to specialise in high-technology intensive exports, but are less competitive in less technology-intensive goods;
- On the other hand, low-income regions tend to be more specialised in medium-low and low-technology-intensive exports and have deficits in high-technology trade;
- However the link between high incomes and specialisation in high-technology goods may be more a trend than a general rule: some low-income regions are developing advantages in high-technology exports, presumably via FDI and global value chains;
- Most of the major economies from the EU-15 have a strong national industrial sector; the EU-13, on the contrary, rely more on FDI for their industrial development;
- Most regions in the south-western Member States lag behind in terms of

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<sup>22</sup> The term business cluster, also known as an industry cluster, competitive cluster, or Porterian cluster, was introduced and popularized by Michael Porter in *The Competitive Advantage of Nations* (1990). Three terms can be distinguished: *Clusters* are geographic agglomerations of companies, suppliers, service providers, and associated institutions in a particular field, linked by externalities and complementarities of various types; *Cluster initiatives* are organised efforts taken by actors in a cluster to increase the cluster's growth and competitiveness; *Cluster programmes* are organised efforts taken by government to increase the growth and competitiveness of clusters in its constituency. Clusters share four critical characteristics. *Proximity*: the companies need to be sufficiently close in space to allow any positive spillovers and the sharing of common resources to occur. *Linkages*: they need to share a common goal (for example, final market demand) for them to be able to profit from proximity and interaction. *Interactions*: being close and working on related issues is not enough. For positive cluster effects to occur, some level of active interaction has to be present. *Critical mass*: there needs to be sufficient number of participants present for the interactions to have a meaningful impact on companies' performance. Because of their proximity (both in terms of geography and activities) the clusters members are driven by various types of externalities specific to their location. These externalities include, for instance, the access to specialized labour markets and suppliers, the knowledge spillovers, a pressure to reach higher economic performance to face the increasing competitiveness, and a continuous learning thanks to a close interaction between the customers and the specialized suppliers.

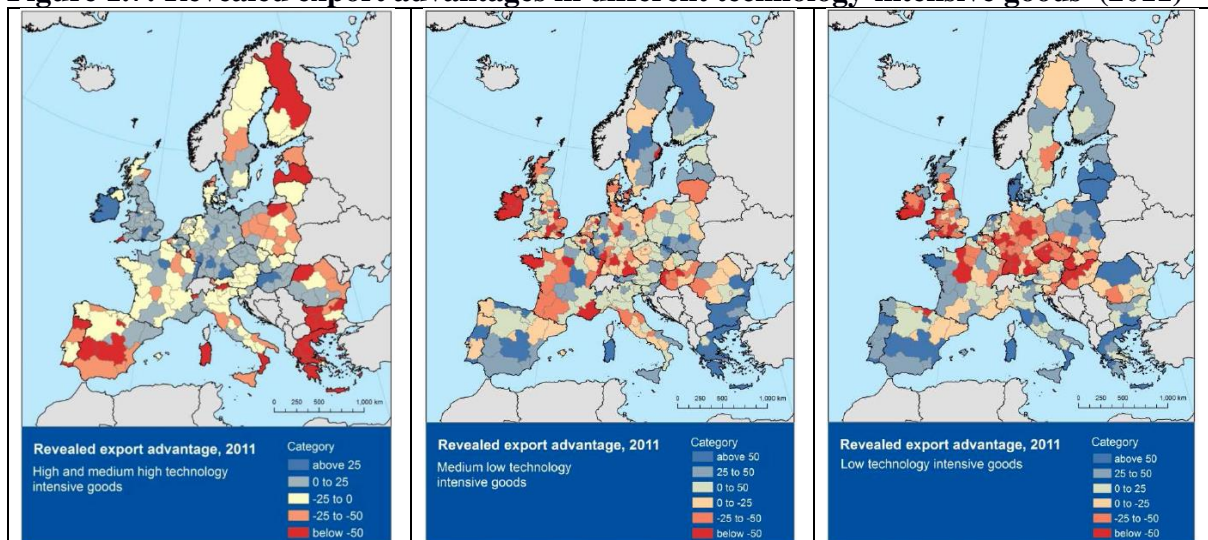


attractiveness for FDI;

- In most Member States, capital and metropolitan regions have the highest levels of competitiveness;
- Regions in central Europe have better infrastructure; this group includes northern and central Italy, eastern Spain as well as capital and metropolitan regions in the EU-13.

The trade specialisation of industry is an important source of economic growth and development also for local and regional economies. Openness to international trade can ensure more goods and services for local customers. It can provide lower cost inputs and raw materials for local producers. It can increase the spread of ideas and technology as well as information on new products and production processes. It can enhance the quality of goods and services as well as production efficiency, thanks to increased competition between firms. FDI can increase the availability of capital and financing for SMEs.

**Figure 1.7: Revealed export advantages in different technology-intensive goods (2011)**



Source: reproduced from Cordes *et al.* (2016)

The main problem in analysing trade specialisation in EU regions is the lack of available data, since trade data are usually collected at the national level. The most recent and detailed analysis is provided by Cordes *et al.* (2016) who developed a methodology to break down national trade data to the regional level and assess the export advantage<sup>23</sup> of EU regions. As displayed in Figure 1.7,

<sup>23</sup> The analysis is based on the RXA (Revealed Export Advantage), which ‘compares the export share of a certain industry in all manufacturing exports in a given region with the global export shares of this industry in the global exports in manufacturing goods. The RXA, thus, indicates whether the significance of a certain industry in a country’s (region’s) total manufacturing exports is higher or lower compared to the significance the industry has

**high-income regions on average tend to specialise in high-technology intensive exports, but are less competitive in less technology-intensive goods. On the other hand, low-income regions tend to specialise more in medium-low and low-technology-intensive exports and have deficits in high-technology trade.** Medium income regions are somewhere in between, having slight disadvantages in high-technology trade, and more or less balanced specialisation in medium-low- and low-technology exports.

Concerning high-technology intensive exports, most German regions have a high comparative advantage, together with Ireland and the majority of United Kingdom regions. Other central European Member States, instead, have fewer regions specialised in high-technology exports (such as Paris and Alsace in France, Brussels and its surrounding regions in Belgium, Lazio and Piemonte in Italy). There are also some regions from the EU-13, mostly low-income, which present a high comparative advantage in high-technology intensive exports: these include the three western Hungarian regions (including the region around Budapest), the majority of Czech Republic regions, two Slovenian regions, the three western Polish regions, the western parts of Slovakia, and three Romanian regions. As stressed by Cordes *et al.* (2016), **the link between high income and specialisation in high-technology goods may be more a trend than a general rule and also low-income regions can develop advantages in high-technology exports, presumably via FDI and global value chains and potentially enhancing long-run economic growth potential<sup>24</sup>.** Regions highly specialised in medium-low- and low-technology-intensive exports are mostly concentrated in the southern and eastern low-income peripheries such as Bulgaria, Greece, and southern Spain. Portugal, most of southern Italy, east Poland and north Romania are exclusively specialised in low-technology-intensive exports.

An important variable to consider in assessing regional trade specialisation is the capacity of regional economies to attract FDI. FDI have an important impact on growth in host economies which can gain access to advanced technology as well as managerial knowledge and skills, enhancing industrial potential. **For regional location choices, foreign investors tend to prefer regions with a high level of development and efficient infrastructure such as international airports<sup>25</sup>.** Moreover, another explanation for investment in these regions can be low labour costs. The level of tertiary education also helps attract FDI. **In 2015, total FDI inflows to Europe reached \$504 billion (around €450 billion) – 29% of global inflows<sup>26</sup>.** Ireland and the Netherlands became the two largest

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in global manufacturing exports', Cordes, *et al.* (2016), p.8.

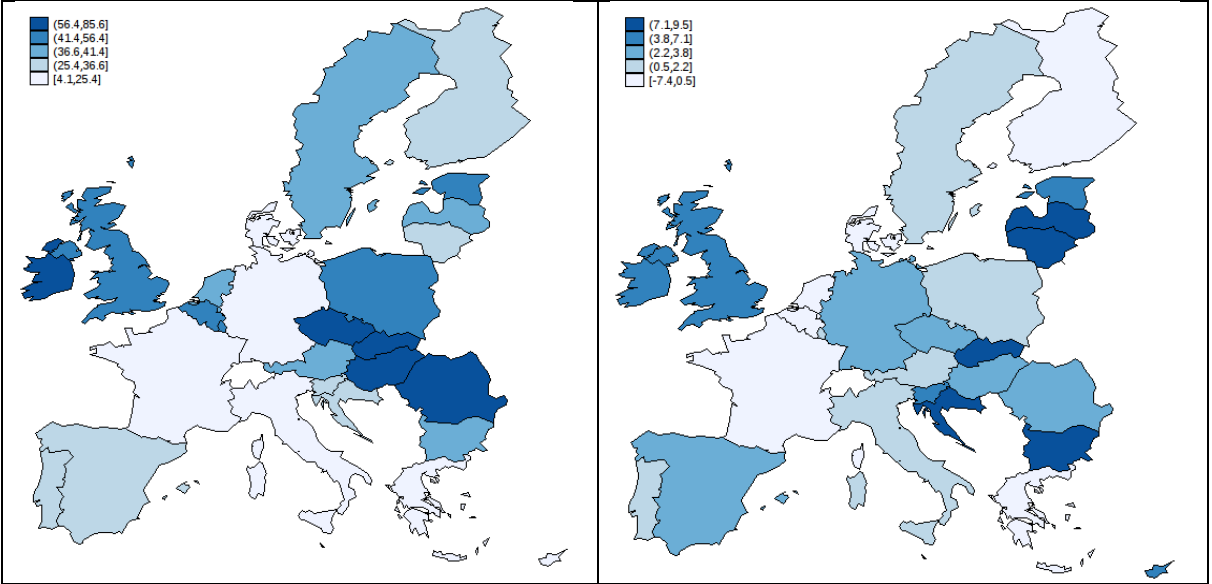
<sup>24</sup> Cordes, *et al.* (2016), p. 10.

<sup>25</sup> Antonescu (2015).

<sup>26</sup> UNCTAD (2016), p.4.

recipients in the EU. Other major recipients were France and Germany, both of which recovered sharply from low points in 2014. Inflows into the United Kingdom – the largest recipient in 2014 – fell back to \$40 billion (€35.7 billion) but remained among the largest in Europe. In the 11 central and eastern European member countries of the EU, combined inflows almost halved, to \$19 billion (€17 billion). The decline was particularly pronounced in 2014’s larger recipients such as Poland (down 40% to \$7.5 billion - €6,7 billion), Hungary (down 83% to \$1.3 billion - €1.16 billion) and the Czech Republic (down 78% to \$1.2 billion - €1.07 billion). Bulgaria and Romania, however, maintained their levels of inflows.

**Figure 1.8: Foreign controlled manufacturing firms value added at factor cost, over total manufacturing firms value added (% , 2014), left side; foreign controlled manufacturing firms value added at factor cost yearly average change (% , 2008-2014), right side**



Source: own calculation based on Eurostat (see Annex II for detail)

With respect to the importance of FDI in industrial sectors, Figure 1.8 shows for 2014<sup>27</sup> the share of total value added in industry due to foreign controlled firms within each country. **Most of the major economies from the EU-15 have a strong national industrial sector with the exception of the United Kingdom and Ireland, while the Czech Republic, Slovakia, Hungary and Romania rely on foreign investment for their industrial development more than the others.**

From 2008 to 2014 (right side of Figure 1.8), the growth of foreign controlled industrial firms in terms of value added was modest because of the crisis in most

<sup>27</sup> Except for a few countries, namely Belgium and Finland (2013), Ireland (2012) and Malta (2008).

of Member States with the exception of Croatia, Slovakia, Bulgaria, Latvia and Lithuania. Unfortunately, there are no updated data on FDI at regional level. The only detailed study was provided by Capello, Fratesi and Resmini in 2011 and analyses FDI at regional and local level for 2005-2007 (Figure 1.9). This therefore captures data from before the crisis. Regions which attracted the most FDI in manufacturing<sup>28</sup> between 2005 and 2007 were in Ireland, the United Kingdom, Poland, Romania and Baltic countries. **These regions, in particular those in the EU-13, are experiencing a long period of FDI inflows, which started in the late 1990s' with intra-European inflows<sup>29</sup> and were then further enhanced by extra-European FDI.** On the contrary, most of the regions in the south-western Member States (Greece, Portugal, Spain and Italy) lag behind in terms of attractiveness for FDI.

Further indications on the attractiveness of European industrial regions can be extrapolated from the Regional Competitiveness Index, which measures 'the ability to offer an attractive and sustainable environment for firms and residents to live and work'<sup>30</sup> by summing-up 11 indicators<sup>31</sup>. According to Figure 1.10, **the most competitive regions in the EU are in the north-west of Europe, including most regions in the Benelux countries, Denmark, Germany, Austria, Sweden, Finland, the south-east of the United Kingdom and northern France.** In contrast, the least competitive regions were generally in the south-east of Europe, in particular in Bulgaria, Greece, Romania, the south of Spain, and the south of Italy. The highest ranking region in 2013 was Utrecht in the Netherlands, while the least competitive region was Severozapaden (in Bulgaria).

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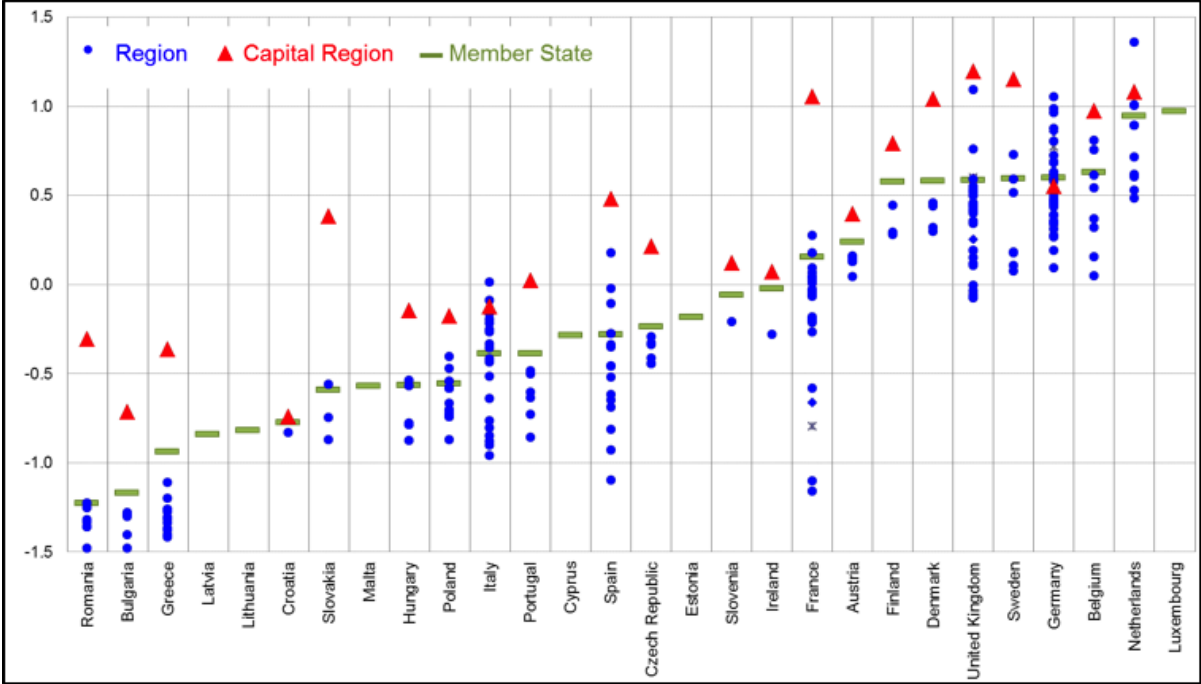
<sup>28</sup> See Table A.2 in Annex II.

<sup>29</sup> Capello, Fratesi and Resmini (2011), p. 97.

<sup>30</sup> European Commission (2013b), p.4.

<sup>31</sup> These are: Institutions; Macroeconomic stability; Infrastructure; Health; Basic education; Higher education; Labour market efficiency; Market size; Technological readiness; Business sophistication; Innovation.

**Figure 1.10: Regional Competitiveness Index (2013)**



Source: reproduced from European Commission (2013b), p.iii (see Annex II for detail)

**Interestingly, most Member State capital and metropolitan regions exhibit the highest levels of competitiveness.** The only capital region with a competitiveness index below its national average is Berlin. Some capital regions are surrounded by similarly competitive regions (for example, in the Netherlands and the United Kingdom), whereas in other countries (such as Spain, France and many of the EU-13), several regions around the capital were less competitive. Figure 1.10 also offers an overview of the variance in the Regional Competitiveness Index within Member States. The biggest differences are in France and Spain even if these results were exacerbated by overseas regions for both of these countries. Particular geographical divisions affect Italy (north–south divide, with the south less competitive) and the United Kingdom (north–west–south–east with Northern Ireland, northern Scotland, parts of Wales, Cumbria and Cornwall being less competitive).

Among the indicators in the Regional Competitiveness Index, the infrastructure indicator<sup>32</sup> is of particular significance for industrial development. Modern and effective infrastructure contributes to economic efficiency helping to maximise local economic potential and the optimal use of resources<sup>33</sup>. Infrastructure can

<sup>32</sup> This indicator is based on: Motorway Length per km<sup>2</sup>; Motorway Length per vehicle; Length of Railway per km<sup>2</sup>; Air Freight Disembarked per 1,000 inhabitants; Air Passengers Disembarked per 1,000 inhabitants; Number of Vehicles per 1,000 inhabitants; Broadband Access Lines per 1,000 inhabitants (national data only); Secure Servers per 100,000 inhabitants (national data only).

<sup>33</sup> Dijkstra, Annoni and Kozovska (2011).

influence the location of economic activity and the kinds of activities and sectors that develop. Moreover, high-quality infrastructure guarantees easy access to other regions and countries, inside and outside the EU, contributes to better integration of peripheral and lagging regions, and facilitates the movement of goods, people and services. Especially in low-income regions of Europe, in fact, strategic investments in infrastructure, and especially in transport infrastructure, become a precondition for economic development<sup>34</sup>. Figure 1.11 illustrates the infrastructure indicator by EU region. **Regions in central Europe are better equipped in terms of infrastructure. This group includes northern and central Italy, eastern Spain as well as capital and metropolitan regions in the EU-13.** Regions with the lowest indicator for infrastructure are in eastern Europe and in less populated parts of the Scandinavian peninsula.

### 1.3 Workers in industry

#### *Key findings:*

- Industrial enterprises provide work for 23.6% of employed people;
- Most EU regions were below the 2020 target of 75% employment for the active population in the 20-65 age group; moreover, growth in industrial employment in the last few years was heavily affected by the economic crisis. The general trend was for lower employment following the economic downturn;
- Few regions experienced increased industrial employment in 2008-2015; moreover, employment growth in industry was more effective in regions where employment in industry was already stronger;
- Very few regions are both heavily industrialised and specialised in high-tech industries;
- The highest participation in education is in regions along the axis from France, through the United Kingdom and the Netherlands to Denmark and Sweden;
- Southern and eastern less industrialised regions suffer from many young people Not in Education, Employment, or Training (NEETs);
- EU-citizens tend to move more towards central Europe regions, which are more knowledge and innovation intensive;
- There is still a huge variation in yearly average gross wage of industrial workers within the common market, which reflects the wide variation of labour productivity;
- Highest values for labour productivity in industry are in northern and central Europe and southern French regions and Ireland; however, the highest labour productivity growth is in eastern regions.

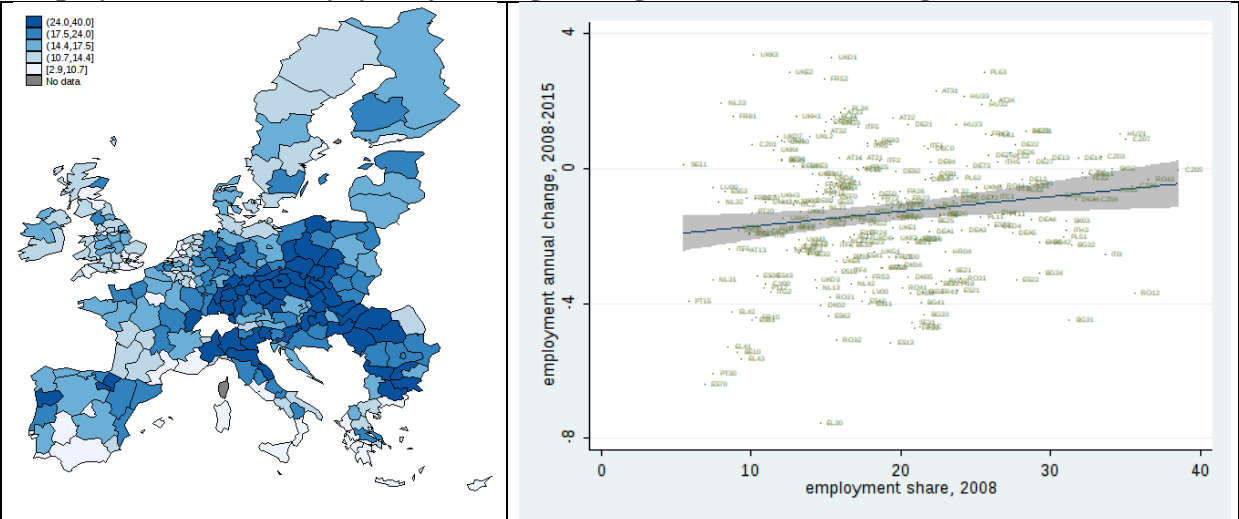
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<sup>34</sup> European Commission (2017b).

Industry is a key sector for job creation and still has a major role in boosting employment in Europe. **In 2014 only 9.9% of active enterprises in the EU were in industry, even though these provided work for 23.6% of employed people.** The difference between these shares is because the average size of industrial enterprises (as measured by the number of employees), is considerably higher for industry than for services<sup>35</sup>.

As shown in Figure 1.12, in 2015, **most EU regions were below the 2020 target of 75% employment for the active population in the 20-65 age group.** The highest regional employment rates were in Germany (Freiburg, Tübingen, and Oberbayern), Sweden (Smaland Med Oarna and Vastsverige) and the United Kingdom (North Eastern Scotland and Berkshire). However, almost 80% of regions were below the target, with some areas, especially in southern Europe, dramatically below (Calabria and Sicilia in Italy, Dikiti Makedonia in Greece, Extremadura and Andalucia in Spain).

**Figure 1.13: Employment in industry, share of total employment (% , 2015), left side; employment in industry, yearly average change (% , 2008-2015), right side**



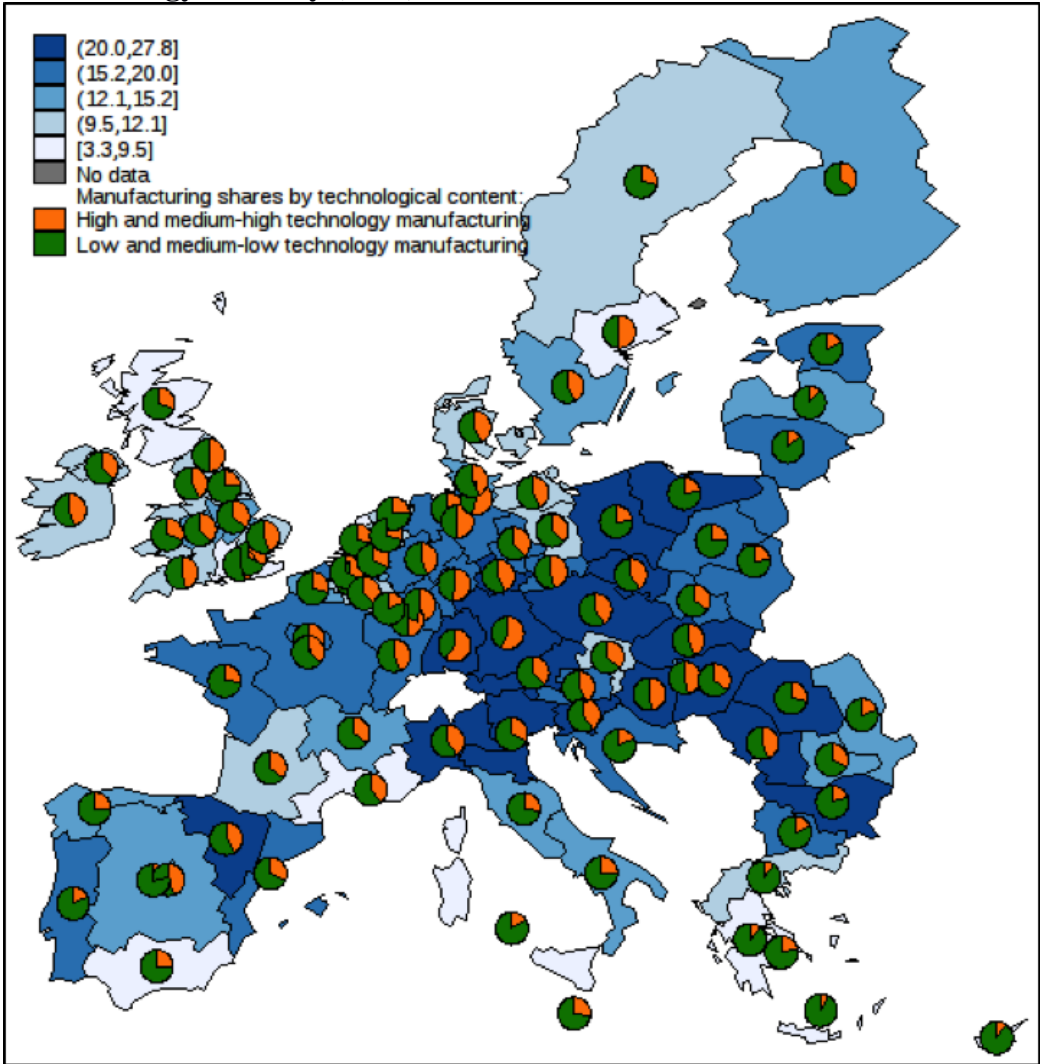
Source: own calculation based on Eurostat (see Annex II for detail)

The leading regions for industrial employment in 2015 are shown in Figure 1.13. When compared to total employment, industry’s share is highest in central and eastern European regions (Vest in Romania, Severovychod in Czech Republic, Slaskie in Poland, Kozep-Dunantul in Hungary, and Stuttgart and Tübingen in Germany) and a few others, such as northern Italy (Piemonte, Lombardia and Emilia Romagna). In terms of growth in industrial employment (right side of Figure 1.13), **the last few years were heavily affected by the economic crisis**

<sup>35</sup> Industrial enterprises employed 13 people on average across the 27 Member States, compared to an average of 5 people for services.

and the general trend was a reduction in employment following the economic downturn. Indeed, few regions experienced an increase in industrial employment over the period 2008-2015 (Oberösterreich and Vorarlberg in Austria, Bretagne in France, Cumbria and North Yorkshire in the United Kingdom, Pomorskie in Poland). Nonetheless, **employment growth in industry was more effective in regions where industrial employment was already stronger** at the beginning of the period (Oberösterreich and Vorarlberg in Austria, Pomorskie in Poland, Eszak-Alfold and Del-Alfold in Hungary) though there is a huge variation between regions.

**Figure 1.14: Manufacturing employment share of sectors by technology-intensity (2015)**



*Source: own calculation based on Eurostat (see Annex II for detail).*



By looking at manufacturing<sup>36</sup>, it is possible to analyse the share of total employment relative to its technological content (Figure 1.14). Different patterns of specialisation emerge as many industrialised areas specialise, in terms of employment, in medium-low- and low-technology manufacturing, while **very few are both heavily industrialised and specialised in high-tech industries**. The exceptions are German regions like Baden-Wurttemberg, Bayern, Hessen, Niedersachsen and Rheinland-Pfalz.

An important source for industrial development is human capital in the workforce. Human capital accumulation contributes to the development of the most advanced industries and more sustainable industrialisation across Europe. The third industrial revolution is going to be driven more by knowledge than in the past, as Ross (2016)<sup>37</sup> puts it “*Land was the raw material of the agricultural age. Iron was the raw material of the industrial age. Data is the raw material of the information age*”, calling for an urgent shift in the skills of the workforce to cope with the new paradigm. Within this framework, the EU supported national actions with Education and Training 2020 (ET 2020)<sup>38</sup> defining benchmarks for 2020 such as:

- at least 40% of people aged 30-34 should have completed some form of higher education;
- at least 15% of adults should participate in lifelong learning;
- at least 20% of higher education graduates and 6% of 18-34 year-olds with an initial vocational qualification should have spent time studying or training abroad;
- 82% of graduates should be employed (aged 20-34 with at least upper secondary education and having left education 1-3 years ago).

In particular, lifelong learning and upgrading skills seem to be an urgent policy challenge with the computerisation of many tasks and occupations thanks to rapid advances in machine learning (Data Mining, Machine Vision, Computational Statistics and other sub-fields of Artificial Intelligence)<sup>39</sup>. From this perspective, **the highest participation in education is in regions located along the axis from France through the United Kingdom and the Netherlands to Denmark and Sweden** as shown in Figure 1.15. However, there is a huge variation between regions which reflects various factors such as

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<sup>36</sup> The disaggregation in terms of technological content is available only for manufacturing. See Table A.2 in Annex II.

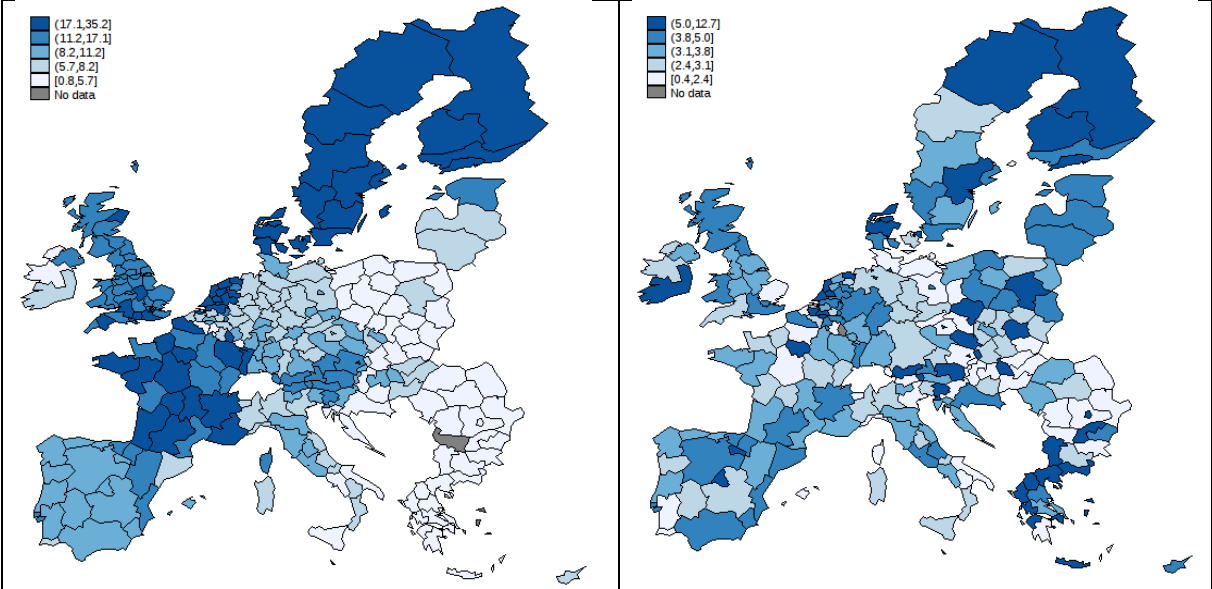
<sup>37</sup> Ross (2016), p.18.

<sup>38</sup> European Commission (2012a).

<sup>39</sup> See Frey and Osborne (2017) for an interesting estimation of computerisation on US occupations.

the population structure, the economic situation and different national policies. On the other hand, the picture changes a lot when looking at tertiary education only (left side of Figure 1.15), with more polarisation within each country, which reflects the historical location of major universities.

**Figure 1.15: Participation rate in education and training (2015), left side; participation rates in tertiary education (2015), right side**



Source: own calculation based on Eurostat (see Annex II for detail)

The picture can be enriched by looking at two other dimensions (Figure 1.16), which contribute to the overall outcome for human capital accumulation, NEETs and vocational programmes which relate to technical jobs required by modern industry. Raising educational attainments and anticipating the skills needed for the labour market are key aspects of ET 2020. Regions vary according to the general economic situation but also in relation to their specific policies to activate new cohorts and prepare them for the labour market. **The NEET rate for people aged 15-24 is particularly high at more than 20% in many southern and eastern less industrialised regions** (especially in Calabria and Sicilia in Italy, Centru in Romania and Severozapaden in Bulgaria). Many industrialised regions, on the contrary, are pushing work-based learning, vocational education and training programmes (especially in Tirol and Vorarlberg in Austria, Pohjois-Ja Ita-Suomi and Etela-Suomi in Finland, Flevoland and Zeeland in the Netherlands, Vzhodna Slovenija in Slovenia, and Zapadne Slovensko in Slovakia). The highest share of such programmes in upper secondary education was in central-eastern industrial areas along with the Netherlands and Finland.

Labour in industry is also subject to migration flows and population structure changes which may impact future economic development. Migration plays an important role, along with migrant characteristics, in terms of age, skills,

education and work experience. Even if there is not enough data to encompass the recent migrant flows which had a major impact on some European regions, it is still worth analysing figures from 2011 census data, which are the most complete and recent updates at regional level. Figure 1.17 shows the total immigrant share and separates out the European component to focus on internal market mobility. **The most attractive regions for migrants are in Ireland, western Spain, northern Italy and the Baltic regions. EU-citizens migrate mainly to central European regions in Germany, Belgium, the Netherlands, northern France and southern United Kingdom.** A CoR study published in 2016<sup>40</sup> concludes that EU inter-regional labour mobility is more efficiently used (i.e. shows a greater elasticity<sup>41</sup>) in regions that are more knowledge and innovation intensive. On the other hand, **regions with low levels of R&D spending as well as a narrow innovation profile, including imitative innovation areas, do not benefit from the mobility of skilled workers, because their elasticity for knowledge is not significant.**

Two other variables to consider are industrial labour cost and productivity. The geography of industrial labour cost at regional level as shown in Figure 1.18, represents both a country's economic development and the comparative advantages of new developing regions. **There is still a huge variation of average gross wages** in industry within the common market<sup>42</sup> ranging from about €5 000 to about €85 000 in 2013. The lowest is in eastern countries with the exception of Norte and Algarve in Portugal. On the other hand, the highest values are in regions in northern and central Europe and the United Kingdom.

It is important to take into consideration labour productivity as a key factor in determining the productive industrial potential of the economy. When looking at labour productivity<sup>43</sup> in Figure 1.19, the highest values for industry are in northern and central Europe and southern French regions and Ireland. **Overall, there is a correspondence between industry wages and labour productivity across EU regions.**

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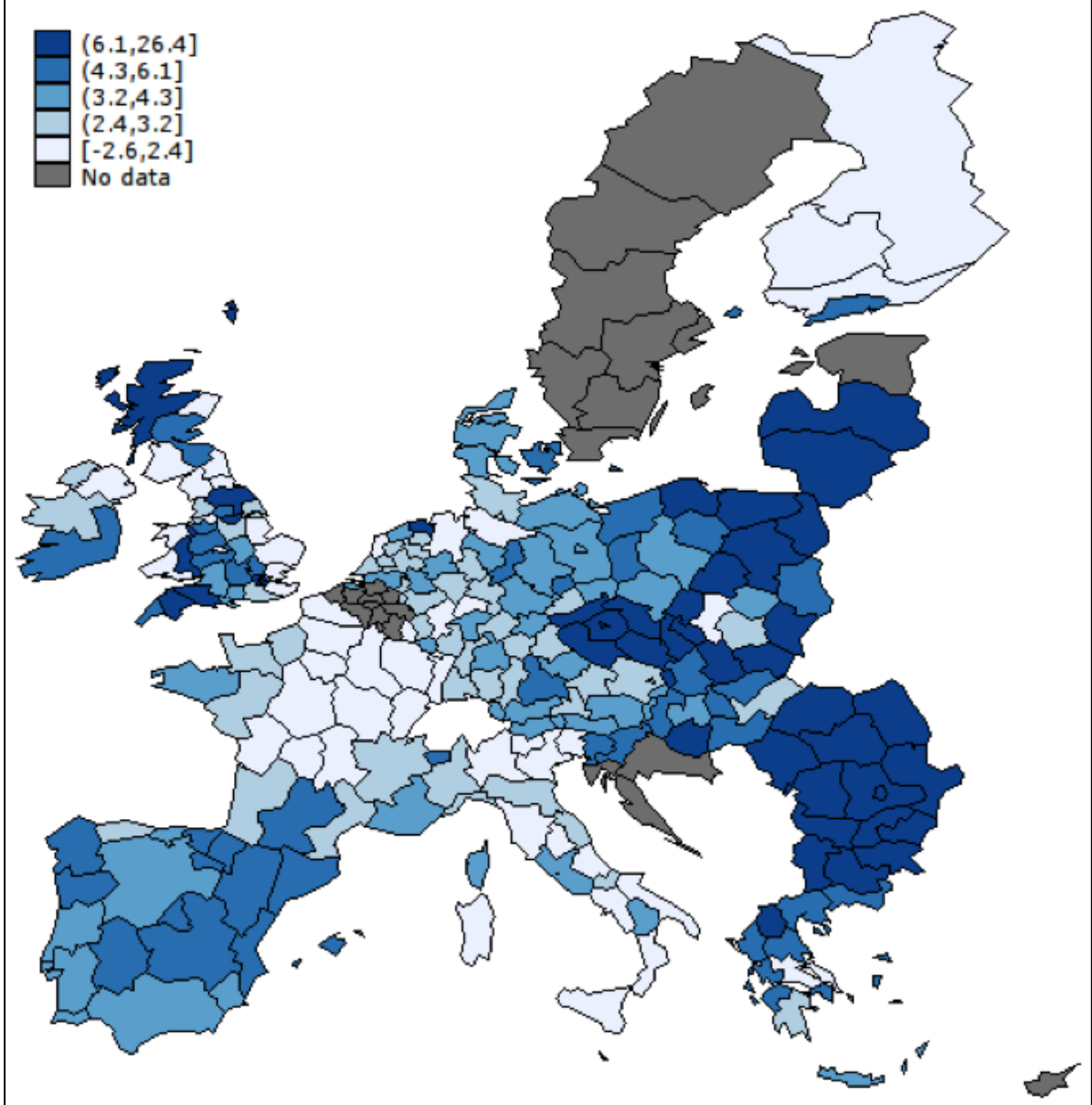
<sup>40</sup> Committee of the Regions (2016), p.26.

<sup>41</sup> Elasticity measures the impact of labour mobility on the capacity of the region to transform knowledge into R&D. See ESPON (2012), pp. 140-141.

<sup>42</sup> The yearly average gross wage has been calculated as the total yearly employee compensation in industry from national accounts divided by the number of employees in industry: "In balance of payments statistics, compensation of employees refers to gross wages, salaries and other benefits earned by individuals in economies other than those in which they are resident, for work performed and paid for by residents of those economies. Compensation of employees includes salaries paid to seasonal and other short-term workers (less than one year) (...) Compensation of employees (D.1) consists of wages and salaries in cash or in kind (D.11) and employer's actual and imputed social contributions (D.121 and D.122)." Eurostat, *Statistics Explained – Glossary: compensation of employees*.

<sup>43</sup> Labour productivity is defined as the amounts of output produced by one unit of work and is measured here as the ratio between value added in industry and the hours worked by an employed person in industry.

Figure 1.20: Labour productivity, industry, Euro, average yearly change (% , 2001-2013)



Source: own calculation based on Eurostat (see Annex II for detail)

Recently, there were major productivity gains **across Eastern regions and some areas in the United Kingdom**, as shown in Figure 1.20 for the period 2001-2013. In particular, the highest increases in labour productivity were in London’s regions and South Yorkshire in the United Kingdom, many regions in Romania (Sud-Vest Oltenia, Sud-Muntenia, Nord-Vest, Bucuresti-Ilfov, Centru, Vest and Sud-Est), Pomorskie in Poland, Severen tsentralen and Yuzhen tsentralen in Bulgaria and Bratislavsky kraj in Slovakia.

It is worth noting that in most cases the **regions with the highest labour productivity growth rates were the ones with a substantially lower increase in employee compensation over the period**. These regions increased their industrial competitiveness. Only 70 out of 243 regions for which both the two

measures are available – labour productivity change and yearly employee compensation change for the period 2001-2013 – show a higher increase in wages than in productivity. However, most regions were almost stagnating in terms of both measures especially those with a higher industrial specialisation, as shown in figure 1.21.

## 1.4 Innovation in industry

### *Key findings:*

- Innovation capacity has been improving in the EU as a whole and for most Member States in the last decade, despite a trend reversal when comparing the years before and after 2012;
- Most innovative regions are in Denmark, Finland, Germany, the Netherlands, Sweden, France and the United Kingdom;
- There is a partial convergence of regions with medium innovative capacity towards innovation-leader regions, while regions with modest innovative capacity are diverging;
  - Regions with the greatest expenditure on R&D are in capital regions and countries like Finland, Sweden, Denmark, the Netherlands, Germany, Austria, the United Kingdom, and France;
- However, despite the low investment in R&D, some regions in southern and eastern Europe perform better in terms of product, process, marketing or organisational innovations.

As economic theory suggests, industry is generally characterised by **diminishing marginal returns on capital**<sup>44</sup>. That is, the incremental gain in output decreases as additional capital is added with a constant labour input. This would lead an economy to a steady state, where labour productivity is constant and output and economic growth equal the rate of increase in the labour force. In this situation, the only way for an economy to avoid a steady state is through continuous investment in human capital, innovation, technology and knowledge. Industrial innovation is therefore considered as an engine of economic growth<sup>45</sup>.

**In recent years (2008-2015), innovation capacity has improved for the EU as a whole and for most Member States.** However, there has been a trend reversal when comparing the years before and after 2012, with many Member States experiencing negative performance for 2012-2015. Most recently (2014-

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<sup>44</sup> Solow (1956).

<sup>45</sup> Romer (1990), Aghion and Howitt (1992), and Grossman and Helpman (1994).

2015), as many as 17 Member States had a reduction in the innovation capacity<sup>46</sup>. As indicated in Figure 1.22, **the most innovative regions are typically in the most innovative countries** (Figure 1.23), defined as Innovation Leaders<sup>47</sup>. These are Denmark, Finland, Germany, the Netherlands, and Sweden and in two Strong Innovator countries, France and the United Kingdom<sup>48</sup>. Only in four countries, France, Italy, Spain and Germany, are there three different performance groups. In terms of performance, it has been observed<sup>49</sup> that Strong and Moderate Innovator<sup>50</sup> regions have improved, while regional Innovation Leaders and Modest Innovators have declined<sup>51</sup>. **This suggests a partial convergence of the two medium groups towards Innovation Leaders and a partial further divergence of Modest Innovator regions from the other groups.**

A key variable of innovation performance for regions which also significantly influences industrial development, is investment in R&D. In the EU, 80% of private sector R&D investment comes from industry<sup>52</sup>, in particular in the automotive sector<sup>53</sup>. Since there are no regional data at sector level, it is assumed in this study that overall innovation capacity of EU regions is a proxy for investment in innovation in industry at regional level. As underlined by the European Commission itself, investments in R&D in the EU remain too low, and, coupled with an inflexible environment and rigidities in some labour markets, hamper the necessary modernisation of European industry with negative effects for future EU competitiveness<sup>54</sup>.

Figure 1.24 shows regional R&D expenditure and business enterprise sector R&D expenditure 2005-2014, as a percentage of GDP. **The highest values are in capital regions and countries like Finland, Sweden, Denmark, the**

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<sup>46</sup> European Commission (2016a), p.7.

<sup>47</sup> According to the European Innovation Scoreboard 2016 (European Commission, 2016a) Innovation Leaders are countries in which innovation performance is more than 20% above the EU average.

<sup>48</sup> The second group of Strong Innovators includes Member States with a performance between 90% and 120% of the EU average. Austria, Belgium, France, Ireland, Luxembourg, Slovenia, and the United Kingdom are Strong Innovators (European Commission 2016a).

<sup>49</sup> European Commission (2016a), p.5.

<sup>50</sup> The third group of Moderate Innovators includes Member States where innovation performance is between 50% and 90% of the EU average. Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, and Spain belong to this group. Latvia has improved from being a Modest Innovator to a Moderate Innovator (European Commission 2016a).

<sup>51</sup> The fourth group of Modest Innovators includes Member States with innovation performance of less than 50% of the EU average. This group comprises Bulgaria and Romania (European Commission 2016a).

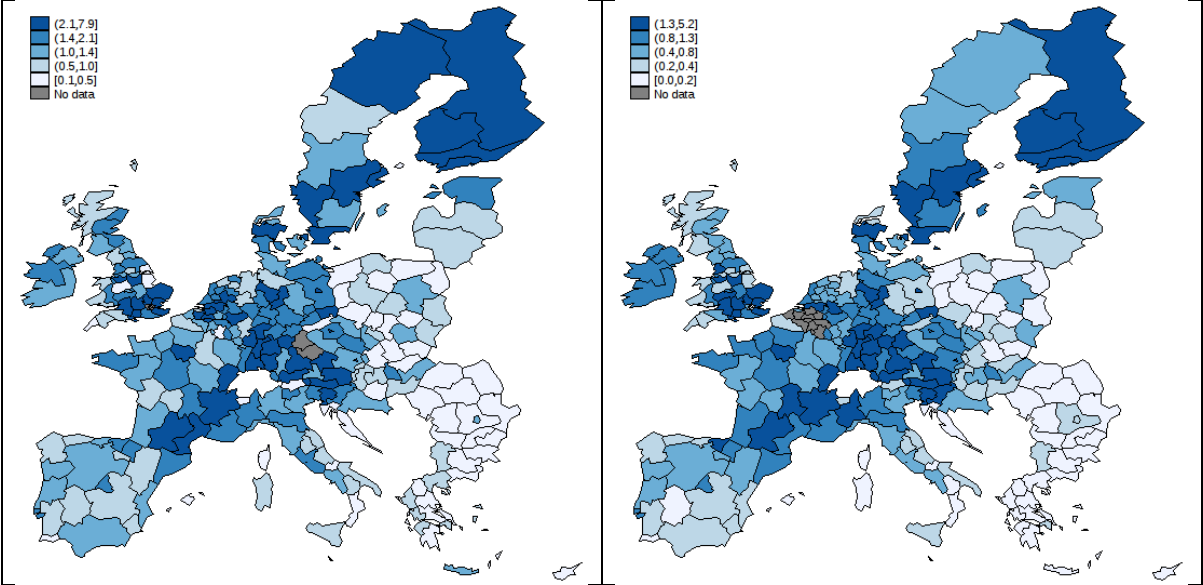
<sup>52</sup> European Commission (2014e).

<sup>53</sup> The automotive industry is crucial for Europe's prosperity. The sector provides jobs for 12 million people and accounts for 4% of the EU's GDP. The EU is among the world's biggest producers of motor vehicles and the sector represents the largest private investor in R&D (see ACEA *EU Automobile Industry*, 2015).

<sup>54</sup> European Commission (2014a), p.2.

**Netherlands, Germany, Austria, the United Kingdom, and France.** A similar geographical distribution can be found in terms of business enterprise sector R&D expenditure (Figure 1.24, right side), with the highest performers in Nordic countries (Sydsverige in Sweden) and in north and central Europe (Hovedstaden in Denmark, Stuttgart and Braunschweig in Germany, Cheshire in the United Kingdom).

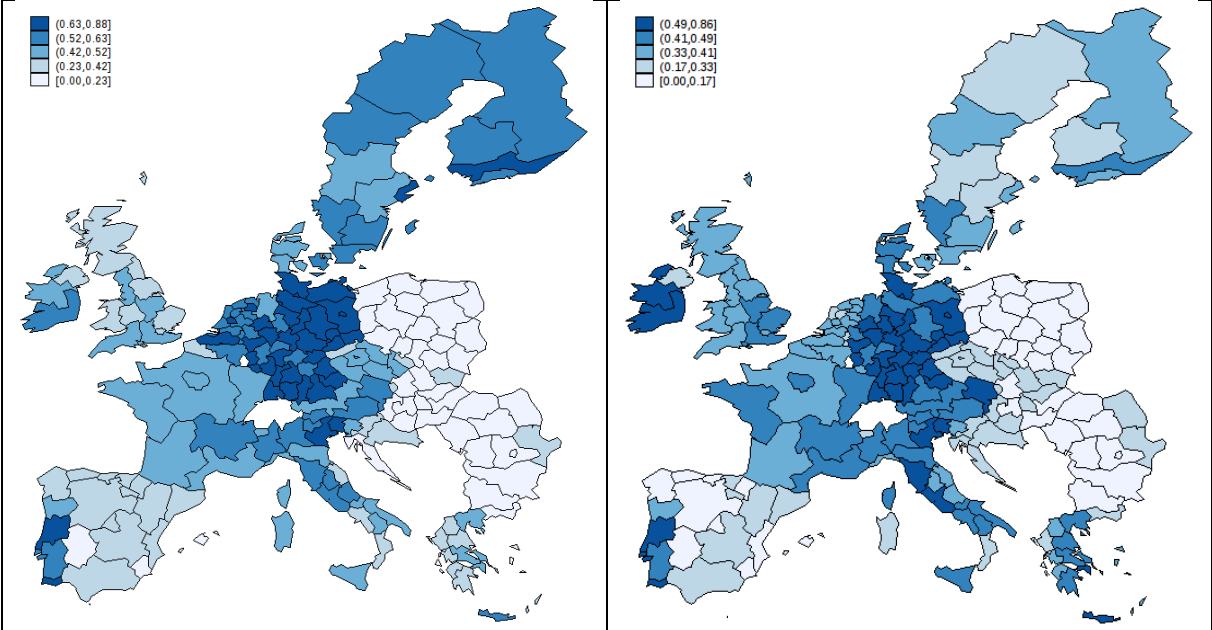
**Figure 1.24: Total R&D expenditure (GERD), % of GDP (average 2005-2014), left side; business enterprise sector R&D expenditure (GERD), % of GDP (average 2005-2014), right side**



Source: own calculation based on Eurostat (see Annex II for detail)

Additional information on the capacity of regional industries to innovate can be derived by looking at the ability of SMEs to introduce product, process, marketing or organisational innovations (Figure 1.25). In some cases, **despite the relatively low propensity to invest in R&D, there are regions in Italy (such as Tuscany), Portugal (Algarve), Greece (Attiki and Kriti), Ireland (Southern and Eastern), and eastern Europe (Severovychod in the Czech Republic), which perform better in terms of product, process, marketing or organisational innovations than regions with a higher propensity to invest in R&D.** On the contrary, some regions which perform better in terms of investment in R&D – such as Lansi-Soumi in Finland or Midtjylland and Syddanmark in Denmark, have fewer SMEs introducing product, process, marketing or organisational innovations.

**Figure 1.25: SMEs introducing product or process innovations as % of SMEs (2012), left side; SMEs introducing marketing or organisational innovations as % of SMEs (2012), right side**



Source: own calculation based on Eurostat (see Annex II for detail)



## 2. The future of traditional industries and industries of the future: the evolving reality of industry in a global context

### 2.1 Towards a new vision for a future oriented EU industrial policy

Industrial policy and the need to enhance the industrialisation of Europe and its regions has become an important issue for EU policy vision. This new orientation has been driven not only by the need for an industrial renaissance after many years of industrial decline, but also by the **rise of innovative industrial sectors based on new technology and technical changes, knowledge-based and services-linked activities, new professions and new customer needs and preferences.**

As already stated, the European Commission intends to put effort into reversing the declining role of industry in Europe from its current level (in terms of value added) of around 17.3% of GDP to as much as 20% by 2020. This ambitious goal should be complemented<sup>55</sup> by higher levels of investment, greater intra-European trade and a significant increase in the number of SMEs and exports to third (non-EU) countries. There should be an industrial shift towards more durable, more customer specific or ecologically sustainable products. Other factors include aligning training, social innovations and more resource efficiency.

The rationale behind this strategy is the ‘Third Industrial Revolution’. The concept was taken from the work of Jeremy Rifkin (2011) and is based on expected shifts in energy production. It puts forward the importance of internet technology and renewable energy integrated into new business orientations. This means a **partial shift from a market- to a network-based organisation of businesses where new management and business practices are gaining importance.** This includes collaborative relationships between suppliers and users, shared interest, openness, collective trust and transparency.

In synthesis, as formulated by Karl Aiginger:

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<sup>55</sup> K. Aiginger (2014).

*“A future oriented Industrial Policy has to start from the challenges revealed by globalisation and those in the financial crisis. It has to be based on research and education, and industrial policy merges with innovation policy. It has to encompass small as well as large firms, and promote close relations between firms and universities and cooperation between firms and universities (clusters); the education policy needs to be able to provide equal opportunities at the outset as well as to promote lifelong learning. Innovation systems are superior if they actively draw from the common international knowledge pool, thus integrating international researchers and also migrants and newcomers are important. The manufacturing sector remains competitive if an economy is open to imports and inward FDI so that it can make use of the division of labour along the value chain. Industrial policy has to be systemic in the sense, that it is derived from the goals of the society. If the welfare function of European citizen gives a large weight so rising incomes, more social inclusion (less wage dispersion), regional equilibria, a stable financial system and sustainability, then industrial policy has to promote these goals e.g. shifting innovation towards social and ecological innovation, while keeping competitiveness and the potential for rising incomes. And industrial policy should make use of those forces which promote change, and foster higher incomes, like competition and globalisation. Thus a Systemic Industrial Policy is pulled by vision and pushed by competition.”<sup>56</sup>*

As stated by the European Commission (2012b) the elaboration of such a comprehensive and structured approach to industrial policy should be based on four pillars: **investment in innovation; better market conditions; access to capital; human capital and skills**. In particular, under the first pillar, there are six priority action lines, which identify six markets where new technologies are ready to deliver new products or contribute to increased industrial productivity. These are<sup>57</sup>:

- ***Advanced manufacturing technologies for clean production.*** In the wake of a new industrial revolution, advanced manufacturing technologies are believed to be key to delivering sustainable and clean solutions by using highly energy- and material-efficient processes, employing renewable and recycled materials, and increasingly adopting sustainable business models. Furthermore, in the light of the growing importance of the industrial internet, the integration of digital technology in the manufacturing process is seen to be a priority for the future<sup>58</sup>. These technologies represent an important business opportunity, **with a global market that is expected to double to over €750 billion by 2020**. EU industry

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<sup>56</sup> K. Aiginger (2012), pp.11-12. See also .K. Aiginger (2014).

<sup>57</sup> European Commission (2012b) pp. 8-13.

<sup>58</sup> European Commission (2012a).

has already achieved a comparative advantage in this sector with a world market share of over 35% and a patent share of over 50%<sup>59</sup>.

• **Key enabling technologies.** Key enabling technologies (KETs) are of exceptional importance for shaping future innovation and the competitiveness of the EU. Moreover, these markets have experienced exceptional growth in recent years<sup>60</sup>. KETs include photonics, industrial biotechnology, nanotechnology, advanced materials, micro-/nano-electronics and advanced manufacturing systems. World leading industries such as automotive, chemicals, aeronautics, space, health and energy are all users of KETs. **Europe is a global leader in KETs research and development with a more than 30% global share of patent applications.** In photonics, for example, a sector with a global market of around €300 billion, Europe has already achieved a strong position with a share of 20% and as much as 40% in key sectors such as lighting<sup>61</sup>. Moreover, it employs about 290,000 people directly, many of these in more than 5,000 photonics SMEs, with substantial leverage on the European economy and workforce<sup>62</sup>. Some 20-30% of the economy and 10% of the workforce depend on photonics, directly impacting around 30 million jobs.

The development and deployment of KETs requires people with appropriate skills<sup>63</sup>. For Europe to be able to fully realise KETs growth potential in the future, there is therefore a need to align the supply and demand for KETs skills. In 2013 demand for KET skills was estimated at 2.2 million KETs professionals and associates<sup>64</sup>, including jobs at all skill levels. Highly-skilled KET employment accounted for 55% of total employment, followed by 37% for medium-skilled employment and 8% for low-skilled employment. Estimates of future demand for KETs skills, show that **by 2025 an additional 953 000 KETs professionals and associates with technical skills are needed** to satisfy demand, corresponding to **79 000 KETs workers per year**. The key share of extra demand is for replacement (e.g. due to retirement or moving to other sectors) with a total of 772 000 KETs professionals and associates. Expansion demand (i.e. new jobs) is estimated to be a relatively small share till 2025, at 181,000 KETs jobs. Most jobs related to additional demand (62%) will require highly skilled people, though there is also a relatively strong increase in demand

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<sup>59</sup> EPO (2016).

<sup>60</sup> According to the European Commission the global market for KETs was estimated to be more than €1 trillion by 2015, from €680 billion in 2008. See European Commission (2013), *What are KETs and why are they important?*

<sup>61</sup> European Technology Platform Photonics21 (2013), p.7.

<sup>62</sup> Photonics also offers solutions which address key social challenges, such as energy generation and energy efficiency, healthy ageing of the population, climate change, and security.

<sup>63</sup> European Commission (2016c) p.17.

<sup>64</sup> European Commission (2016c) p.12.

expected for medium skilled people (30%).

- ***Bio-based products.*** Bio-based industries are believed to deliver a much wider impact beyond economic performance, especially for environmental and social benefits. Advances in bioeconomy research and innovation uptake will allow Europe to improve the management of its renewable biological resources and to open new and diversified markets in food and bio-based products. Establishing a bioeconomy in Europe holds great potential. It can maintain and create economic growth and jobs in rural, coastal and industrial areas, reduce fossil fuel dependence and improve the economic and environmental sustainability of primary production and processing industries<sup>65</sup>. **The growth of EU bio-based chemical products** (including bio-plastics, bio-lubricants, bio-solvents, bio-surfactants and chemical feedstock) **to 2020 is expected to be 5.3% p.a., resulting in a market worth €40 billion and providing over 90 000 jobs within the biochemical industry alone**<sup>66</sup>. Significant growth is expected from sustainable primary production, food processing, industrial biotechnology and bio refineries. These lead to new bio-based industries, transform existing ones, and open new markets for bio-based products. New high skilled jobs and training options need to be developed to meet labour demands in these industries, as well as in agriculture, forestry, fisheries and aquaculture<sup>67</sup>.

- ***Sustainable industrial and construction policy and raw materials.*** Improving energy efficiency in residential housing and supporting recycling and sustainable waste management are seen as important actions benefiting performance in the construction industry<sup>68</sup>. The energy used in residential, commercial and public buildings accounts for 40% of EU final energy consumption and contributes to CO<sup>2</sup> emissions and air pollution<sup>69</sup>. Moreover, in the EU, at least 30 million jobs depend on the availability of raw materials. **New investments in energy efficiency in residential and public buildings and infrastructure have therefore strong growth potential and are expected to be worth some €25-35 billion per year by 2020**<sup>70</sup>. The Ecodesign directive<sup>71</sup> has set the requirements for a number of energy-related products, including motors, pumps, fans and chillers. Measures for other household goods and industrial equipment are underway. Although energy has been the main resource

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<sup>65</sup> European Commission (2012c), p.2.

<sup>66</sup> European Commission (2010b), p.23.

<sup>67</sup> European Commission (2012c), p.5.

<sup>68</sup> European Commission (2014a).

<sup>69</sup> European Commission (2012b).

<sup>70</sup> European Commission (2012b), p.10.

<sup>71</sup> Directive 2009/125/EC of the European Parliament and of the Council of 21<sup>st</sup> October 2009 establishing a framework for setting ecodesign requirements for energy-related products.

targeted so far, improvements related to all environmental aspects are expected, including material efficiency. Improvements will affect a wider range of industrial products with significant environmental benefits.

- ***Clean vehicles and vessels.*** Clean, energy-efficient and environmentally friendly transport using alternative fuels and increased substitution of combustion engines with electric ones (especially in personal vehicles) are seen as a central element in achieving sustainable mobility throughout the EU. **This will also benefit future industry performance as the sustainable vehicle market is expected to account for 7% of industry by 2020<sup>72</sup>.** The deployment of electrical mobility will require profound changes in industrial value chains, business models, skills and customer attitudes, as well as recharging infrastructure.
- ***Smart grids and digital infrastructure.*** Establishing smart energy grids is considered necessary to integrate energy-efficient solutions (in housing, transportation, industry, etc.) in an effective and efficient distribution system. Developing and implementing a sound policy framework for smart energy systems<sup>73</sup> has to be underpinned by the implementation of intelligent metering in at least 80% of households by 2020 **together with accompanying investment of €60 billion (by 2020), rising to around €480 billion by 2035<sup>74</sup>.**

## 2.2 The changing role of industry in the global economy

Industry still matters and will continue to matter for the global economy, but its role and nature are changing<sup>75</sup>. The new era of industry will be marked by highly agile, networked enterprises that use information and analytics as skillfully as they employ talent and machinery, to deliver products and services to diverse global markets and meet new demands. In advanced economies, industry will continue to drive innovation, exports and productivity growth, while in developing countries it will continue to provide a pathway to higher living standards. The key features of industry changing in a global prospective are:

- ***Large developing economies are moving up in global manufacturing.*** In terms of a gross value added, industrial output in large developing economies continues to grow much faster than in advanced economies. Economies like China, India, South Korea and Indonesia are rising to the level of the world's

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<sup>72</sup> European Commission (2012b), p.11.

<sup>73</sup> European Commission (2011).

<sup>74</sup> European Commission (2012b), p.13.

<sup>75</sup> McKinsey & Company (2012).

leading manufacturing industries, while Europe's largest manufacturers (Germany, France, Italy, the United Kingdom and Spain) continue to drop on the global scale<sup>76</sup>. Advanced economies are still more specialised in industries with greater value added, while being less competitive in low-contribution industries, like labour intensive ones. However, some developing countries are moving towards high value added industry. China's industrial production is currently experiencing rapid growth in smart manufacturing. **Chinese frontrunner manufacturers and their advanced production lines will increase global competitive pressure for high-tech industries**, such as electronics and machinery<sup>77</sup>. They will actively challenge the leadership of foreign manufacturers in industries that are key pillars to economic prosperity in many industrial countries. The Chinese leadership sees **smart manufacturing as a key tool for challenging the technological dominance of industrial countries while simultaneously defending China's low-end industries against growing competition from developing countries**.

• *Industry share of total employment drops as economy grows wealthier*. In major manufacturing economies - both advanced and developing - industry provides more than 70% of total exports and accounts for up to 90% of business R&D spending<sup>78</sup>, but only adds 27.7% to global GDP<sup>79</sup>. However, at the same time, as economies mature, the share of services continues to increase together with ongoing productivity improvements and specialisation in high-skill activities. This leads to less employment in industry. **The increasing use of technology**, especially automation technology, **will make future manufacturing processes less labour intensive, but nevertheless require an increasing number of highly qualified staff**. However, the global demand for high-skill workers is outpacing supply. By 2020, the world may face a global shortage of 40 million high-skill workers<sup>80</sup>.

• *Changing society requires new industrial responses*<sup>81</sup>. Global migration will also increase, and will continue to be driven by political and economic factors as well as increasingly by population imbalances and environmental factors. This

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<sup>76</sup> Among the 15 top manufacturer countries in terms of share of global nominal manufacturing gross value added, China jumped from the 7<sup>th</sup> position in 1990 to the 2<sup>nd</sup> in 2010; India from the 14<sup>th</sup> to the 10<sup>th</sup>; South Korea from the 11<sup>th</sup> to the 7<sup>th</sup>; Indonesia joined the group in 2010 at the 13<sup>th</sup> position. On the contrary, Germany decreased from the 3<sup>rd</sup> position in 1990 to the 4<sup>th</sup> in 2010; France from the 6<sup>th</sup> to the 8<sup>th</sup>; Italy from the 4<sup>th</sup> to the 5<sup>th</sup>; the United Kingdom from the 5<sup>th</sup> to 9<sup>th</sup>; Spain from the 9<sup>th</sup> to the 14<sup>th</sup>. See McKinsey & Company (2012), p. 21.

<sup>77</sup> Wübbeke *et al.* (2016), p.12.

<sup>78</sup> McKinsey & Company (2012), p.3 (data refer to manufacturing).

<sup>79</sup> World Development Indicators, World Bank. .

<sup>80</sup> McKinsey & Company (2012), p.11.

<sup>81</sup> European Commission (2014f).

will also result in increased urbanisation, especially in emerging industrialised countries, as people seek work. Factories with zero environmental impact will have a key role in this urbanisation trend as they become integrated into urban society. Moreover, in the vast majority of global regions, and especially in the EU, an ageing and dwindling society will have effects on demand for products and services, with new markets serving older populations. Customer behaviour will therefore also evolve. Customers, **especially in more affluent, mature economies, will increasingly choose products on the basis of their social and environmental impact rather than on price alone.** A new generation of customers seem prepared to prefer access over ownership<sup>82</sup>. This can be seen in the increase of shared cars, machinery, and even articles of daily use. This is driven by the fact that there is increased awareness of the ethical issues surrounding product production. Customer choice will be better informed thanks to the widespread use of social networking. This will result in a social ranking of products, services and business practices.

- *The share of services in manufacturing has increased.* Manufacturing industries of today conduct more service-like activities (like R&D, customer support and marketing) than before. These activities usually account for 30% - 55% of manufacturing jobs in advanced economies. This is the result of changes in demand and customer needs. **Customers will increasingly demand a package of products and services tailored to meet their individual needs.** The traditional model of ownership will evolve as social and environmental pressures encourage people to demand more integrated products and services<sup>83</sup>. As a result, industrial enterprises and service providers will work more closely together to build customer-driven solutions. Personalisation, enabled by new production technologies such as robotics and additive manufacturing will be a key driver for industry.

- *Regional and local customisation will have a major effect on how industry operates*<sup>84</sup>. Diverse global markets, distributed manufacturing and an increasingly informed and prosperous global middle class will bring challenges to industry. **The new global market will lead to regional diversity of customer choice**, with different regions often requiring very particular products, with different features and different pricing policies. Industry will have to respond by significantly improving its market analysis capabilities to capture customer requirements adequately. The production of goods and services will therefore have to address mass customisation, and become localised and

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<sup>82</sup> The Ellen MacArthur Foundation (2013).

<sup>83</sup> European Commission (2014f), p.32.

<sup>84</sup> European Commission (2014f), p.32.

networked to **be closer to customers, to respond to local demand, and to decrease costs.**

- ***Local comparative advantages in terms of factors of production will influence more the location of enterprises.*** Depending on the sectors, factors such as energy and labour costs or proximity to talent, markets, and partners such as suppliers and researchers, will have greater weight. Five groups<sup>85</sup> of industrial sectors highlight where industrial activities are most likely to take place, and help understand the role of innovation in various industries (see Table 2.1).

The first group is *global innovation for local markets*, covering sectors such as chemicals (including pharmaceuticals), automobiles, other transportation equipment, and machinery, equipment, and appliances. Sectors in this group have moderately highly R&D and depend on a steady stream of innovations and new models to compete. Also, the nature of their products requires production facilities close to customers to minimise transportation costs. The footprints of these industries may also be influenced by regulation (e.g., safety standards) and trade agreements.

The second group includes *regional processing industries* covering food processing and other industries located close to demand and sources of raw materials. Their products are not heavily traded and are not highly dependent on R&D, but they are highly automated.

*Energy- and resource-intensive commodities* such as basic metals make up the third group. For these sectors, energy prices are important, but they are also tied to markets in which they sell, due to high capital and transportation costs. *Global technology sectors*, the fourth group, such as computers and electronics depend on global R&D and production networks. The high value density of products such as electronic components and mobile phones, make them cheaper to transport from production sites to customers around the globe.

The last group, *labour-intensive tradables*, such as clothing manufacturing, covers goods that are highly tradable and enterprises require low-cost labour. Production is globally traded and migrates to wherever labour rates are low and transport is reliable.

- ***The supply chain will become more flexible.*** Industrial enterprises will also seek to **assure flexibility in their supply chain and that their production**

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<sup>85</sup> McKinsey & Company (2012), pp.4-6.



**lines can be reconfigured quickly** (e.g. through self-adaptive and modular machine tools and robots) **to meet changing customer requirements.** However, the regional customisation of demand will mean that the production system will become more fragmented. **Enterprises will therefore practise ‘hybrid manufacturing’, incorporating a mix of production processes located in both high-cost and low-cost countries according to geographic advantage**<sup>86</sup> and based on a wide range of factors (labour costs and skills, infrastructure, regulation, policy, materials, market demand, etc.) enabled by technological developments, especially in ICT. Different business models will be developed to cope with the complexities of a global market. Clusters of partners offering specialised services will form. These will be based on similar technological skills, a common interest in a nearby source of raw materials, or shared energy schemes. These partners will act as an ‘ecosystem’, applying industrial symbiosis, feeding off each other in the value chain, and enabling the ‘cross-fertilisation’ of technology. The need for efficiency, and the realisation of an increasing scarcity of natural resources, will drive some enterprises to seek full control of their value chain through vertical integration. Enabled by new technologies, the entire value chain will be controlled by individual enterprises from the supply of raw materials to sale of products and services.

• *Digitalisation and digital technological advances are creating new development possibilities.* Data will become the ‘new oil’<sup>87</sup>. **Increasingly complex and large sets of data, supported by advanced analytical tools, will enable manufacturing firms to better understand and optimise all stages of their value chains.** Ubiquitous computing has already become pervasive, connecting all aspects of daily life, ranging from industrial processes to the ‘Internet of Things’ and cloud-based computing<sup>88</sup>. These stages cover from design to distribution, including supply chain management, production processes and marketing. Moreover, in today’s highly competitive environment, digital innovation is critical when it comes to addressing industrial enterprises’ key business drivers and creating value<sup>89</sup>. These key drivers include the potential to cut costs, increase productivity, shorten time-to-market and increase customer focus. **Digital tools also allow for more efficient approach to capturing, sharing and developing knowledge.** Integrated knowledge management systems allow industrial enterprises to build customer-tailored documentation, user guides and technical specifications. Social technologies such as internal social networks, wikis and micro-blogs can also be used as an aid to enhance

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<sup>86</sup> European Commission (2014f), p.33.

<sup>87</sup> European Commission (2014f), p.33.

<sup>88</sup> European Commission (2014d) p. 24

<sup>89</sup> Capgemini Consulting (2012).

communication within the organization. **Digital analytics helps also industrial enterprises to reduce working capital costs through the use of centralized data sources such as virtual factory.** A central resource management database also provides insights into the available and installed manufacturing means while predictive maintenance reduces machine down-time. The result will be agile manufacturing, enabled by new production processes and technologies, such as additive manufacturing, software-enhanced added-value services, and ICT. Companies will create more intelligent products based on cyber-physical systems. **The value chain, with complex logistics systems able to supply, produce and distribute products flexibly, will result in a manufacturing process that is more efficient and responsive to change.**

• *Materials will remain one of the critical factors for the competitiveness of any advanced manufacturing company.* The scarcity of many important materials will continue to push the development of new, advanced materials. These will provide industry with increased functionality, lower weight, lower environmental burden, and energy efficiency. **Smart, multifunctional materials, able to change properties according to the environment (e.g. temperature, pH, light, magnetic field, etc.) will become increasingly available.** These will enable the development of new, advanced and environmentally friendly products, often based on organic, non-toxic, non-harmful synthetic materials, which can be used endlessly in different product cycles to enable a waste-free manufacturing system that can even protect and enrich ecosystems. New technologies, arising from nanotechnologies and associated nanomaterials, will underpin these developments.

• *Industry of the future will enormously affect the way people work and live, posing new social challenges*<sup>90</sup>. Increased application of robot-based solutions in industry as well as in every-day life will revolutionise the global economy (which will be further spurred by artificial intelligence and machine learning). At the same time, dramatic advances in life sciences will undoubtedly yield effects both on human longevity as well as on lifestyle, leading to demand for new, specific and tailored products. **Economic returns from these new sectors and production processes will, most likely, be unevenly distributed. This will generate deeper and possibly new global divisions of rich and poor societies, which will have to find new ways to adapt.** Contrary to the 20<sup>th</sup> century when the left-right divide between political systems and markets dominated, in the 21<sup>st</sup> century, the primary difference is between open and closed political and economic models. Spurred by new competition, a series of

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<sup>90</sup> Ross (2016), pp.17-18.

hybrid political and economic models around the world are **contributing to greater uncertainty about which markets will dominate in the future.**

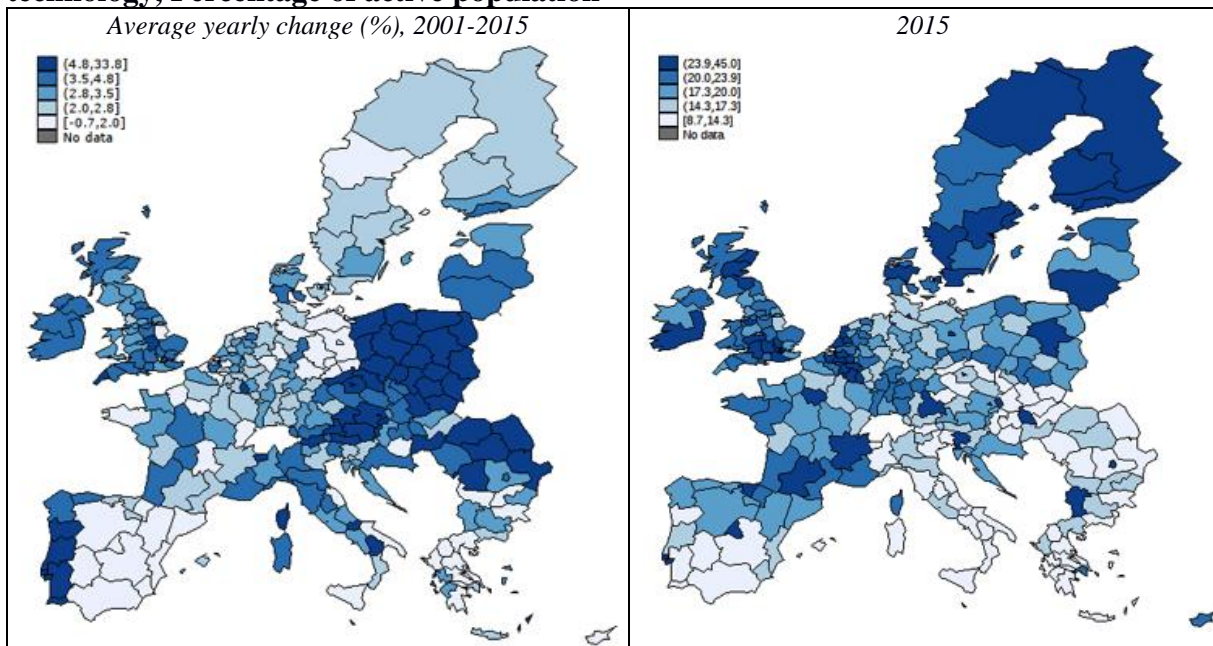
### **2.3 Future pattern of specialisation of European regions**

Forecast and data estimates of the evolution of regional industrial specialisation across the EU in the coming years are not available. However, looking at current key variables and taking into account industrial priorities foreseen in the EU political agenda and the changing features of global industry discussed in previous sections, it is possible to analyse the direction regions are moving in. By looking at where regions have invested in human capital and innovation in recent years, it is possible to identify trajectories for regional industry.

• ***Regions from central and northern Europe are expected to lead the industrial innovation process in the coming years.*** Most of the technological progress measured by the number of patent applications by technological category to the European Patent Office related to the regional population (Figure 2.1), over the last decade has been in the central and northern Europe centres of innovation. High-tech and ICT innovation areas almost perfectly overlap with the most innovative regions in Noord-Brabant in Netherlands, Helsinki-Uusimaa in Finland, Sydsverige and Stockholm in Sweden and Oberbayern and Mittelfranken in Germany. Regions most innovative in biotechnology are Brabant Wallon and Oost-Vlaanderen in Belgium, Hovedstaden in Denmark, Oberbayern in Germany, Wien in Austria and Utrecht in the Netherlands. Southern and eastern regions seem not to keep up the pace of innovation, pointing to divergent paths of specialisation.

• ***Enhancement of human capital is expected to continue in eastern regions.*** Despite regions from the EU-13 having a tendency to invest less in innovation, they are investing significantly in human capital (right side of Figure 2.2) to close the gap with the EU-15 (left side of Figure 2.2). Whether industries will be able to produce goods in high-quality, high value added segments depends on the skilled human capital in the regions. To this extent, human capital plays a crucial role when designing and implementing long-term strategies and shaping future patterns of specialisation towards more sophisticated products. Some areas in eastern Europe and Portugal where high-tech industries are not yet well developed, already have a lot of technical and scientific skills available with respect to their active population. This makes a shift towards sectors requiring high skills more feasible. Also when considering medium-term trends in the technical and scientific professions (Figure 2.3), many peripheral areas that are not standing out as innovation centres have a better perspective in terms of human capital, indicating a path towards more knowledge-driven sectors.

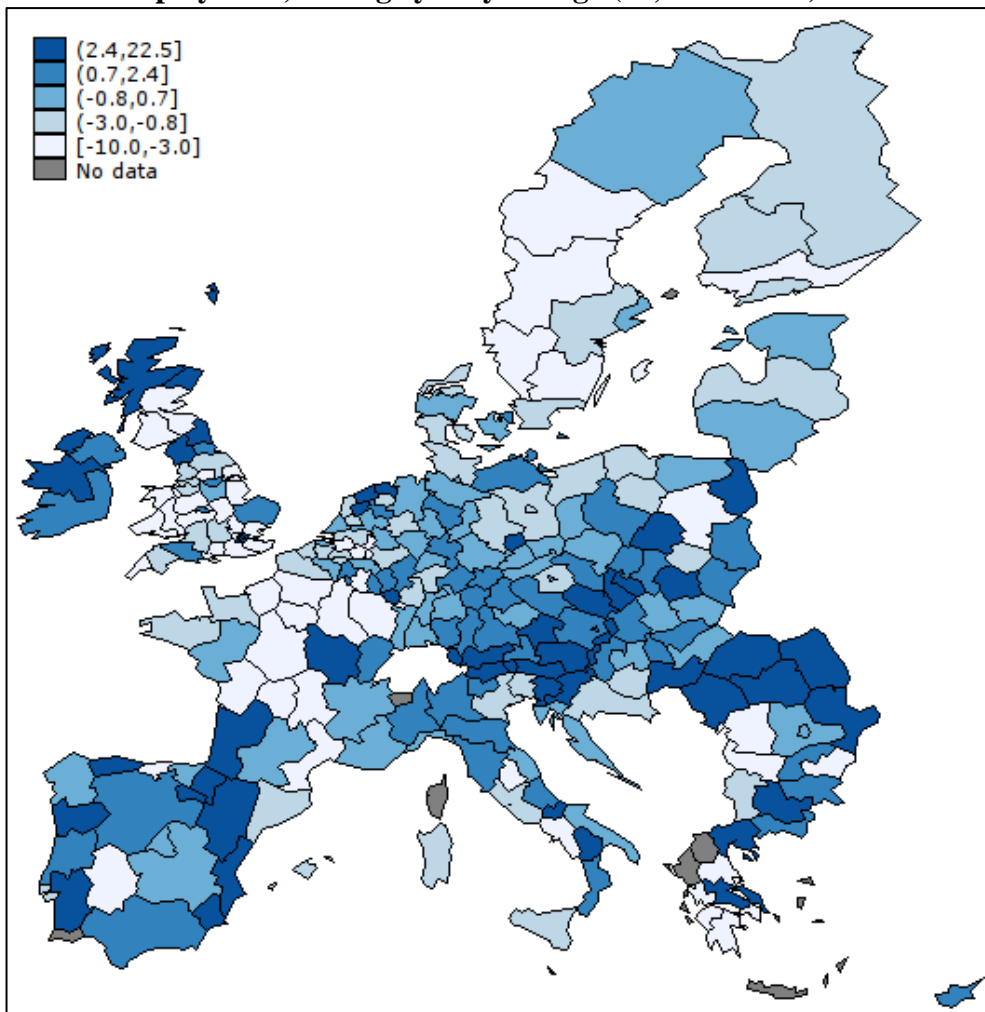
**Figure 2.2: Persons with tertiary education (ISCED) and employed in science and technology, Percentage of active population**



Source: own calculation based on Eurostat (see Annex II for detail)

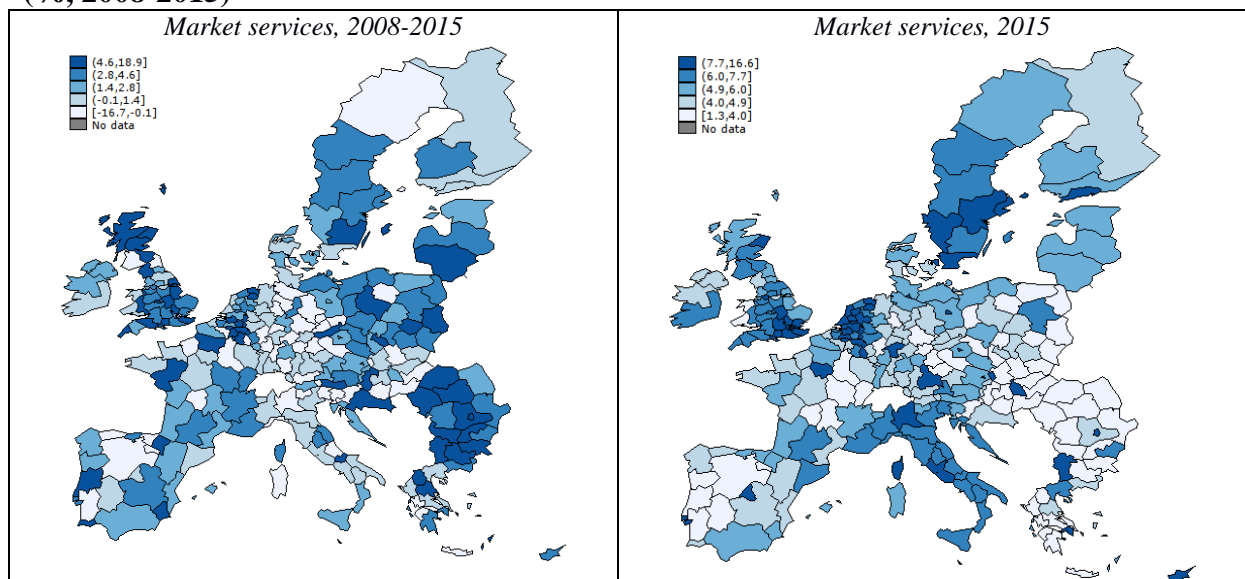
- **Specialisation of eastern regions in high and medium-high technology industries have the potential to increase.** As shown in figure 2.4, employment increased in high and medium-high technology manufacturing across the economic downturn in almost two regions out of five. Most of these are in the EU-13, but also in Italy, Spain, Ireland and Portugal. Eastern regions seem to be more competitive also in international markets for high-tech products (Figure 2.5). While most regions in the EU-15 maintained or lost their comparative advantages in high-tech sectors, eastern regions, especially in Romania and the Baltic Member States, have gained comparative advantage in exporting technology intensive goods.

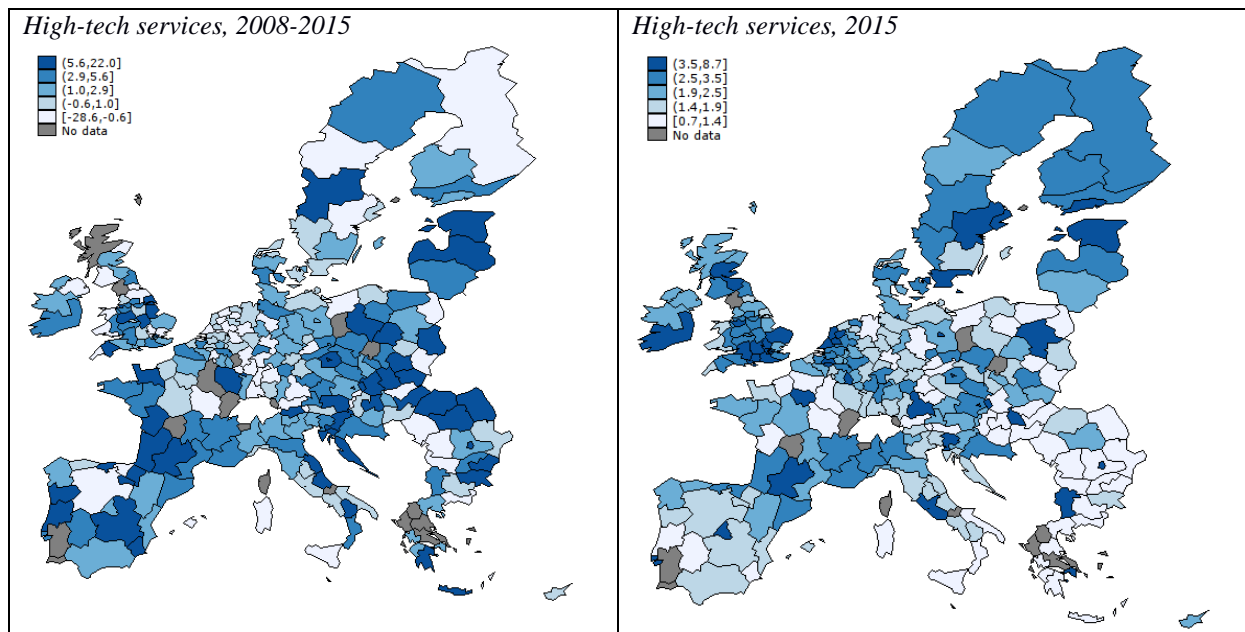
**Figure 2.4: High and medium high-technology manufacturing, Percentage of total employment, average yearly change (% , 2008-2015)**



Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 2.6: Knowledge-intensive services, average yearly change in total employment (% , 2008-2015)**





Source: own calculation based on Eurostat (see Annex II for detail)

- EU regions will further develop knowledge-intensive services related to industry.** Customising and providing high value added goods also requires manufacturing products to include embedded services. Faced with a choice of whether to produce internally or outsource the production of a component, product or service, industrial enterprises tend to be reluctant to internalise such activities. Outsourcing or establishing stable partnerships with service firms can provide an opportunity for European manufacturers to experiment with service implementation without internalising risks. In this regard, Knowledge-Intensive Business Services (KIBS) firms are increasingly viewed as vital to maintaining or enhancing the competitiveness of European industrial sectors. To this extent, some regions are more ready to offer advanced services, allowing for a smoother industrial transition. As Figure 2.6 points out, regions differ in their ability to develop knowledge-intensive services recently. The highest growth has been in Nord-Vest, Vest and Centru in Romania; Cornwall and Isles of Scilly, East Yorkshire and Northern Lincolnshire, Highlands and Islands and North Eastern Scotland in the United Kingdom; Ditiki Makedonia in Greece; Province de Liege and Province de Limburg in Belgium. While for high-tech knowledge-intensive services, the highest growth was in Inner London - West and Lincolnshire in the United Kingdom, Basse-Normandie and Lorraine in France, Cantabria and La Rioja in Spain; Centru, Nord-Est, Nord-Vest in Romania; Vzhodna Slovenija in Slovenia and Lodzkie in Poland.

- There is a growing potential for re-shoring industrial activities.** The recent growth in Chinese wages in manufacturing sectors (Figure 2.7) has encouraged

some industrial activities to return to their original location<sup>91</sup>. The development of off-shore areas in terms of better working conditions and higher safety regulations as well as the need to be closer to R&D centres and costumers, to better anticipate their needs, may encourage the reshoring of some industrial activities. The benefits from being redesigned in a local area can outweigh lower production costs for some activities. While labour costs contribute to a lower share of total costs, rising wages in China along with increased transport and energy costs have contributed to a different perception of the global value chain in some manufacturing sectors. The potential for relocating some parts of the supply-chain is also connected to the increasing role of services in manufacturing. Hence, by stimulating small scale specialisation and local competencies linked to market opportunities, diversifying into related fields and repositioning in the world value chain, activities can be successfully reshored for some industries, e.g. automotive in the United Kingdom Midlands<sup>92</sup>.

• ***Northern and central Europe will be the location for clusters in the most dynamic emerging sectors.*** Regions in the EU-15, mostly in north and central Europe, will be the location for emerging clusters (Figure 2.8). These have been identified<sup>93</sup> thanks to their cross-sector links in the most advanced sectors and their potential in terms of internationalisation. Such industries include advanced packaging, biopharmaceuticals, blue growth, creative industries, digital-based, environmental, experience, logistical services, medical devices, and mobility technology. Some of them are very broad and ubiquitous such as environmental, digital-based and logistical services. These are cross-sector by nature, span many other industries and are relevant to many types of cluster. Other emerging industries have a well-defined core industry such as medical devices, biopharmaceuticals, advanced packaging and mobility technology. These demonstrate new industrial dynamics both through cross-technological spill-overs and cross-industrial links. Blue growth is an emerging industry that connects three big industrial themes; maritime, fisheries and off-shore drilling. The creative and experience industries are diverse and include many design, creative and recreational activities.

• ***Regions continue to invest in KETs, especially in Advanced Manufacturing Systems and Advanced Materials.*** The consistent interest in KET-related RIS3 priorities has grown in recent years<sup>94</sup>. Two out of every three regions and countries have selected such priorities in their Smart Specialisation Strategies

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<sup>91</sup> Gibson (2014).

<sup>92</sup> See Bailey and De Propris, (2014) and Bailey and De Propris (2016).

<sup>93</sup> European Commission (2015a).

<sup>94</sup> High-Level Expert Group on Key Enabling Technologies (2015), p.98.

(see Figure 2.9). Priorities in just two groups (Advanced Manufacturing Systems and Advanced Materials) remain the largest share of all KET-related priorities. Since 2013, their share has increased from 51.3% to 64.2% of all registered KET-related priorities.

• ***European enterprises will increasingly adopt digital technologies.*** Looking at the integration of digital technology (see Figure 2.10), European enterprises are already increasingly adopting digital technologies, such as the use of a business software for electronic information sharing (from 26% in 2013 to 36% of enterprises in 2015), sending electronic invoices (from 11% in 2014 to 18% of enterprises in 2016) or using social media to engage with customers and partners (from 14% in 2013 to 20% of enterprises in 2016)<sup>95</sup>. This pattern is expected also for the incoming years. Moreover, it is estimated that digitisation of products and services can add more than €110 billion of annual revenue in Europe in the next five years<sup>96</sup>. An additional contribution for the European industrial development is expected from the ‘Internet of Things’ (IoT), which has inaugurated a new age of ubiquitous connectivity and intelligence in which components, products, services and platforms connect, virtualise and integrate everything in a communication network for digital processing<sup>97</sup>. The number of IoT connections within the EU is estimated to increase from approximately 1.8 million in 2013 to almost 6 billion in 2020, leading to the EU IoT market being higher than one trillion euros by 2020<sup>98</sup>. This growth in connectivity is expected to bring vast economic benefits, whereby the IoT significantly reshapes industry structures, with borders between products and services, as well as borders between industrial sectors becoming less obvious than today. This may materialise through, for example new innovative IoT services or applications; improved products thanks to the addition of new services or applications coming from connectivity; increased efficiency in processes; reduced consumption of resources and energy; better understanding of customers' needs; increased flexibility and possibility for sharing and co-creation<sup>99</sup>.

• ***Industrial change will require a more holistic approach, combining different tools.*** In many regions, there is a lack of systemic support architecture and capable intermediaries. Single initiatives at universities or single investments cannot replace them. To a certain extent, the smart specialisation agenda (RIS3) of the European Commission has helped to establish local processes of

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<sup>95</sup> European Commission (2017a), p.4.

<sup>96</sup> European Commission (2016), *Digitising European Industry*.

<sup>97</sup> European Commission (2016d), p. 6.

<sup>98</sup> European Commission (2016d), p. 7.

<sup>99</sup> European Commission (2016d), p.8.



entrepreneurial discovery. However, much remains to be done in many regions and therefore RIS3 will be more a key policy strategic tool for regions to take full advantage of the benefits offered by the new industrial revolution. RIS3 strategies are integrated, place-based economic transformation agendas that do five important things: they focus policy support and investments on key national/regional priorities, challenges and needs for knowledge-based development; they build on each country/region's strengths, competitive advantages and potential for excellence; they support technological as well as practice-based innovation and aim to stimulate private sector investment; they get stakeholders fully involved and encourage innovation and experimentation; they are evidence-based and include sound monitoring and evaluation systems.



### 3. Key challenges for European industry and their territorial implications

As shown in Chapter 1, there are significant differences between EU regions in terms of industrial specialisation, human capital endowment, innovation capabilities, openness to trade flows, FDI attractiveness and infrastructure efficiency. Challenges for LRAs and policy solutions that can be implemented can therefore vary from region to region.

Countries and regions that fared best through the financial crisis had a systemic industrial policy<sup>100</sup>, based on pro-active actions supporting innovation, investment in technology, education, openness, combining industrial development with environmental and social goals and strengthening relations between actors in the productive system<sup>101</sup>. An effective industrial policy to enhance local productivity, favour the upgrade of traditional industrial activities or the creation of new segments in dynamic and modern sectors, should therefore be **“pulled by vision and pushed by competition”<sup>102</sup>**. It should promote competition and be a discovery process in a cooperative climate involving government and enterprises<sup>103</sup>, be aligned with the long-term social interests and be systemic, driven by a wider vision, instead of a standalone policy in conflict with other strands of government policy.

**Combining a policy vision that has long-term economic, social and environmental objectives, with competitiveness, which is affected by short-term economic factors and forces, is challenging for LRAs.** This is especially so when they are called on to design and implement a systemic approach for sustainable and solid industrial growth while dealing with continuous changes in demand and the fast emergence of new competitors.

This trade-off poses a series of questions for LRAs: which path to follow? What are the key local sectors on which the industrial policy should be based? What are the main constraints that dampen development of these sectors? How to support these sectors to match the new demand needs, reach new markets and

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<sup>100</sup> Aiginger (2011).

<sup>101</sup> Colletis (2014).

<sup>102</sup> Aiginger (2014), p.10.

<sup>103</sup> Aiginger (2014) p.24.

attract new investment? Is the institutional and governance framework adequate to face these local industrial challenges?

The first group of challenges for LRAs relates to **designing the pattern of industrial specialisation**. This means to identify the key sectors on which industrial policy should be based. LRAs should understand if industrial policy should be based on ‘comparative advantage-following’ – consolidating existing strengths or on ‘comparative advantage-developing’ – seeking strategic advantage in new sectors<sup>104</sup>. Having identified the key sectors, LRAs should then understand how to **enhance industrial enterprise efficiency in the use of inputs**. This requires determining the key inputs to invest in to increase industrial enterprise labour productivity (human and physical capital) or to reduce production costs (raw materials and energy). A third group of challenges is how LRAs support industrial enterprises to become **more globally connected** to meet new demands and attract new investment. Finally, there are challenges related to **the adaptation of institutional capabilities to new industrial challenges** and how to make LRAs more responsive to industrial enterprise needs.

The following sections will discuss these four groups of challenges.

### 3.1 Designing the pattern of industrial specialisation

The first challenge for LRAs promoting an industrial policy is to understand the sectors to invest in and where to concentrate policy actions. **There is no one-size-fits-all approach** to what is needed locally, or otherwise to foster an industrial pattern of specialisation. Local specificity is both inevitable and desirable. What works in one locality cannot be transferred in some context-free way to another, no matter how similar. LRAs therefore need to **analyse and clearly understand the specific sectoral constraints and capabilities in the territory**. They can then identify economic activities that might be held back by market failures and design policies to help these activities realise their full potential.

LRAs are called on to identify the path industrial policy should take<sup>105</sup>. **This is a choice between fostering industrial specialisation by enhancing traditional sectors in which local industry already has a comparative advantage and**

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<sup>104</sup>Warwick (2013).

<sup>105</sup> European Parliament (2013), p.23. See also Skokan (2009), p.774.

**existing strengths, or supporting enterprises to move towards more dynamic and high-technology sectors**, which may be already established or new<sup>106</sup>:

- **Path renewal**, which denotes the rejuvenation of existing clusters or industries and may imply severe changes in products, processes and organisations, including the application of new technology in existing industries. Renewal is associated with incremental change in old industrial regions, modifying their development trajectory rather than altering it.
- **Path formation** of industries that are new for the region. This is based on changes led by diversification. Diversification as way to renew old industrial regions involves more significant change than the regeneration of mature clusters. It opens up new directions of development, broadening the economic base of the regional economy. Diversification is defined as the emergence of clusters in established industries, that are, however, new in the region.
- **Path creation** implies a more radical change towards new high-tech and knowledge intensive industries and results in radical changes in the technology and knowledge base. This implies a major shift in the development trajectories of these regions relying less on incumbent firms and more on completely new enterprises.

### ***3.1.1 Challenges for path renewal***

Compared to the other development paths, revitalisation of traditional clusters in most cases does not presuppose a far reaching transformation of the knowledge generation and diffusion subsystem. This path means that LRAs need to discover and elicit more information about the constraints that sectors face. This typically **requires close and strategic co-operation with the private sector**. Regions with very specialised traditional sectors that are experiencing decline<sup>107</sup> may

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<sup>106</sup> Tripl and Tödting (2008), p.8.

<sup>107</sup> With changes in the international division of labour in the 1970s, the oil crisis and subsequent blows to manufacturing in Europe, many industrial regions in the EU-15 relying on traditional sectors such as coal, steel, textiles or machinery were suddenly confronted with shrinking businesses, unemployment and decline<sup>107</sup>. A common feature of these regions was that they had experienced long periods of prosperity thanks to specialisation on products that were basic inputs to other sectors (trains, rail infrastructure, chemical products, electronics), or mass consumption goods (textiles, cars). The physical infrastructure as well as the qualification of the workforce was completely focused on these basic industries and when these faced Europe-wide decline, the crisis had a severe impact<sup>107</sup>. After EU enlargement similar issues of economic decline in huge agglomerations were seen in some parts of new EU member states: decades of central planning left many regions with even larger-scale problems of overdependence on basic industries, rapidly rising unemployment, and acute environmental and infrastructure legacies. See European Parliament (2013).

find private investment insufficient and less profitable. Impediments are physical infrastructure not adapted to the needs of industries, an extensive need for land reclamation, a lack of future-oriented skills and R&D capacities, little forward-looking entrepreneurship, physical distance from or poor connectivity to future-oriented agglomerations, as well as institutional and cultural factors that make it more difficult for forward looking firms to operate profitably. An industrial policy aiming to modernise declining industries should be viewed as a **discovery process** in which firms and government learn about underlying costs and opportunities for traditional sectors and engage in strategic coordination<sup>108</sup>. The activities of **research organisations, educational institutions and technology transfer agencies can be vital to the restructuring process of mature industries**, pointing to the importance of the region's knowledge infrastructure.

The capacity of a sector to escape from lock-in and to regain its competitive position is **critically dependent on the restructuring strategies of large, endogenous firms**<sup>109</sup>. In most cases a simple cost reduction response to a severe crisis is not viable, whereas a search for market niches and an orientation to innovation promises better results. To take the innovation path often presupposes a major reorganisation of large dominant enterprises through organisational innovation and changes such as decentralisation and enforcement of innovation related functions and management tasks. However, **in many cases knowledge providers must also orientate strongly to the requirements of smaller firms**. Old industrial areas hosting heavy industries often have a supply driven approach to technology transfer, which reaches larger firms better than the smaller ones. A wider adjustment can only be realised if restructuring and innovation are not confined to the larger enterprises. Smaller firms must also be enabled to improve their innovation capabilities. This underscores the importance for LRAs of **improving the existing technology transfer system by placing more emphasis on the needs of smaller enterprises**.

An additional challenge for LRAs that embrace a pattern of revitalising traditional industry, is **to get rid of institutional legacy and ossified networks**. Breaking out of lock-ins and overcoming various forms of rigidities are key to recovery for mature industries. Traditions and old patterns of behaviour and thought can be long-lived, with institutional persistence negatively impacting regional adaptation and change. For LRAs operating in these situations, there is a strong need to renew business networks by substituting hierarchical inter-firm links with more innovation-oriented interactions, leading to regional collective

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<sup>108</sup> Rodrik (2004).

<sup>109</sup> Trippi and Tödting (2008).

learning and innovation. Moreover, **a substantial amount of policy learning is crucial for mature industries to follow an innovation-oriented development path.** To break up petrified policy networks and to unlearn old patterns of intervention such as providing subsidies for declining industries, in favour of new growth coalitions and **modern approaches of governance are crucial in this respect.**

### ***3.1.2 Challenges for path formation or creation***

A policy aimed at developing entirely new groups of enterprises in selected established or new sectors could **entail higher costs, higher risks and give rise to destructive competition** compared to renewal. The formation and growth of high technology clusters presupposes a major transformation in the knowledge generation and diffusion dimension of the regional innovation system. New dynamic sectors and advanced manufacturing such as those based on KETs require **greater investments and policy initiative efforts.** These industries are associated with knowledge and capital-intensive technologies, necessitate significant R&D, high capital expenditure and highly-skilled employment. They also have rapid and integrated innovation cycles<sup>110</sup>.

The key problem is that **most leading technologies are developed by a few frontier countries** which dominate the entire global market<sup>111</sup>. Innovation follows different location criteria than production<sup>112</sup>. Therefore, regions that lag behind in terms of technological innovation capacity, can benefit by imitating such technologies, for example by exploiting the benefits of inward investment. Foreign enterprises with high value-added functions, which embed themselves in the local economy by forming long-term links to regional suppliers and partners, can give an important impetus to the emergence of new industrial activities. The challenge for the LRAs in this case is to **adopt policy tools to ensure that these regional links are fully developed** otherwise FDI projects operating within global value chains may not be embed to the optimal degree from a regional point of view.

In order to assimilate and exploit transferred knowledge, it is therefore indispensable for industrial enterprises in laggard regions to develop a **degree of absorptive capacity**<sup>113</sup>, so they can reach a necessary level of technological

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<sup>110</sup> High-Level Expert Group on Key Enabling Technologies (2014).

<sup>111</sup> European Commission (2013a).

<sup>112</sup> McKinsey and Company (2012). See also Warwick (2013), p.36.

<sup>113</sup> Cohen and Levinthal (1990) assigned the term “absorptive capacity” to the general capability of individuals, groups, and enterprises to recognize the value of new information, choose what to adopt, and apply it to innovation. Essential to the concept of absorptive capacity is the idea that accumulated experience with adoption

competence. Absorptive capacity is considered essential to close the gap with technology leaders and spur economic growth. The formation of new agglomerations in established industries can be heavily supported by an accompanying reconfiguration of the regional innovation system for knowledge generation and diffusion. Absorptive capacity can be increased through the **reorientation of research and educational organisations that are strongly linked to the old industrial specialisation**. The presence of excellent research organisations, higher education institutes and supporting agents such as science parks, academic spin-off centres, incubators, technology licensing offices or innovation centres specialised in promoting young high tech enterprises, can have an important impact on the emergence of high technology agglomerations.

However, taking the high tech road **is strongly linked to intensive institution building and institutional change**. The emergence of new clusters in established or new industries can only be effectively supported if key agents in the political system promote reconfiguration of the region's knowledge infrastructure and if they redefine their role and learn to act as interlocutors and facilitators of innovation networks. **Strong institutions for knowledge generation and diffusion are essential to help enterprises** build bridges to new technology paths or to differentiate their production. Stimulating new industries cannot be done with old policy recipes and traditional instruments such as subsidies, tax incentives or low cost labour. It requires a new mode of LRA engagement, covering aspects such as investment in knowledge infrastructure, securing risk capital and other measures to promote entrepreneurship, assisting the formation of innovation links to encourage a steady flow of knowledge.

**This requires a long-term perspective and willingness to take risks within the political system**. Consequently, in old industrial regions a substantial amount of policy learning is necessary as key agents in the political system have experience of how to support traditional sectors **but often lack a profound understanding of the needs of high tech industries**.

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and invention improves the capacity to recognize and absorb high quality external ideas and create valuable inventions. Absorptive capacity has two constituent components: 1) the capacity to adopt ideas from the outside world, defined as "adoption capacity"; and 2) the capacity to create new inventions, defined as "invention capacity".



### 3.2 Enhancing industrial enterprise efficiency in the use of inputs

Once the key sectors and the industrial path have been identified, the second group of challenges for LRAs is related to a more in-depth analysis of the main factors (inputs) to enhance in order to raise industrial productivity, foster competitiveness and encourage specialisation. Broadly, these are human and physical capital, which are strictly related to labour productivity, as well as raw materials and energy which affect production costs.

**Regions with low labour productivity** also spend less on R&D and have the highest rates of NEET and fewer tertiary-educated people. **For these regions** in particular, **increasing public investment in R&D and supporting SME innovation as well as enhancing the education and training system and the employability of skilled workers, is vital.** As seen in the previous section a highly skilled labour force and production process innovations are a prerequisite for the modernisation of local traditional sectors to make them more competitive and for the launch and emergence of high-tech and dynamic sectors moving industrial capability towards higher value added products.

A key challenge for regions that lag behind in terms of economic development is **to reverse the brain-drain of skilled workers**<sup>114</sup>. The departure of skilled workers is a loss of public investment in education and of potential tax revenues. This also affects innovation and technological progress and, in turn, industrial productivity and growth. The drain of highly-skilled professionals leaving Eastern and Southern Europe plays a major role in increased inequality, contributing to the slowdown of the affected Member State economies.

However, **regions with more innovation capacity can suffer skills mismatches** especially as progress in manufacturing technologies and changes in customer needs will increase demand for specific skills and training. Increasing the cross-border mobility of EU workers<sup>115</sup>, which is still limited, should favour knowledge transfer and match industrial demand for new qualifications. Of course, **industrial enterprises should be incentivised to take**

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<sup>114</sup> Committee of the Regions (2016).

<sup>115</sup> A CoR study on labour mobility reveal that EU-15 immigrants are much more highly educated than non-EU immigrants and the national population in every country analysed. By contrast, the proportion of highly qualified immigrants from new EU Member States varies substantially across destination countries: southern European countries have a very low proportion of highly qualified immigrants from new EU Member States, while the other destination countries have attracted a much larger proportion of highly qualified immigrants from the new EU Member States. The education level of EU mobile workers has an important effect also on the capacity of regions to generate knowledge and implement a definite pattern of innovation. Labour mobility is therefore more efficiently used in regions that are more knowledge and innovation intensive. See Committee of the Regions (2016).

**on higher-skilled workers**, ensuring proper wages for more qualified jobs but without affecting production costs.

Empirical studies of the labour productivity gap between Europe and the US found that the EU is not only still lagging behind the US, but the gap has recently widened<sup>116</sup>. In the EU there is insufficient investment in the skills and organisational changes necessary to reap the benefits of ICT. Lower investment in broadly conceived intangible assets such as R&D and human capital, are likely to explain some of the US-EU productivity gap. These factors affect countries' absorptive capacity and their ability to take advantage of technology developed elsewhere (international technology transfers). **European regions and industrial enterprises cannot compete on low price and low quality products.** They must turn to productivity, resource-efficiency and high value-added to compete in global markets, basing their comparative advantage on high value added goods and services, the effective management of value chains and access to markets across the world. **Fostering absorption capacity is a key challenge for regions that lag behind in terms of innovation capacity.** Favouring exchange of knowledge with science-based regions, enhancing collaboration between universities and the productive sector, support for collaborative research networks of inventors and the mobility of inventors within the local labour market are all required to enhance local knowledge creation<sup>117</sup>.

Additional challenges relate to the use of inputs in the production process such as raw materials and energy. EU **industrial regions are mostly dependent on raw materials from international markets**, especially unprocessed minerals and metals<sup>118</sup>. They face a number of challenges regarding access to both primary and secondary raw materials throughout the value chain of exploration, extraction, processing and refining, recycling and substitution. This raises the cost of production for industrial enterprises and reduces their capacity to compete<sup>119</sup>.

Moving to a strong bioeconomy and favouring adoption of a green model of production **would require LRAs to leverage further public and private**

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<sup>116</sup> European Commission (2013a), p.75.

<sup>117</sup> ESPON (2012).

<sup>118</sup> European Commission (2014a), p.16.

<sup>119</sup> In particular, regarding energy, EU industrial electricity prices are estimated to be twice as high as in the USA and Russia and 20% higher than in China according to the International Energy Agency data. The price gap is greater for gas: EU gas is three to four times more expensive for EU industry than for US, Russian and Indian competitors, 12% more expensive than in China but cheaper than in Japan. Nevertheless, the prices effectively paid by industrial users may vary from one Member State to another. See European Commission (2014a).

**investment.** This would increase the positive effects of spillover, improving research productivity, launching public-private partnerships (PPPs), as well as creating incentives for and reducing barriers to technology development and research based innovation<sup>120</sup>. **The potential of green models of production can be fully realised by working across several disciplines, policy areas and sectors with a strong willingness to jointly address diverse responsibilities.** Greater benefit could be obtained from better policy coherence in the identification and deployment of promising pathways for the green model. These could cover next generation biofuels and bio-based products, facilitation of their commercialisation and use, coordinated national planning for waste management and use, better customer acceptance of new technologies, and understanding the links between non-food use of food commodities and agricultural land, on the one hand, and food price levels and volatility on the other hand to reduce or prevent adverse effects.

### **3.3 Supporting industrial enterprises to become more market connected**

Internationalisation is important for the growth of European industrial enterprises. There is a positive correlation between being internationally active and reporting high turnover growth, and higher employment growth. The relationship between internationalisation and innovation is strong<sup>121</sup>.

**Internationalisation of European industry means not only support for enterprises to exploit the advantages of operating in a single market with more than 500 million potential customers, but also to enhance their capacity to reach new fast growing markets outside the EU<sup>122</sup>.** However, emerging markets have diverse customers in terms of cultures, living conditions and income. **This raises pressures to adapt manufacturing to new patterns of demand. Greater variation in product requirements puts pressure on manufacturing business models** to support flexible production for more varied products in different markets. Diverse customer demands are an opportunity for enterprises that can use input from customers as a source of innovation. Enterprises that also manage to modularise production processes through

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<sup>120</sup> European Commission (2012c).

<sup>121</sup> European Commission (2015b).

<sup>122</sup> Around half of SMEs (52%) in the EU are involved in international business inside or outside the Internal Market. The EU is the main destination of goods or services for four fifths of SMEs that export; moreover, among exporters, the local market still represented the largest proportion of sales in 2014; on average, 66% of sales in 2014 were within a company's own country. Moreover, the larger the company the more likely it is to have exported to or imported from countries outside the EU. See EC (2015b).

digitalisation are more capable of tailoring products to different markets cost effectively.

LRAs can play a significant role in stimulating SMEs to internationalise and meet the new growing markets, reducing key obstacles to international trade. The main obstacles to internationalisation are<sup>123</sup>:

- **complicated administrative procedures** as a barrier to exporting,
- **delivery costs** as a problem when importing;
- **large financial investments** required for SMEs to participate in international markets;
- **complicated or costly foreign taxation** or cross-border complaints and disputes;
- **limited use of e-commerce**<sup>124</sup>, just over two thirds of SMEs across the EU have a website which displays the products or services they have to offer; it is possible to order goods or services online at less than a third of SMEs and only a fifth accept payments online<sup>125</sup>;
- **scarce information about the potential export market**, (not knowing the rules causes problems when exporting), and difficulties in identifying partners abroad (SMEs are also generally not very aware of public support programmes for internationalisation: for example, less than one in ten SMEs have heard of the Enterprise Europe Network<sup>126</sup>);
- **lack of skills** such as foreign languages, or specialised staff to deal with exports.

**An additional challenge for LRAs that intend to push SMEs to be more market connected and exploit the advantage of openness to trade, is creating an economic and institutional environment to attract FDI.** FDI may complement local investment and can add to local production capacity<sup>127</sup>.

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<sup>123</sup> EC (2015b), p.10.

<sup>124</sup> EC (2015b), p.15.

<sup>125</sup> Generally, countries located in northern and central Europe tend to have larger proportions of SMEs with a website that presents products or services. For example, more than four fifths of SMEs in Denmark (89%), Sweden (87%), Austria (85%) and Belgium (81%). Conversely, less than half of SMEs have this facility in Bulgaria (34%), Italy (45%) and Romania (48%). Interestingly, no geographical patterns emerge with regard to the possibility of ordering SME products or services online. At least four in ten SMEs in Poland (50%), the Czech Republic (49%) and the UK (41%) have this capability, compared with less than a quarter in Italy (16%), Spain (20%), Bulgaria and Germany (both 23%). Polish SMEs are by far the most likely to say that it is possible to pay for their products or services online, with just under a third holding this claim in the Netherlands (31%), the Czech Republic, Greece and Ireland (all 30%). By contrast, just over a tenth say this in Slovenia (11%), Spain and Estonia (both 13%). See EC (2015b).

<sup>126</sup> EC (2015b), p. 11. With some 600 member organisations covering more than 60 countries, the Network helps enterprises take advantage of international business opportunities inside the EU and beyond.

<sup>127</sup> Casi and Resmini (2011).

Moreover, it can promote growth by stimulating productivity gains from spillovers to local firms. FDI is a primary mechanism for host economies to gain access to advanced technology, managerial expertise and skills. The inward flow of FDI also has a positive impact on employment. It may generate increased demand for skilled workers and encourage inter-regional mobility<sup>128</sup>.

To make local industrial sectors more attractive for FDI, LRAs should reduce the following bottlenecks:

- **industrial stagnation** reducing the attractiveness of foreign capital (fast growing markets are associated with higher FDI inflows);
- **a less educated regional workforce and low level of R&D spending**<sup>129</sup>;
- **weak infrastructure**, limited information, technology and access;
- **labour rigidities**, as labour market flexibility is key for attracting FDI;
- **low institutional quality**;
- **few clusters** and agglomeration economies;
- **information asymmetries**<sup>130</sup> (investors typically do not have perfect information about countries, regions and investment opportunities).

The internationalisation of industry poses new challenges for enterprises not only in terms of how to reach new markets or attract new sources of investments (FDI), but **also in terms of where to locate production activities**. A current debate<sup>131</sup> questions the key advantages and challenges for industrial enterprises moving parts of their value chain to their home economies after decades of production offshoring and outsourcing.

With labour costs making up a lower share of total costs, increased transport and energy costs, rising wages in key areas of China (see Figure 2.6), and a greater awareness of supply chain resilience, the reshoring of some production activities can be an efficient option. **Reshoring could generate significant spillover for local economies**, especially those specialised in industrial activities for which demand is less price-elastic and where technology, knowledge and innovation shape the competitiveness contest<sup>132</sup>. Reshoring contributes to repopulating the regional business network with domestic SMEs in the industrial supply chain. These were squeezed out by large corporations in the past. This could create new synergies with services requiring a co-location of activities to maximise quality for customers. There is a new generation of products for which local co-

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<sup>128</sup> Driffield *et al.* (2013).

<sup>129</sup> European Commission (2006).

<sup>130</sup> Warwick (2013).

<sup>131</sup> Bailey and De Propris (2014), Gibson (2014), and Bailey and De Propris (2016).

<sup>132</sup> Bailey and De Propris (2016).

production between the producer and the user is necessary to the extent that innovation tends to be embedded in the production itself. However, **support for reshoring production can be challenging especially in areas affected by<sup>133</sup> high labour costs, limited access to finance, lack of skilled workers and high energy and raw material costs.**

### **3.4 Adapt institutional capabilities to new industrial challenges**

Additional challenges for LRAs dealing with industrial policy concern their ability to adapt the institutional framework to local industrial needs. The process of upgrading the industrial structure to a level consistent with regional factor endowments cannot rely solely on the market mechanism<sup>134</sup> to promote economic growth<sup>135</sup>. A European Commission analysis<sup>136</sup> indicates that the poor quality of governance and institutions is the main obstacle to development in the low-growth regions. Improving the quality of government can have multiple benefits from a more efficient business environment, to better public services and to improved regional development strategies. LRAs can shape incentives for key economic actors, influence investments in physical and human capital and technology<sup>137</sup> and the organisation of production. LRAs can help allocate resources to their most efficient use, help territories to adjust and react to change, as well as generate ‘adaptive efficiency’ that enhances the willingness and capacity of local actors to adopt new knowledge and to engage in innovative and creative activities<sup>138</sup>.

Policies to promote productive capabilities relate to different areas and **require a comprehensive and coordinated strategy**. Education, training, trade, investment, R&D, technology and migration policies can all play an important role as they contribute to transforming and enriching knowledge structures in the labour force and support the evolution of routines and institutions. **LRAs can therefore play a decisive role in creating a high competence institutional framework** to support rapid and sustained processes of learning and capability

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<sup>133</sup> Bailey and De Propris (2014).

<sup>134</sup> UNCTAD and ILO (2014).

<sup>135</sup> Acemoglu, Johnson and Robinson (2005).

<sup>136</sup> European Commission (2017b).

<sup>137</sup> According to Silve and Plekhanov (2015) exports of innovation-intensive industries grow relatively faster in countries with stronger economic institutions, and this effect is statistically significant. In particular, the analysis showed that industries with higher levels of innovation grow faster in countries with a higher quality of economic institutions. Countries with better economic institutions therefore tend to develop more innovation-intensive structures of exports as over time innovation-intensive industries increase their contribution to exports from these countries.

<sup>138</sup> Rodríguez-Pose (2013).

development, generating incentives and pressure to learn, encouraging experimentation and learning from it, rewarding critical thinking and creativity and providing direct support measures for such activities. **Specific local institutional arrangements can enable localities and regions to embark on a sustainable trajectory to economic development.** It is often thought that these institutional arrangements work better locally and regionally, **as the national scale can be too distant, remote, and detached to be effective in mobilising organisations**<sup>139</sup>.

Industrial policy has moved from a traditional approach, based on product market interventions (subsidies, state ownership, tariff protection), through a phase of correcting market failure with taxes and subsidies, operating mainly on factor markets (R&D, training, access to finance) to a third stage of helping to build up systems, create networks, develop institutions and align strategic priorities<sup>140</sup>. As manufacturing evolves, **policy makers must adjust their expectations and look at industry not as a source of mass employment in traditional production work, but as a critical driver of innovation, productivity and competitiveness**<sup>141</sup>. The role of policy in industry is not only about enabling and creating an environment for competitive and innovative enterprises to grow, nor just in terms of a more efficient use of inputs or a more tailored matching of demands, **but also about removing regulatory and administrative barriers that dampen entrepreneurial initiatives**, investing in infrastructure supporting industrial development and coordinating policy interventions with the private sector.

Industry production in Europe and the sale of goods and services are subject to many administrative requirements and regulations<sup>142</sup>. These include registration of a firm, certification of products and services, their respective mutual recognition schemes, requirements on emissions, the security of industrial goods, safeguarding intellectual property rights and technical standards. All of these factors have cost implications for industrial enterprises. Moreover, **differences in regulations or how regulations are implemented and interpreted across Member States can lead to additional costs. So firms can be at a competitive disadvantage** in worldwide markets.

The centrality of institutions and policies in structural change highlights that the general quality of institutions is important. The main role of public actors should

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<sup>139</sup> Rodríguez-Pose (2013).

<sup>140</sup> Aiginger (2014), p.13. See also Warwick (2013).

<sup>141</sup> McKinsey and Company (2012).

<sup>142</sup> European Parliament (2014), p.36.

be to examine developments and anticipate the complementary abilities required by enterprises. This will involve:

- significant improvement in the **quality of co-ordination between public actors as well as strengthening relationships between public and private actors**;
- a **long-term vision** for industrial policy, making each policy initiative part of a long-term industrial plan;
- within institutions, **limiting the fragmentation of policy initiatives** across different departments and promoting well-coordinated initiatives;
- implementing a **comprehensive and coordinated strategy**;
- developing **accountability and transparency mechanisms**<sup>143</sup>;
- **reducing the administrative burden** for SMEs, as indicated by Principle IV of the SBA<sup>144</sup>, making public administration more responsive to enterprise needs, by adopting for example, IT and e-government.

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<sup>143</sup> Rodrik (2004).

<sup>144</sup> European Commission (2008).



## 4. How LRAs are responding to the challenges

European regions have different industrial inputs, follow different patterns of specialisation and face different challenges. **Various policy actions can be designed and activated by LRAs to solve industrial challenges and exploit local industrial potential.** A broad and inclusive definition provided by the OECD<sup>145</sup> specifies that an industrial policy is:

*“... any type of intervention or government policy that attempts to improve the business environment or to alter the structure of economic activity toward sectors, technologies or tasks that are expected to offer better prospects for economic growth or societal welfare than would occur in the absence of such intervention...”*

This definition foresees a wide range of policy initiatives. It includes **any type of intervention**, not just selective or targeted interventions, thus including functional or horizontal policies as well as more targeted approaches. It includes **policies to improve the business environment**, sometimes referred to as ‘framework conditions’, not just those with the express aim of altering the structure of the economy. It includes those that **aim to alter the structure of economic activity**, a much broader term than ‘production’, which might be construed as relating only to production industries or the manufacturing sector alone or, even more narrowly, the fabrication stage of the manufacturing value chain. It may aim to switch resources not only to particular sectors but also **towards certain technologies** (for example biotech, ICT or clean-tech) or even ‘tasks’. It may target not only productivity, employment or growth objectives, but **may contribute to social welfare**, ensuring industrial policy is closely integrated with other policies as part of a broader government social and economic strategy.

The next sections include examples showing how LRAs are responding to industrial challenges, adopting different policy solutions with different rationales, domains, orientation and target groups, to achieve different objectives<sup>146</sup>.

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<sup>145</sup> Warwick (2013), p.16.

<sup>146</sup> Warwick (2013) p.17. Target group: Is the policy aimed at a specific sector (or technology, or input, e.g. R&D, or stage of the value chain), at individual firms or at local/regional clusters? Rationale: Is the philosophy that the distribution of economic activity should generally be left to the market, is there a role seen for correcting market failures or, indeed, is market failure regarded as endemic? To what extent does thinking based on new growth, evolutionist and institutionalist models shape the approach taken to addressing market failure? How is systems failure viewed? What about government failure? Are there areas where government action can be particularly effective in reducing distortions or unlocking inertia? Policy domain: Do the instruments of industrial policy operate mainly on the product market, or are they focused on factor markets – labour, capital, land and technology? What is the role for policies aimed at developing entrepreneurship or facilitating co-ordination or at the creation of new systems and networks? Policy orientation: Is policy horizontal/functional or vertical/selective? Is targeting done strategically or in

## 4.1 LRAs designing the pattern of industrial specialisation

### 4.1.1 Dealing with traditional sectors

As stressed in section 3.1.1, industrial path renewal necessitates an in-depth understanding of the key problems that constrain modernisation in traditional sectors. A successful strategy to enhance the competitiveness of a traditional sector requires **close co-operation with the private sector**.

*Marinha Grande*<sup>147</sup> is an industrial town in the central region of Portugal with a traditional dependence on manufacturing (accounting for 63.2% of jobs), particularly in advanced processing for glass and plastics. Faced with a need to reconvert the glass-making industry, a partnership led by the local authority and including local entrepreneurs, developed a strategy to increase the competitiveness of the town's glass and moulding industry for consideration by the Portuguese Government as a 'zone of excellence'. **Success of the partnership is attributed to strong leadership provided by the local authority and the strength of involvement of local industry representatives**. This enabled identification of specifically local needs relating to competitiveness, as well as the development of a customised local response.

**Improving collaboration between universities and research centres and the productive sector is another effective strategy** for industrial policy initiatives aiming at renewal.

*Moravian-Silesian Region* in the Czech Republic is a region with an old tradition of steel production and a high concentration of metallurgical enterprises since the 1970s. After 1990 a new cluster in the region started as a joint initiative of VSB-Technical University of Ostrava and the Regional Development Agency of Ostrava supported by the Czech government agency CzechInvest<sup>148</sup>. Interactions between the highly developed industrial base and extensive education system with a range of initiatives supporting research and development, have led to the region becoming the Czech leader for clusters to support the local development of key economic sectors.

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response to market pressures? Is intervention time-limited or longer-term? Is support conditional or unconditional? To what extent does policy work with existing comparative advantage or explore new areas?

<sup>147</sup> European Commission (2004).

<sup>148</sup> European Commission (2004).

### Box 4.1 The experience of Podkarpackie Voivodship (Poland)

<i>The region in figures</i>	
Industry value added, share of total value added (%)	29,3
Industry value added, share of total value added. avg. yearly change 2001-2014 (%)	6,7
Services value added avg. yearly change 2001-2014 (%)	4,9
Employment in Industry avg. yearly change 2008-2015 (%)	-0,7
Labour Productivity 2013 (EUR per hour)	10,7
Labour Productivity avg. yearly change 2001-2013 (%)	6,2
Business enterprise sector intramural R&D expenditure (% of GDP avg. 2014-2005)	0,5
Employment share of High and medium high-tech manufacturing 2015 (%)	6,0
Employment share of High and medium high-tech manufacturing avg. yearly change 2009-2015 (%)	1,2
Employment share of High-tech Knowledge Intensive services 2015 (%)	0,9
Employment share of High-tech Knowledge Intensive services avg. yearly change 2009-2015 (%)	-1,4
Regional Competitiveness Index 2013	-0,7

Semi-peripheral position of Poland in the global economy leads to certain challenges from the point of view of development and supporting it by means of industrial policy. Firstly, Polish enterprises depend largely on foreign knowledge and technology, as well as on decisions of leading multinationals in European production networks. Secondly, Polish enterprises very often lack the scale and scope of activity that are necessary to compete internationally, especially in the European Single Market. Low scale means low margins and small own capitals. Thus, their strategies are oriented mostly on the short-term, with low propensity and capability to invest and to innovate. Finally, institutional surrounding of industrial policy in Poland remains underdeveloped. It refers to such crucial aspects as capabilities of policy makers and developmental agencies, existence of ‘intermediate institutions’ and channels of coordination between the businesses and the state. For years, Polish policy was oriented on attracting foreign capital and spending EU funds, and only recently the government started to notice the need to enhance domestic capabilities.

The most prominent example of a successful regional industrial development in Poland is represented by Podkarpackie Voivodship, related to the growth of the aviation sector. The region as a whole, situated in Eastern Poland, is one of the poorest in the country. Podkarpackie Voivodship is specialised in aviation since the inter-war period, as an element of the Polish industrialization strategy. Technological knowledge, specialized, high-skilled employees, as well as networks of suppliers managed to survive the tough transition period of 1990’s. In 2003 a cluster ‘The Aviation Valley Association’ was founded, to enhance cooperation between enterprises in the sector. The cluster includes over 100 enterprises, with around 24 thousand workers employed. Main activities of the cluster have been: development of a high-quality supply chain, cooperation with local universities (R&D, engineers) as well as high-schools (skilled manual workers), participation in the processes of regulation, promotion of the industry abroad. The industry has been supported by local and state authorities, as well as by the European funds. **Apart from involvement of universities and schools, and financial support from the EU, important**

**intermediary institutions were formed, oriented at creation of networks and knowledge.** A key success factor for developing the cluster was in fact the tight cooperation with local universities (R&D, engineers) as well as high-schools (skilled manual workers). Moreover, the science and technology park, AEROPOLIS, strongly supported individual enterprises and built links between firms. It also ran a ‘Pre-incubator’, which facilitated the growth of small, student enterprises. The Centre of Advanced Technology ‘AERONET - Aviation Valley’ was responsible for **long-term research and the commercialisation of technologies, involving actors from business and science.**

*Nordrhein Westfalen* in Germany had a concentration of old and established industries for a long time. New universities, public science and technology institutes and technology transfer centres were established and built up after reunification, to re-structure the traditional industries<sup>149</sup>. One major objective of the regional industrial policy referred to improved links between enterprises, public R&D institutions, technology transfer centres and consultants.

#### **Box 4.2 The experience of Saxony (Germany)**

<i>The region in figures</i>	
Industry value added, share of total value added (%)	24,0
Industry value added, share of total value added. avg. yearly change 2001-2014 (%)	3,7
Services value added avg. yearly change 2001-2014 (%)	2,2
Employment in Industry avg. yearly change 2008-2015 (%)	-0,6
Labour Productivity 2013 (EUR per hour)	40,0
Labour Productivity avg. yearly change 2001-2013 (%)	4,1
Business enterprise sector intramural R&D expenditure (% of GDP avg. 2014-2005)	1,2
Employment share of High and medium high-tech manufacturing 2015 (%)	8,7
Employment share of High and medium high-tech manufacturing avg. yearly change 2009-2015 (%)	0,2
Employment share of High-tech Knowledge Intensive services 2015 (%)	2,4
Employment share of High-tech Knowledge Intensive services avg. yearly change 2009-2015 (%)	1,0
Regional Competitiveness Index 2013	n.a.

*Saxony* was under socialist regime until 1989 and therefore was faced with the need to reorganize its economic structure and innovation systems. Saxony has to be seen as an industrial heartland of the Eastern Länder with a long tradition of industrial expertise. After re-unification, large investments by leading multinational companies, e.g. Volkswagen in Dresden and Mosel (Zwickau), Porsche and BMW in Leipzig, Infineon in Dresden-Leipzig, indicate the importance of industries for the economic development in this region. Moreover, Saxony has the largest population and is the most closely settled Land of all East German Länder. Simultaneously Saxony is the

<sup>149</sup> Helmut, Möller and Wink (2003).

most strongly industrialised economic region in East Germany. GDP and turnover as well as export rates and investment rates indicate the leading position of Saxony among the East German Länder.

Saxony is certainly the most successful East German region in terms of innovation performance and technological restructuring<sup>150</sup>. Saxony was highly successful in attracting outward investment (including R&D investment by multinationals) in high technology industries. **The regional government has played, and continues to play, a critical role in this process.** The experience of Saxony suggests in fact that **strong coordination between different policy levels can be essential for improved innovation in local industries and technological restructuring.** A differentiated research and innovation policy has used strengths in science and industrial research which were built up under the German Democratic Republic. By strongly interacting with national initiatives and with EU structural funding, Saxony was able to develop a strong research base in both the public and private sectors<sup>151</sup>. Policy actions of the European Union, the national government, the regional government and the local government are well-coordinated. Formal and informal coordination mechanisms maintain these interactions. EU and national funding have played a major role in the technology focus of R&D programmes. These address different target groups with different instruments, offering a full range of support initiatives. Large projects by enterprises with an international focus tend to be co-funded by the EU and national sources, while large projects with a primarily national focus are typically funded by the national government. National programmes are frequently oriented towards basic research while smaller collaborative projects with a regional focus are almost all funded by the region. These R&D policy initiatives and measures have a double aim. One is to **develop and maintain a strong research basis** with a particular focus on academic research with a clear link to potential commercialisation of research results, including the potential to co-operate with enterprises. The other aim is to **focus on thematic research** that is either **closely linked to traditional strengths of the regional economy** (microelectronics, machinery, materials, automotive) **or to growth perspectives for successful industrial restructuring of the region** (e.g. biotechnology, environmental technology, medical technology).

Another successful policy instrument is **to create a new local ‘image’**, as in *Marinha Grande* in Portugal. Here improved tourist facilities increase the attractiveness of the region and put considerable attention on local services to encourage social integration through sports and culture. While continuing to attract investment remains a priority, local partnerships in old industrial and mining areas can also add a new ‘story’ to a view of the future<sup>152</sup>. ‘Rebranding’ the locality and ‘image’ are a means of drawing

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<sup>150</sup> Sellenthin and Rammer (2007).

<sup>151</sup> Sellenthin and Rammer (2007).

<sup>152</sup> European Commission (2004).

wealth as well as investment to particular locations. **The strength and depth of local partnerships and networks and the extent to which they share a positive view of themselves and their city or region's place in the world, is an attractive force for new investment.**

A similar strategy was implemented by the *Municipality of Lyon* in France, with the ONLYLYON programme. This aims to make Lyon a top business location by exploiting the city's comparative advantages. The programme promotes Lyon as a biotech capital with world-class clusters, boosts university standards to join the top 30 in Europe, develops infrastructure, strengthens financial and service systems and develops the tourist industry. During 2011, 340 investment projects were successfully created, creating 4,221 jobs. This added to the portfolio of 400 projects from Aderly<sup>153</sup>, the Economic Development Agency for Lyon. The 2012-2014 strategy identifies performance indicators, target sectors and a plan to monitor international investors in the region, adapting to new economic challenges affecting the business environment.

#### ***4.1.2 Moving industrial specialisation towards new sectors***

As already underlined in Chapter 3, adopting a strategy of formation or creation may require greater policy efforts, entailing higher costs and risks, and potentially leading to destructive competition. More investments enhancing R&D and human capital are therefore needed and stronger cooperation between institutions and research centres, the private sector and different policy levels is necessary.

This includes LRAs stimulating local enterprises to move towards **industry 4.0 activities**. The tremendous evolution of ICT is driving this digital transformation of industry (but also society as a whole) with increasing speed. The establishment of intelligent production processes as well as intelligent products and systems ('Internet of Things'<sup>154</sup>) is the focus of industry 4.0. There are huge opportunities for new businesses in Europe, but more importantly for existing industrial enterprises. The European Commission estimates that 75% of the economic impact from the digital economy will be captured by traditional industries. The speed of evolution will be critical also for new job creation.

In *Flanders*, Belgium, the concept is promoted through Industrie 4.0<sup>155</sup>. This platform connects all industry 4.0 initiatives in Flanders and related concepts. The platform highlights initiatives and organisations supporting industrial development in Flanders such as Flanders Make, a strategic research centre for the manufacturing industry set

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<sup>153</sup> ECORYS (2013).

<sup>154</sup> See European Commission (2014d), p.26.

<sup>155</sup> Geerts *et al.* (2016).

up in in 2014. Its purpose is to create a top-level research network in Flanders that delivers full support to industrial enterprise innovation projects. This includes new products and processes for vehicles, machines and factories of the future. The mission of Flanders Make is to strengthen the long-term international competitiveness of the Flemish manufacturing industry, by carrying out excellent, industrially relevant, pre-competitive research in the field of mechatronics, product development and advanced production technologies. **It builds an ecosystem in which industry and knowledge institutes collaborate closely to translate the results of fundamental research into product and process innovations.**

The creation of new sectors and support for the start-up of new industrial enterprises in most advanced activities is also **beneficial for the re-vitalisation of enterprises operating in traditional industries.**

*Baden-Württemberg* in Germany<sup>156</sup> is an innovation leader in Europe. The federal state is highly specialised in manufacturing machinery and equipment as well as motor vehicles, trailers and semi-trailers. Several big enterprises are based in the region and already apply or produce industry 4.0 solutions. In order to combine knowledge and activities in the region, Alliance Industry 4.0 was established in 2015. This network was initiated and funded by the federal state of Baden-Württemberg to assist enterprises in their digital transformation process by pooling resources and know-how from production, information and communication technology. To promote the application of industry 4.0 solutions on a broad scale, 15 learning factories are being established at vocational schools. These facilities also contribute to spreading technologies to SMEs. The emerging industry sectors stimulate innovation in the entire region (both by supplying innovation as well as by creating a demand for innovative solutions) and have a positive effect on the modernisation of other industries. **The best evidence of this process is the intensive transformation of the car industry in recent years with modern production technologies, microelectronics and new IT solutions.** At present, the car industry in Baden-Württemberg is a leader in robotics and other advanced technologies. It also allocates more resources to research and development than all other industries in the region.

One key factor for the success of a formation or creation path **is the presence of high-level educational facilities that can establish collaborative synergies and cooperation activities.**

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<sup>156</sup> Technopolis (2016).

*North Karelia* in Finland has generated new clusters, thanks to its high-level research centres<sup>157</sup>. As a result of long-term development, North Karelia succeeded in creating a cluster of high-quality expertise in materials and precision technology and diffractive optics. The strong educational foundation in natural sciences at the University of Eastern Finland combined with technological studies in the North Karelia University of Applied Sciences have enabled the formation of a broad cluster based on high-quality expertise. This has also generated new spin-off enterprises and entirely new types of business based on plastics and metals and associated with composite materials. The fields of materials and precision technology and diffractive optics constitute strategically important interfaces for the technology industry. The areas of expertise are based on hi-tech infrastructure and knowledge-intensive research and development activity. **The development work was funded by mutually complementary investment and projects, implemented through a cooperation network of local businesses and institutes of higher education.**

Successfully generating a complex and differentiated cluster landscape was developed in recent years also in, the already cited, *Baden-Württemberg* in Germany<sup>158</sup>. Many **enterprises, research institutions and universities were involved in regional cluster initiatives and state-wide networks. The stakeholders of these cluster initiatives interact effectively, at a high level.** With this cluster approach, innovative processes were enabled through an interdisciplinary and organised exchange of knowledge and expertise. Five agencies were established and made responsible for the promotion of different sectors, financed by the regional government. The sectors were chosen based on their potential to support the necessary transformation of industries to stay competitive. In the region **clusters are seen as an ideal instrument for continuous organic innovation transfer to SMEs** (60% of cluster members in the region are SMEs).

The development of new clusters and the establishment of new high-tech sectors also require strong **cooperation between governments, research institutes and industrial enterprises.**

*Upper Austria* in Austria in 2006 created Clusterland Upper Austria, a centre of competence for cross-company cooperation, to support networking through clusters<sup>159</sup>. This has six clusters and three networks. Upper Austria's regional innovation agency (TMG) owns 61%, the Upper Austrian Chamber of Commerce and the Federation of Austrian Industry each have 19.5%. More than 1,600 enterprises are cross-linked in clusters and networks. These were developed gradually in sectors of regional strength such as automotive, plastics, furniture and timber

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<sup>157</sup> Regional Council for North Karealia (2010).

<sup>158</sup> CluStrat (2013).

<sup>159</sup> Technopolis (2012).



construction, health technology, mechatronics and environmental technology. Many cooperation projects have developed new technologies and products. These represent a successful proof-of-concept. Many factors influence a company's competitiveness and competence but they are not necessarily specific to the particular industry in which the company operates. **Experiences from one sector can often be used in another** just as well. Therefore, inter-sector networks have been developed in Upper Austria covering human resources, design and media and energy efficiency. These networks focus on **non-technological innovations**.

### Box 4.3 The experience of Southern Denmark (Denmark) – Part 1

<i>The region in figures</i>	
Industry value added, share of total value added (%)	19,0
Industry value added, share of total value added. avg. yearly change 2001-2014 (%)	0,7
Services value added avg. yearly change 2001-2014 (%)	3,4
Employment in Industry avg. yearly change 2008-2015 (%)	-3,7
Labour Productivity 2013 (EUR per hour)	63,0
Labour Productivity avg. yearly change 2001-2013 (%)	4,1
Business enterprise sector intramural R&D expenditure (% of GDP avg. 2014-2005)	1,0
Employment share of High and medium high-tech manufacturing 2015 (%)	5,3
Employment share of High and medium high-tech manufacturing avg. yearly change 2009-2015 (%)	-2,7
Employment share of High-tech Knowledge Intensive services 2015 (%)	2,1
Employment share of High-tech Knowledge Intensive services avg. yearly change 2009-2015 (%)	4,5
Regional Competitiveness Index 2013	0,3

Development and production of welfare and health technological solutions are an area which comprises major economic and business growth potential on a global scale. The welfare technological cluster in the Region of *Southern Denmark* seems to have spotted this potential<sup>160</sup>. The number of companies in the cluster is growing. **New welfare technological entrepreneurial businesses are established while at the same time the existing companies see new opportunities within the area and convert their production completely or partially to the welfare technology.** In addition, big, already established companies, regard the cluster as access to a possible growth market for selling their knowledge and products. Furthermore, the companies in the cluster become more and more interested in cooperating with other companies in order to develop together and bring new solutions to the market.

Denmark's strong position in the field of welfare technology is due to the unique competence and knowledge present in Danish companies, knowledge institutions, investor and other players. Since 2008, the Region has had a special focus on cluster development as a business-political tool for promoting growth, innovation and

<sup>160</sup> Napier and Kethelz (2014).

employment. An active role in the development of the cluster is provided by the Growth Forum of Southern Denmark. The Growth Forum is a hub for regional growth initiatives and is made up of representatives of the regional council, local authorities, research institutions, business communities and business organisations<sup>161</sup>. The Growth Forum prepares a commercial development strategy and action plan, monitors regional and local growth conditions and recommends co-financing of regional business development activities. In particular, the Growth Forum enhances cluster infrastructure in health and social innovation, sustainable energy and the experience economy (tourism and design). **This commercial-political infrastructure targets areas where the challenges are greatest and offers a broad perspective for individual businesses.** The model supports the establishment of more enterprises along with more and better products and services. It stimulates, organises and qualifies demand for new products and services. It boosts enterprise access to venture capital and development funds. It reinforces research, education and knowledge within the business areas and provides enterprises with access to the relevant skills.

### **Cooperation between regions can help the development and strengthening of clusters in new dynamic sectors.**

The *Alsace* Region, in France, has the Strasbourg Parc d'Innovation d'Illkirch, one of the largest techno poles in France<sup>162</sup>. After political decentralisation in the early 1980s, new regional governments were established and new 'regional techno poles' were introduced. The new region of Strasbourg and local governments strongly supported the establishment of a techno pole in the region. In 1985, 0.63 km<sup>2</sup> was designated for the techno park (later extended to 1.7 km<sup>2</sup>). Planning and management were delegated to the regional governmental development agency (SERS). The techno-park focuses on biotech research and industries, genetics and space technology. Twenty years later, 69 enterprises and institutions employ 9,600 employees. Since late 1996, the biotech industry has been connected with German territories in the Upper Rhine Region as part of the Bio Valley Project, which, since 2003, has also included Baden-Württemberg in Germany, and the Constance Region in Switzerland. Today the Bio Valley has 50,000 high-skilled employees, 15,000 scientists, 100,000 students, 600 pharmaceutical and MedTech enterprises covering the whole value chain for pharmaceuticals and medical devices, 10 universities and academic research institutes, 14 technology parks and two European reference points for medical research (the European Pharmacopoeia and the European Science Foundation).

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<sup>161</sup> OECD (2012). See also Region of Southern Denmark *The Future of Business in the Region of Southern Denmark and Strategy 2012-2020*.

<sup>162</sup> Salet and Gualini (2007) p.263.

## 4.2 LRAs supporting industrial enterprise efficiency for using inputs

### 4.2.1 Human capital and innovation capacity

**Investing in human capital, supporting education institutions and research centres, and the enhancement of collaboration between research and industrial enterprises is central to industrial strategy aiming at renewal or formation/creation.** In some cases, higher education, research, cultural and scientific institutions and industrial enterprises already collaborate without the need for policy initiatives.

*Munich* in Germany has a remarkable network of higher education, research, cultural and scientific institutions<sup>163</sup>. This grew especially after investment in the post-war period, and supports one of Europe's most highly qualified labour markets. Munich has emerged as an international leader in technology R&D and innovation, including in biotechnology, medical, automotive and energy. Technological know-how, outstanding education and high levels of human capital have made it Germany's leading technology city, also rated first in Europe for specialist knowledge<sup>164</sup>. Munich is distinctive in that 20% of the workforce is in export-led manufacturing, while services and high tech capital-intensive clusters have also thrived. Munich's firms have few challenges accessing skilled workers because of strong connections to skill suppliers. Large enterprises, employer associations and universities are seen as best placed to understand the skills the city needs to provide and attract. **There is a profound dialogue between them and designers of the well-funded school system, which enlists and integrates enterprises and universities as stakeholders in the city. This places knowledge generating institutions and innovative thinking at the heart of urban decision making.** The curriculum in vocational training offers Munich's mid-ability students wide access to high-quality on-the-job apprenticeship training, combined with classroom tuition as part of the German dual system. Approximately 250,000 students are in vocational training in Bavaria, nearly as many as are in higher education. Although Munich's graduation rate is not outstanding, at 37% (London 63%, Copenhagen 47%, Madrid 46%, Paris 42%), the employment rate of young people and women is one of the highest in the EU. **The responsive education ecosystem allows Munich to create a mid-skill, technical workforce that continually sustains its manufacturing prowess.**

LRAs can **improve the capacity of enterprises to attract and employ high-skilled workers.**

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<sup>163</sup> Clark and Moonen (2014).

<sup>164</sup> The metropolitan area alone produces 10-15 percent of Germany's patents and is home to 13 higher education establishments, while being consistently rated as one of the best student cities globally.

In *North Karelia*, Finland, the level of employment for higher education graduates decreased with the global economic downturn<sup>165</sup>. Moreover, regional businesses are struggling with a lack of affordable highly skilled people and motivated experts. This is hindering North Karelian enterprises from succeeding locally, but also from integrating with the global economy. Enterprises, in particular SMEs, are also facing growing challenges to strengthen their innovation capacity and competitive potential to optimise trade and growth opportunities. To counter these, in 2009 the local government launched the Innovation Assistant project. The project's main goal is to **address identified needs of target groups by promoting the permanent employment of graduates with a higher degrees in enterprises and organisations in the region, and to improve the competitiveness and innovation capacity of local SMEs**. Under the project, job seekers are offered both intensive training as well as practical training in a company. The project also has a parallel project administered by the Centre for Economic Development, Transport and the Environment, North Karelia implementing labour market measures. Other co-operation partners include regional enterprises. The project, administered by the North Karelia University of Applied Sciences, is supported by the European Social Fund, and funded by the Centre for Economic Development, Transport and the Environment, North Karelia, and Josek Ltd with municipal financing.

To improve human capital, LRAs can **support cross-border cooperation initiatives**.

The *Vidzeme Planning Region* in Latvia recently initiated the BSR Lifelong Learning for Smart Specialisation<sup>166</sup>, bringing together partners from Latvia, Lithuania, Sweden and Germany. This identifies improvements in lifelong learning and implements them in the Baltic Sea Region. Under this initiative, adult education programmes are structured for the needs of regional industries, according to the business environment and culture. **A common understanding is to educate employees and also business and human resources managers who encourage employees to further their skills and competences**.

**Coordination of stakeholders is fundamental to increase enterprise innovation capacity**, especially for traditional sectors.

To promote industrial competitiveness through cooperative innovation, *Piemonte* region in Italy, created POINTEX in 2009<sup>167</sup>. This association of enterprises and research centres provides innovative, highly beneficial technological solutions to the textile and textile machinery sector in the region. It offers tutoring and monitoring, as well as support for finding financial resources. Cooperation with local bodies and

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<sup>165</sup> Regional Council for North Karealia (2010).

<sup>166</sup> EUSBSR (2015).

<sup>167</sup> Textile-future.com (2015).

institutions has always been very close in the textile sector in Piemonte, to the benefit of the overall system, especially in the Biella district. Here handloom and power loom enterprises have continued to maintain high quality production, extending it to total quality, involving technological research and creativity, as well as customer service. Continuous technological research, with in-depth knowledge of the needs of fashion and stylistic creativity have allowed Biella to produce very high quality yarns for any purpose, not just for weaving and knitting, but also for flat knitting and hosiery, furnishing and technical textiles. Use of the best raw materials and increasingly sophisticated machinery makes the excellent fabrics from Biella valued around the world. In Piemonte **textile development has focused on an interactive approach, combining chemistry, physics, biology and engineering.**

**Providing incentives not only for knowledge production, but also for its transfer to enterprises and application in production processes, is fundamental.**

*Baden-Württemberg* in Germany founded Steinbeis in the 1970s<sup>168</sup> an institute headquartered in Stuttgart, dedicated to the transfer of academic findings and knowledge into the field of business. In this foundation **university professors are offered administrative and market support to act as entrepreneurs and sell their knowledge to SMEs.** Steinbeis is now a world-wide company, very successful in the field of knowledge transfer with a problem solving approach rather than a technology push approach. Over 850 Steinbeis enterprises around the world produce a turnover of €134 billion with 697 professors, 1,462 employees and 3,361 freelancers. Steinbeis University is the biggest private university in Germany and at the same time the only one not needing public money, as enterprises pay for education of their staff.

In other cases, LRAs use their **public demand strategically to enhance enterprise innovation capabilities and promote and create growth in specific clusters, through public-private collaboration.**

#### **Box 4.4 The experience of Southern Denmark (Denmark) – Part 2**

In *Southern Denmark* the local government has made considerable investments in welfare technology to strengthen the potential for innovation and growth<sup>169</sup>. In this context, the Region offers, among other things, test facilities, consultations and tools facilitating public-private innovation and innovative public procurement. In addition, **enterprises can enter into partnerships with regional hospitals, as well as psychiatric and social institutions to develop and implement technological welfare solutions.** A cluster organisation (Welfare Tech) has been established, and an elite

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<sup>168</sup> CluStrat (2013).

<sup>169</sup> Napier and Kethelz (2014).

training programme (Accelerace Welfare) launched for entrepreneurs. An investment fund has also been set up where health and welfare enterprises operating in Southern Denmark can apply for venture capital (Welfare Tech Invest). Denmark's biggest welfare technological research and innovation project, Patient@Home is also based in the region. The development of new super hospitals is expected to push forward regional and national growth. Building works worth billions can give Danish enterprises and enterprises in Southern Denmark excellent experience, competence and networking, which can strengthen their global position. Numerous new innovative solutions are planned in connection with the new building and hospital, which opens up opportunities for cluster enterprises. **Public (regional and municipal) demand for the products and services of the cluster can drive its development.**

#### *4.2.2 Enhancing efficiency in the use of raw materials and energy*

Pushing industry towards green models of production has a twofold scope. It supports the **adoption of high-tech production and advanced environment-friendly materials**. It also helps **enterprises increase efficiency in using inputs, decreasing production costs**.

The entrepreneurial sector in *Emilia-Romagna* in Italy is very developed, articulated and specialised in green production<sup>170</sup>. In recent decades it has been progressively structured around Productive Poles. These are homogeneous local production systems with a high concentration of industrial enterprises (mainly SMEs) with high production specialisation, large enterprises, cooperatives and widespread entrepreneurship. These **technological basins are supported by a network of intermediate bodies including administrative bodies, representative organisations and associations as well as technical facilities such as service centres, schools and education centres, markets and trade fair and exhibition centres**. The green-industry sector is currently driven and promoted by several policy documents and successful initiatives. For example, the Plastice project (concluded in 2014) promoted the development and use of environmentally friendly and sustainable solutions in the packaging and end-user industries, particularly the use of biodegradable plastics. The Plastice project in turn promoted the BiorefER project that assessed the degree of development and potential of the regional bio-refining supply chain that focuses on biodiesel and bio-plastics. In addition, specific support could be provided by the Vanguard pilot bio economy project that will implement and demonstrate synergies in new bio-based value chains and by the Green Lab Valley Strategic Project. This will lead to a Consortium Research Lab 'Biomass HUB' converting agro-industry biomass into high added value products for the health and packaging industries.

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<sup>170</sup> Plasticeproject (2014).

As seen in the previous sections, **cooperation within regions as well as between regions can generate significant economic spillovers for local industries. This is valid also for green models of production.**

In *Roubaix*, France, a broad partnership involving the local authority, urban community, national government, consular bodies, schools and training institutions, trade associations and professional unions, major customers and funding bodies, created the Cité de l'Initiative<sup>171</sup>. This operates as a French association under the law of non-profit organisation managed by a limited company (SARL) in the form of a Union d'Economie Sociale (UES or Social Economy Union). Cité de l'Initiative is a group of 26 textile and clothing enterprises based in Roubaix and engaged in complementary activities. The group also includes partners linked to this production chain. The basic principle is **sharing resources, including techniques, technologies, management and communication tools and human resources**. The motto is: “We will pool our resources, tools and expertise to meet all our customers’ expectations more effectively, faster and at lower cost”. The aim is to **reduce enterprise fixed costs** and allow them to **use as many high-performance tools as possible to enhance their competitiveness and reliability and to open up new markets.**

#### Box 4.5 The experience of Nord-Pas-de-Calais (France)

<i>The region in figures</i>	
Industry value added, share of total value added (%)	15,8
Industry value added, share of total value added. avg. yearly change 2001-2014 (%)	-0,6
Services value added avg. yearly change 2001-2014 (%)	3,0
Employment in Industry avg. yearly change 2008-2015 (%)	-1,5
Labour Productivity 2013 (EUR per hour)	45,8
Labour Productivity avg. yearly change 2001-2013 (%)	1,1
Business enterprise sector intramural R&D expenditure (% of GDP avg. 2014-2005)	0,4
Employment share of High and medium high-tech manufacturing 2015 (%)	4,1
Employment share of High and medium high-tech manufacturing avg. yearly change 2009-2015 (%)	-0,9
Employment share of High-tech Knowledge Intensive services 2015 (%)	2,0
Employment share of High-tech Knowledge Intensive services avg. yearly change 2009-2015 (%)	4,6
Regional Competitiveness Index 2013	n.a

*Nord-Pas-de-Calais* is a region in France now part of Hauts de France after the union with Picardie during the territorial reform of French Regions in 2014<sup>172</sup>. The region was one of the very first to be industrialized in Europe. The industrial landscape is characterized by the presence of textile industry factories in Roubaix/Tourcoing, slag

<sup>171</sup> European Commission (2004).

<sup>172</sup> TIR Consulting Group LLC (2013), Overbeek *et al.* (2016) and Ministère de l'Agriculture de l'Agroalimentaire et de la Forêt (2016).

heaps (“terrils”) in the mining “croissant” through the conurbation of Béthune-Lens-Douai-Valenciennes, and the steel industry in Dunkirk or Maubeuges. The Region has industrial strengths in rail (first region in France), the car industry (second), food industry (third), and health research (fourth).

Nord-Pas de Calais is among those French regions that have the highest energy consumption. Greenhouse gas emissions per inhabitant are 30 per cent higher than the national average. The share of renewable energies is four times lower than the national average. Against this scenario, the region is implementing its Third Industrial Revolution to make the regional economy one of the most resource-efficient, productive and sustainable in the world. The strategy is based on 5 Pillars: Pillar 1 – The Shift to renewable energy; Pillar 2 – Buildings as micro-power plants; Pillar 3 – Storage technologies; Pillar 4 – The Energy Internet; and Pillar 5 – Plug-in and fuel cell transport. The Third Industrial Revolution aims to proactively develop the economy and spawn jobs by creating synergies between the pillars and leveraging the macro business case of energy efficiency. **The process of elaborating the strategy was supported by six regional working groups gathering experts, representatives from regional public bodies, and enterprises.** Each working group worked on one of the 5 Pillars, and the last one worked on the transversal view of energy efficiency. The Region Nord-Pas de Calais also mandated two additional working groups to work on two other related topics that are transverse to the 5 Pillars of the Third Industrial Revolution: the circular economy and functional economy. This enables it to deal with two essential topics: **the evolution of uses and consumer behaviour (functional economy) and a new link with resources thanks to the circular economy, which has a strong impact on consumption and energy efficiency.**

As part of the Third Industrial Revolution, the region is also developing a specific industrial policy to increase the weight of the bioeconomy locally. This is based on strong agricultural and fishery production, several universities as well as research and technology centres with dedicated expertise in renewable resources, the bioeconomy and biorefining, and the establishment of important enterprises as well as SMEs and start-ups active in numerous fields of the bioeconomy. **The region has well-developed innovation clusters covering the bioeconomy (renewable resource production, food, feed, fibres, materials, chemicals and bioenergy).** Some organisations worked together before the merger of the two former regions. For example, the clusters IAR, Up-TEX and Matikem founded CEEBIOS, the European centre of excellence in biomimicry. First conceived in 2013, the centre helped to create the first European biomimicry network, a process of innovation inspired by nature. It is also committed to fostering collaborative and cross-cutting projects. Furthermore, some clusters of the two former regions used to answer collaborative calls together at the national level. However, despite some collaborative work there was no territorial strategy. It was more a one shot strategy. The two former regions are very complementary, so significant development of the bioeconomy is likely since the territory is bigger, with more resources and biomass. The merger is also **an opportunity to provide complementary services proposed by technical and**



**innovation centres. Several projects, initiatives and instruments in recent years have boosted the green industry.** The most notable are the establishment of the IFMAS Institute focusing on plant-based chemistry and the SAS PIVERT company strengthening the regional green chemistry value chain. A further initiative hosted by the region is the biannual Plant-based Summit, which has significant impact on the regional green industry.

### 4.3 LRAs supporting industry become more market connected

One key initiative to help industrial enterprises **reach new markets is to enhance and modernise infrastructure and decrease transport costs.**

*Munich* in Germany inherited a very strong infrastructure platform, both in terms of public transport and international connectivity<sup>173</sup>. The city is rated in the world's top five for electricity, water, transport and telecommunication systems. The re-development of Munich airport has allowed it to become Lufthansa's second most important hub after Frankfurt and regular flights to North America and emerging regions such as China and the Gulf have fostered strong transcontinental business connections. This provides the whole metropolitan region with new diverse market opportunities. **Key inter-regional and international transport infrastructure have stimulated Munich's business attraction for over four decades.** Periodic investment in basic infrastructure and business parks has enabled Munich's enterprises to tap the entirety of the labour force and move people and goods with few delays. Because of the expense of oil-based transport, Munich has **efficient and environmentally friendly public transport systems.** A new high-speed train to Nuremberg connects the two largest cities in Bavaria, and will eventually connect to Berlin. The seamless intra-regional transport prompted Siemens recently to describe Munich as 'the model' for cities "pursu[ing] the path of achieving a nearly carbon free future over the coming decades".

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<sup>173</sup> Clark and Moonen (2014).

## **Inter-regional cooperation reducing transport costs is also a successful strategy.**

*Northern England* in the United Kingdom has suffered from decades of underinvestment<sup>174</sup>. Infrastructure in the area has been recognised as dated, poorly integrated and lacking the large-scale investment it needs. In recent years several actions have targeted making Northern England a strong investment location in the global marketplace. In 2014 Transport for the North (TfN) was established to improve connections between economic centres in the north. In 2015 it developed a long term Northern Transport Strategy to build a ‘Northern Powerhouse’ which capitalises on the strengths of northern cities and encourages economic growth and investment. The three regions that make up the Northern Powerhouse are the North West of England, the North East of England as well as Yorkshire and Humberside. Northern Powerhouse promotes regional economic growth and is looking to rebalance the national economy. Alongside investment in skills, support for business and regenerating city centres, a transformation in connections between the northern cities and beyond aims to increase their productivity to levels currently only seen in London and the south east of England. **After the announcement of the intention to build a Northern Powerhouse the number of FDI projects increased significantly.** The Ernst and Young attractiveness survey<sup>175</sup>, revealed that transport, skills and business networks all rank highly in what investors are looking for.

The northern England effort to **enhance infrastructure in the area** has not only **reduced transport costs for local enterprises and workers**, but has **also increased the attractiveness of the territory for foreign investors**.

Several regions in Europe are implementing initiatives to attract FDI.

In *Frankfurt Rhine-Main Metropolitan Region* in Germany, FrankfurtRheinMain GmbH is the region’s inward investment promotion agency that advises and supports foreign investors<sup>176</sup>. The agency proactively markets regional strengths and implements targeted measures to improve regional competitiveness. FrankfurtRheinMain connects investors with potential partners, identifies business locations, helps establish enterprises, and provides information on taxes and legal regulations. FrankfurtRheinMain attracts foreign investments through promotion activities abroad with offices in Asia, America and Europe. **Being in several countries enables the agency to easily reach potential investors** with market and site information. The agency also has a number of **industry experts to provide advice on a variety of sectors**. The agency’s website also promotes Germany’s

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<sup>174</sup> Cox and Raikes (2015).

<sup>175</sup> Ernst and Young (2016).

<sup>176</sup> ECORYS (2013).

competitive advantages and offers general economic, geographic and political information.

Invest in Andalucía is an initiative to attract high value FDI and to support existing foreign enterprises with expansion in *Andalucía*, Spain. The agency, based in Seville and with 21 offices around the world, assists investors with planning, implementing and expansion. Specific services include market analysis, site selection, tour coordination and international promotion advice. **Connecting with service providers, technical contractors and suppliers, along with support in accessing finance and funding are also part of Invest in Andalucía services.** A unique service that is not offered by the other international promotion agencies is ‘Soft-landing’ to assist employees from large multinationals integrate in Andalucía.

As part of the already mentioned ONLYLYON initiative, Aderly<sup>177</sup>, Lyon’s economic development agency, was founded in 1974 making it one of the first economic development agencies in France. Aderly guides investors through setting up or expanding business in Lyon and the surrounding area. The agency assists with conducting feasibility studies, finding locations and facilities, advising on regulatory, fiscal and administrative issues, fundraising and introducing partners and local authorities. The agency also offers services to welcome employees of foreign multinationals and follow-up services after the business is established.

**LRAs can promote the territory to incentivise inward investment and also help local enterprises invest abroad and partner with multinationals.**

*Flanders* in the Netherlands has the Flanders Investment and Trade (FIT) agency that assists local and foreign enterprises to develop business in Flanders through trade and investment<sup>178</sup>. FIT was created in 2005 through the merger of Flanders Foreign Investment Office and Export Vlaanderen. FIT offers information on sectors, trade customs and regulations, as well as advice on how foreign businesses can set up or expand in Flanders. FIT has offices in each of the five provinces in Flanders that provide assistance and incentives to Flanders-based enterprises involved in international activities. **The agency also helps to form partnerships to facilitate business and provides SMEs with financial support for trade fairs, prospective investment trips, capital goods or feasibility studies.** In 2011, FIT facilitated 174 projects valued at €1.72 billion, which created 3,720 jobs. Nearly half of the investment projects were in greenfield investments, followed by 32% in mergers & acquisitions and 18% in expansions. FIT was awarded top prize for the ‘Best Foreign

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<sup>177</sup> ECORYS (2013).

<sup>178</sup> ECORYS (2013).

Direct Investment Strategy' and ranked in the top ten for overall FDI attractiveness in the Financial Times Magazine.

### **Policy actions to make local industrial potential more global can also target local clusters rather than individual enterprises.**

*Baden-Württemberg* in Germany has regional ministries that provide different instruments for the internationalisation of clusters<sup>179</sup>. The support programme is provided by Baden-Württemberg International (Baden-Württemberg's competence centre for the internationalisation of business, science and research). This **supports domestic and foreign enterprises, research institutions and universities encouraging foreign capital investment, helping enterprises to settle in the region and promoting cooperation between business and science**. Services include the initiation of international cooperation between enterprises through market-penetration measures in the most important global markets, participation in location-marketing campaigns in Germany and abroad, and back-up support for foreign enterprises wishing to invest in Baden-Württemberg. There are also projects relating to business promotion, training, qualification and management in selected target countries.

## **4.4 LRAs adopting solutions to be more responsive to industrial enterprise needs**

In 2008 the EC set out the Small Business Act (SBA)<sup>180</sup>, with 10 principles designed to encourage entrepreneurship in the EU and to make it easier for small businesses to thrive. The SBA foresees a number of principles that could help LRAs be more responsive to industrial enterprise needs. These include solutions to make public administration more responsive to the needs of SMEs, designing rules under the 'think small first' principle, adapting public policy tools to SME needs, facilitating SME participation in public procurement and better use of State aid for SMEs.

### **A common strategy adopted by LRAs is to implement actions to reduce the administrative burden.**

In *Trentino Alto Adige*, a region in Italy, the Autonomous Province of Trento (Trentino) considered streamlining administrative procedures and the computerisation of services for businesses and residents as essential to recovering competitiveness, by pursuing greater organisational efficiency at lower cost<sup>181</sup>. Recent years have seen

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<sup>179</sup> Ministerium für Wirtschaft, Arbeit und Wohnungsbau Baden-Württemberg (2016).

<sup>180</sup> European Commission (2008).

<sup>181</sup> Investi in Trentino (2012).

concrete and significant steps. For example, in 2013 it needed an average of 44 days to conclude administrative procedures (as compared to 54 days in 2012). The extraordinary plan of action to reduce bureaucracy for enterprises has reduced the ‘cost’ of procedures for enterprises by 25%. There is increasing use of telecommunications technology and continuing simplification of procedures, particularly in sectors considered to be strategic (including businesses, families and agriculture). Furthermore, in 2013, 93% of public administration payments to creditors were within 30 days. Moreover, it should be underlined that the average time for these payments was 10 days against the national average of 90. **The growth of territorial competitiveness can be seen in improved services and reduced burden for enterprises.**

*Murcia*, in Spain, has implemented an approach to reduce the time required for starting an activity, as well as to simplify and standardise the documentation required for licensing<sup>182</sup>. The time to process replacement of a business license with prior notification has reduced from over three months to 15 days. There is limited possibility for this timeframe to be further reduced without compromising protection for the environment. In parallel, the approach has decreased the number of documents handled during the process and also replaced physical files with electronic documentation. Both these changes reduced working time and costs, though quantified data are not available. This approach **facilitates the establishment of small businesses, supporting job creation and entrepreneurship.**

**In some cases, a simplified administrative approach could also be more targeted, by integrating, for example, sustainability into management practices<sup>183</sup>.**

The *Walloon Region* in Belgium, has adopted the REGINE initiative (Referential Environment: Integrated Management of Enterprises) offering a rational and simplified approach to environmental monitoring and reporting. This allows enterprises to exchange environmental information with the public administration in line with the requirements of EC Directives, as well as national and regional laws. Central to the approach is a user-friendly online application (environmental survey), integrating information in a single inventory. This is used by the authorities to monitor the environmental performance of enterprises and to produce sector reports and indicators (which are then published on the internet). The environmental survey was developed by the Walloon regional administration in consultation with stakeholders such as the Walloon federation of enterprises and industrial federations. It integrates all environmental requirements, which are applicable to the target group of enterprises (initially about 300 operators of activities/installations covered by

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<sup>182</sup> Committee of the Regions (2011).

<sup>183</sup> Committee of the Regions (2011).

local, national, EC or other regulations). REGINE has consolidated overlapping regulations, significantly simplifying the environmental information requirements applying to enterprises. Furthermore, **the initiative has raised enterprise awareness of environmental obligations. The majority of enterprises submit environmental questionnaires on time.**

**Cross-border cooperation can also be an effective policy tool to make regional public administration more responsive to enterprise needs.**

Grenzoffensive is a cross border initiative launched in 2002 for workers and SMEs wanting to operate in the adjacent regions of *Bavaria* (Germany), *Upper Austria*, and *Southern Bohemia* (Czech Republic)<sup>184</sup>. It aimed to minimise or eliminate administrative obstacles faced by local SMEs when attempting to expand their operations across the border. 'Grenzoffensive' facilitates cross-border services, particularly procedures for posting workers. An internet site is accessible in German and Czech, presenting the relevant legislation, explaining procedures and costs. All the forms can be downloaded. Some formalities were eliminated between the three regions, while other procedures were clarified. Moreover, 'Grenzoffensive' has completed dozens of information and training seminars, and over 2,500 SMEs received individual counselling.

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<sup>184</sup> High Level Group on Administrative Burdens (2014).

## 5. Conclusions and recommendations

This study has illustrated how there are still noticeable differences across European regions in terms of industrial specialisation, production inputs, endowment and policy solutions to respond to local industrial needs. Due to continuous transformations and evolution in both supply and demand, **industry will be a critical driver of innovation, productivity, competitiveness, inter-sectoral spillovers, meeting social and environmental goals and customer behaviour, rather than just a source of mass employment in traditional production.**

The way LRAs embrace this new paradigm depends on their ability to exploit and modernise the strengths of specific industrial activities and to design and embrace new industrial development trajectories in new sectors. In doing this, LRAs should be aware that **there is no one-size-fits-all approach and that local specificities can represent an opportunity.** The EU single market can compete better internationally, offer greater job opportunities and better satisfy European customer needs if perceived as a balanced industrial landscape of different coordinated industrial patterns. Here regional and local peculiarities should be recognised rather than adapted to a single industrial path vision. In shaping this landscape, LRAs can therefore play a decisive role.

**The EU will have to acknowledge this situation of pronounced regional concentration of capacities with a view to technology generation, in particular in emerging fields.** At the same time, it will have to leverage the existing potential more broadly outside of the existing frontrunners' ecosystems where both the generation and use of advanced manufacturing technologies have reached already internationally outstanding levels. The identified regional disparities with respect to industrial modernisation should be tackled by facilitating the integration into European value chains. Emerging of technological development outside of the industrial heartland should be supported. This would not only ensure a more diffuse absorptive capacity but also support and boost the efforts of Europe's leading industrial stakeholders. **Research, evaluation and reporting related to Cohesion policy needs to include the topic of old industrialized regions, by acknowledging the specific problems of these areas.** Efforts are needed to define such areas and provide information on their long-term development, as well as to assess the success or otherwise of reconversion strategies.

LRAs are the closest institutional level to territories, so they are better positioned to identify local industrial strengths, weaknesses and the potential for development. The first strategic step for an industrial policy is to discover and elicit more information about what constrains industrial sectors. This requires LRAs to establish **close and strategic co-operation with a private sector that is rapidly evolving towards more 'hybrid' models of production, is less place-based and is surrounded by**

**increasingly complex market dynamics.** The involvement of local industry representatives in designing an industrial strategy is fundamental to meet entrepreneur needs, limit labour mismatches and strengthen the innovative capabilities of enterprises. Moreover, monitoring and evaluation of entrepreneurial industrial activities and the labour market, as well as collecting and elaborating data on key industrial variables, are crucial for a clear overview of local industrial problems.

If, as stated in Section 2.2, data becomes the ‘new oil’ for industrial development, this also applies to the design and implementation of industrial policies. **Alongside industrial enterprises, LRAs should enhance the collection and analysis of data in monitoring systems. Descriptive and predictive analytical techniques are needed to better understanding and forecasting for the dynamics of local industrial sectors.** In doing this, the adoption of indicators used by the European Commission (European Regional Competitiveness Index, Regional Innovation Scoreboard, Industrial R&D Investment Scoreboard and others) or by the OECD (as in the Regions at Glance report) can facilitate assessment of the competitiveness of the regional industrial landscape. This will enable benchmarking and comparison of its evolution with similar regions.

As the experiences of LRAs testify, whichever industrial path (renewal or creation) is chosen, a skilled workforce, including researchers, scientists, and engineers, and the ability to drive innovation, are the most important drivers of industrial competitiveness. Favouring **cooperation networks that include local institutions, enterprises and institutes of higher education is essential** for enhancing local human capital. LRAs, especially those affected by a brain-drain, should also encourage industrial enterprises to hire local skilled workers and offer job opportunities to highly qualified young people, for example, by co-financing high-quality on-the-job apprenticeship training programmes. Moreover, LRAs should facilitate local industry in taking advantage of foreign nationals, who tend to be among the most entrepreneurial in society, and often have higher skills than local people, by improving the attractiveness of the territories where the industries are located (housing, nurseries etc.). In parallel, EU citizens working in another EU country should be encouraged to invest in their region of origin by providing, for example, administrative simplification in the creation of new businesses, which should become more promising than the simple transferring of remittances aimed at building new houses.

Of particular importance for LRAs aiming to stimulate regional innovation, is to **incentivise not only the production of knowledge, but also its transfer to enterprises and its application to production process.** Enhancing synergies and collaborative networks between industrial enterprises, research centres, and technological parks, is vital to modernising traditional sectors and stimulating the uptake of new dynamic industrial trajectories.



LRAs that encourage enterprises to invest in R&D and innovation, to adopt new technology and to use new production processes, should ensure that incentives are provided to entrepreneurs to finance high quality projects and reduce the risk of failure. **The use of financial instruments instead of grants to deliver public financial support, could not only be a valid way to leverage additional resources and re-use repaid support to finance more enterprises, but also could ensure that better quality projects are supported, as investments must be repaid.** This applies to a vast array of investments, including start-ups, training and lifelong learning, marketing and commercialisation.

LRAs should adopt strategies to make the territory more attractive for investors, foreign enterprises, new talent and scientists, as well as for local enterprises looking to re-shore activities. **Diversifying and ‘rebranding’ the local economy strategically, so industrial progress is seen as part of a holistic territorial system, can increase attractiveness for investors.** The strength and depth of local partnerships and networks and the extent to which they can be seen as sharing a positive view of themselves and their city or region’s place in the world is an attractive force for new investment and human capital.

LRAs **should favour local enterprise connections with international markets, either as a source of new investment (outward and inward) and new customers.** Industry is becoming more ‘hybrid’, incorporating a mix of production processes located in both high-cost and low-cost countries and based on a wide range of factors enabled by technological developments, especially ICT. **It is crucial to have modern, efficient, smart and interoperable infrastructure,** both physical and digital, to reduce transport costs, ensure that enterprises can reach more customers and suppliers, and to attract new investment. LRAs should also better focus regional trade and investment agencies mission on preventing information asymmetries that obstruct the efficient allocation of investment abroad or locally, especially in sectors important to regional industrial specialisation.

The examples highlighted in this study indicate that effective industrial policies favour cooperation and coordination at different levels. **Within regions, LRAs should encourage the exploitation of clusters,** by incentivizing enterprises’ networks, favouring joint projects among enterprises, universities and research institutions, supporting the creation of science parks and incubators, providing advisory services, and creating labels and marketing of clusters. This creates favourable innovation and creativity ecosystems and supply-chain networks, enhancing individual enterprise access to raw materials, sophisticated machinery, new technology and new ideas. It also **generates new synergies and integration mechanisms with services activities** that help industrial enterprises better match demand mainly driven by individual needs (servitisation). **At an inter-regional level, LRAs should establish coordinated projects and initiatives with other specialised technology suppliers from other EU regions** to favour technological and

knowledge transfer, enhance labour mobility, support inter-regional clusters and foster 'hybrid' models of production.

**LRAs should be more responsive to local industrial needs**, by promoting actions to reduce administrative burden, adopting e-government solutions, creating monitoring and reporting systems to evaluate the progress of industrial initiatives, and adjusting and adapting policy makers' expectations and capabilities to industrial changes and challenges. Moreover, LRAs should strengthen coordination of regional industrial initiatives with European and national level policy actions. This would **avoid overlapping actions as well as fragmentation, so each initiative has a specific industrial focus and targeted beneficiaries.**

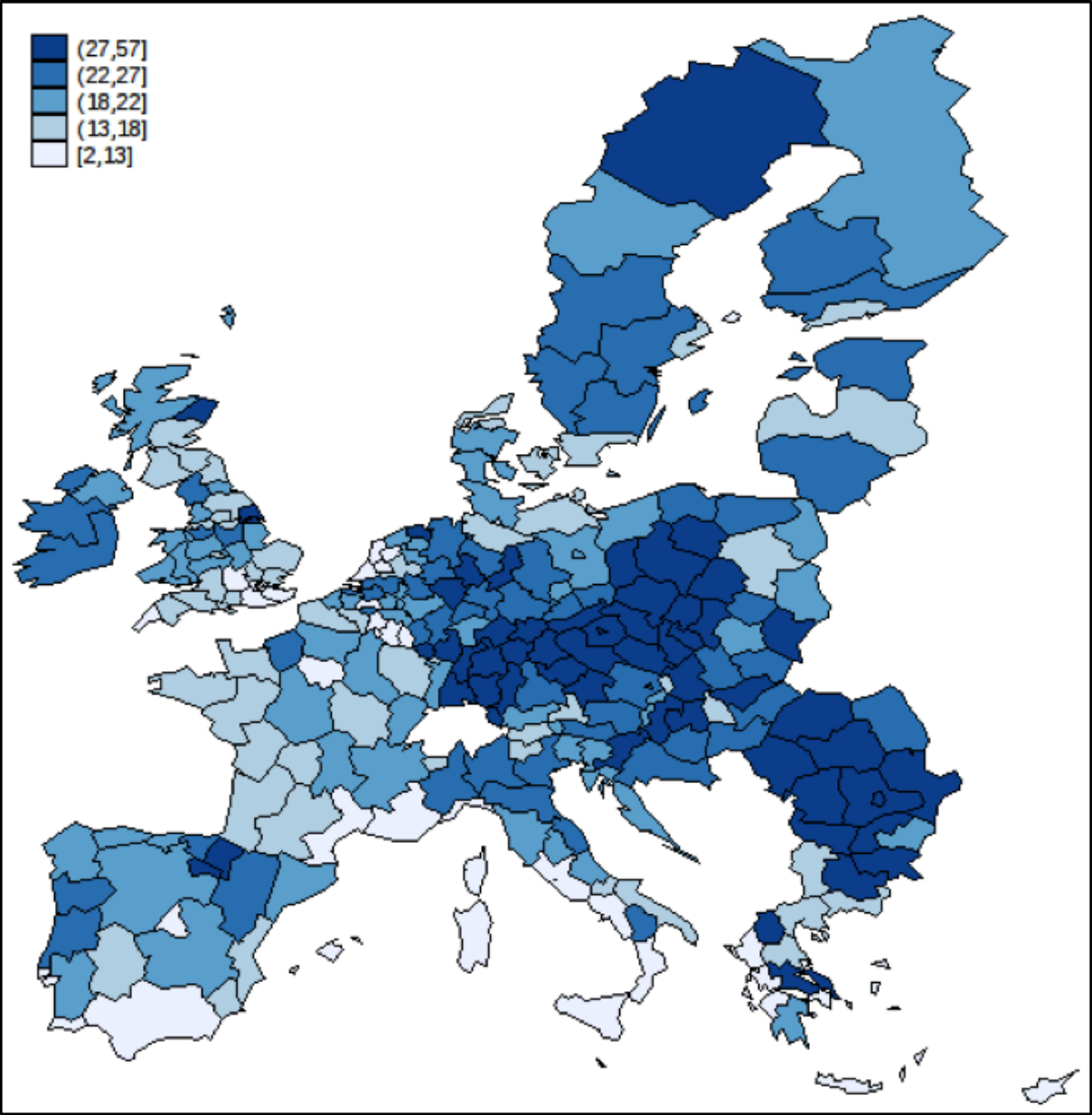
Finally, **LRAs can also play an active role on the demand side.** As final buyers, establishing public-private partnerships or opting for pre-commercial procurement procedures<sup>185</sup>, the public sector is the driving force for particular products or services. This potential turns to be particularly important when the new demands generated by major trends such as ageing are concerned. Partnerships between LRAs and hospitals (as it is the case of Southern Denmark) and pre-commercial procurement in the health sector, f.i. in the area of rehabilitation or home automation for the elderly, can contribute to a better future of the European industry. **In addition LRAs can stimulate customers to change behaviours and habits, moving towards products with particular prerequisites.** A strategy could incentivise industrial enterprises towards a green production model (for example using solar panels in production facilities) or to sell products that respect established social or environmental requirements. This would be more effective when the demand choices are also sensitised to social and environmental aspects (for example, by incentivizing the use of solar panels in private houses, the consumption of organic food in the school canteens, or stimulate the use of shared cars, machinery, and even articles of daily use). **One of the main factors that could successfully drive European industry is the high-level of European customer expectations.** The EU internal market represents a potential that should be fully exploited to stimulate competitive industrial development.

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<sup>185</sup> Procurement of research and development of new innovative solutions before they are commercially available.

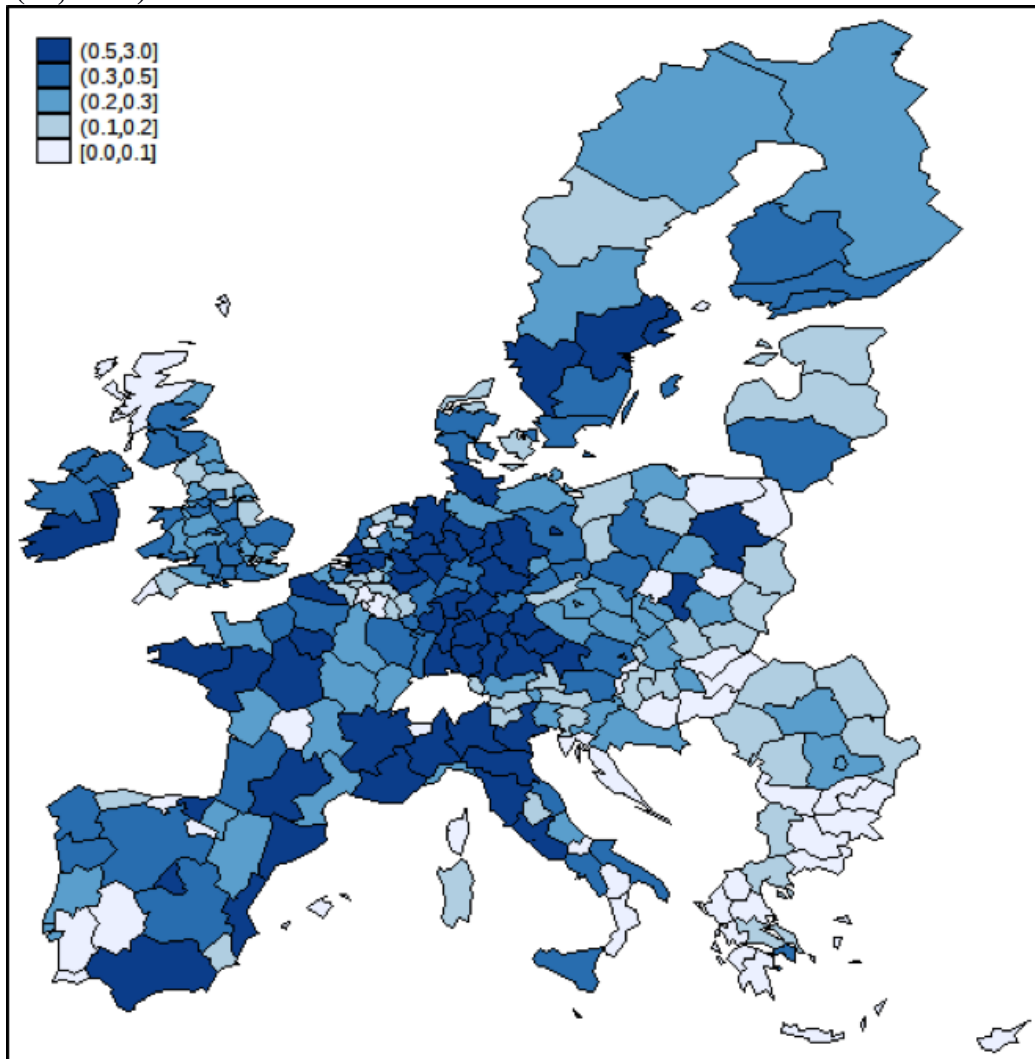
# Annex 1. Maps and figures

Figure 1.1: Industry share of total value added by region (% , 2013)



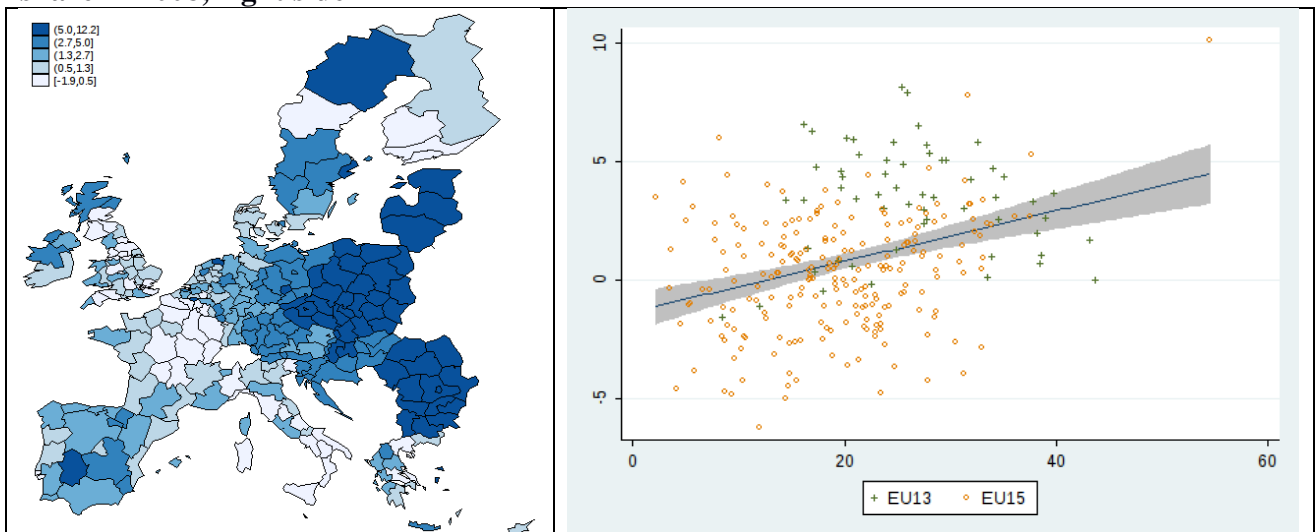
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 1.2: Regional industry share of total European industrial value added (% , 2013)**



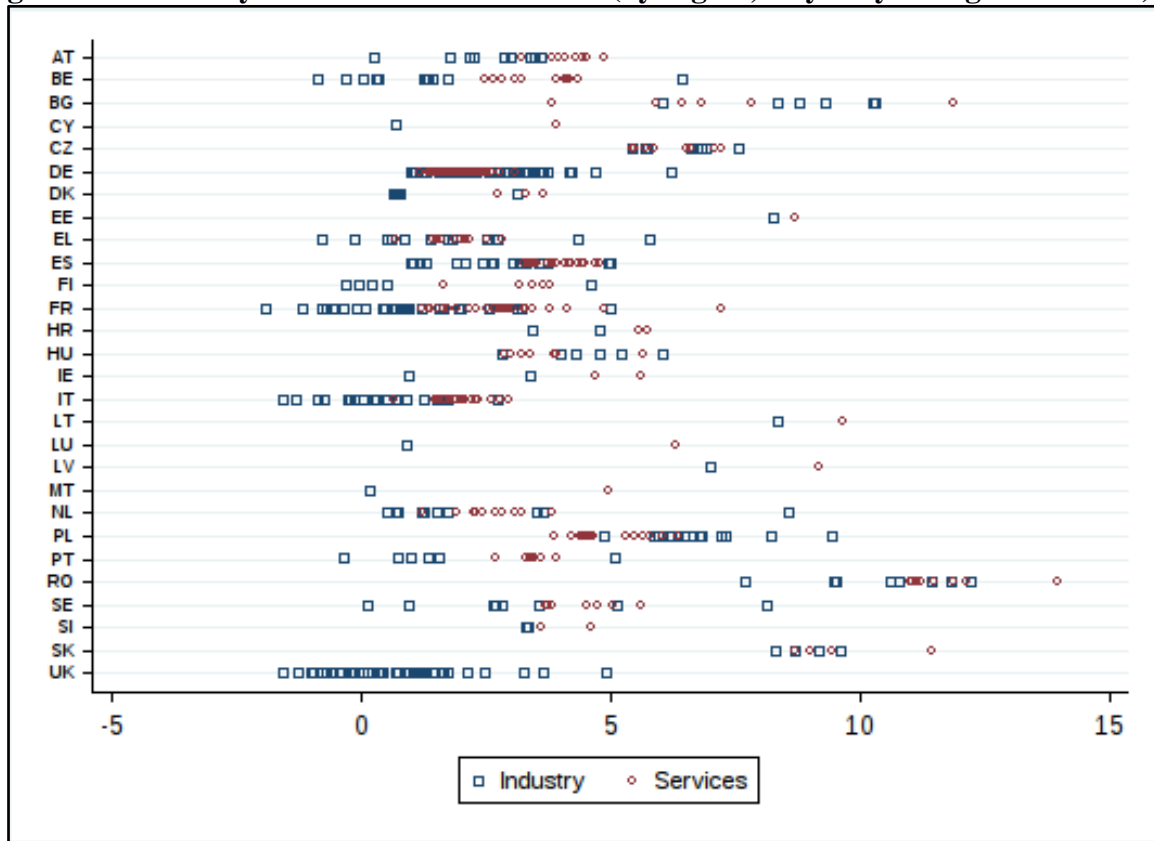
Source: own calculation based on Eurostat (see Annex I for detail)

**Figure 1.3: Industry value added growth (by region, % yearly average change, 2002-2014), left side. Industry value added average yearly growth 2008-2014 vs. industry value added share in 2008, right side**



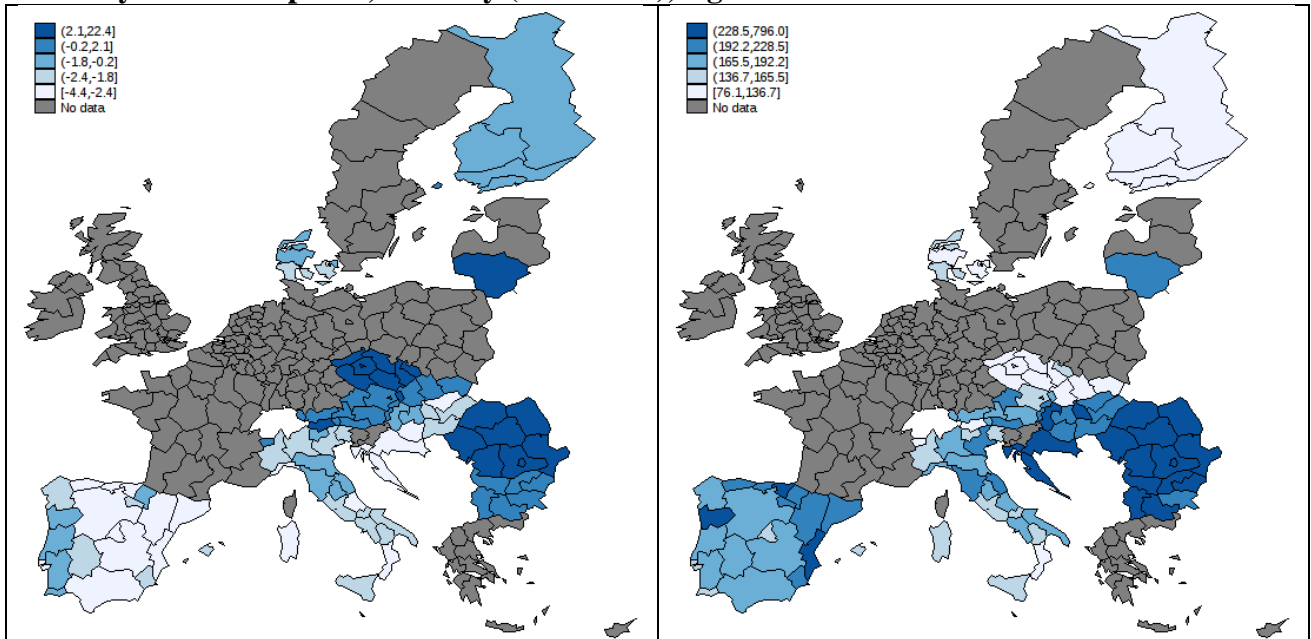
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 1.4: Industry and services value added (by region, % yearly change 2002-2014)**



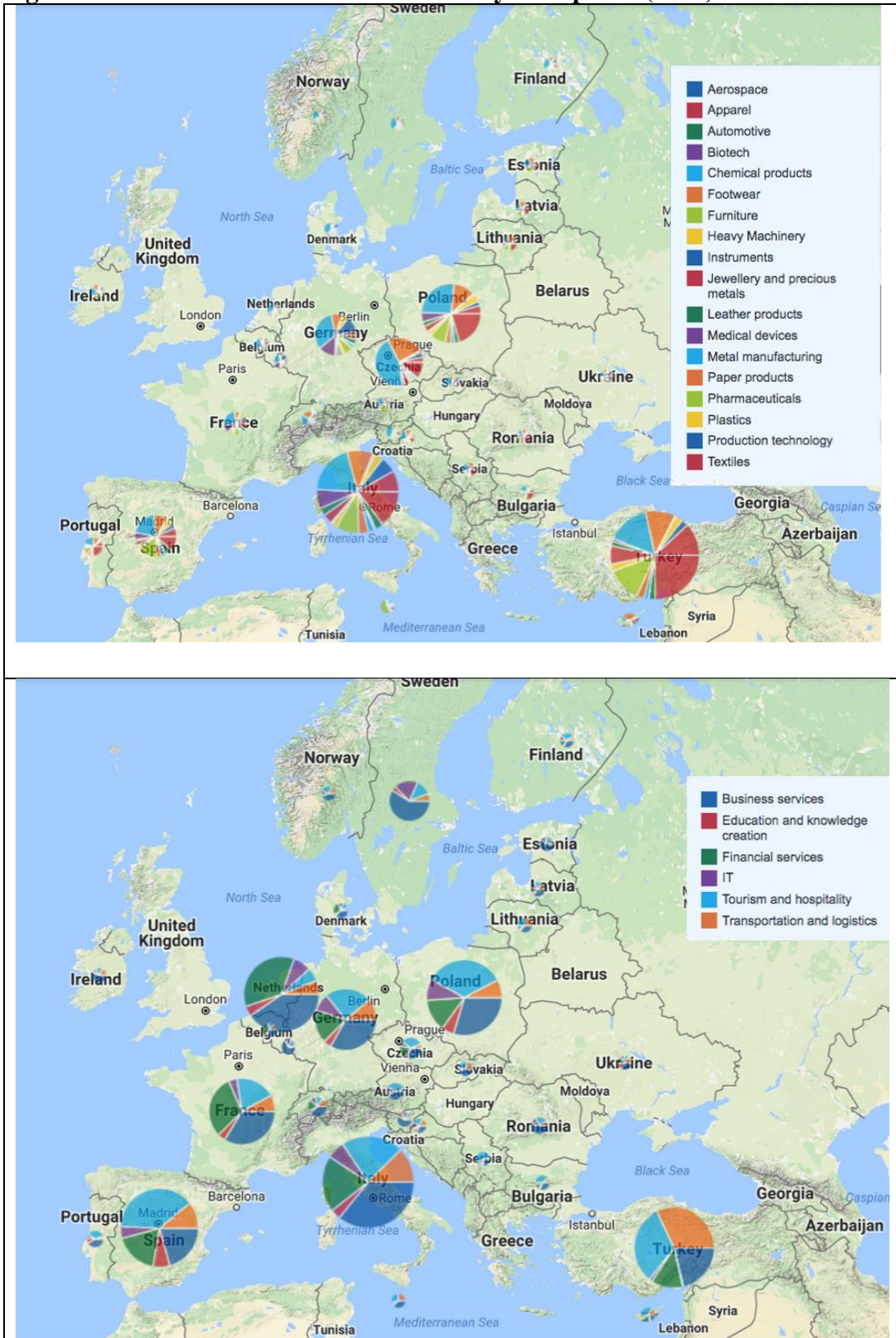
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 1.5: Net business population growth in industry, (% , 2012-2014), left side; average size of newly born enterprises, industry (2011-2014), right side**



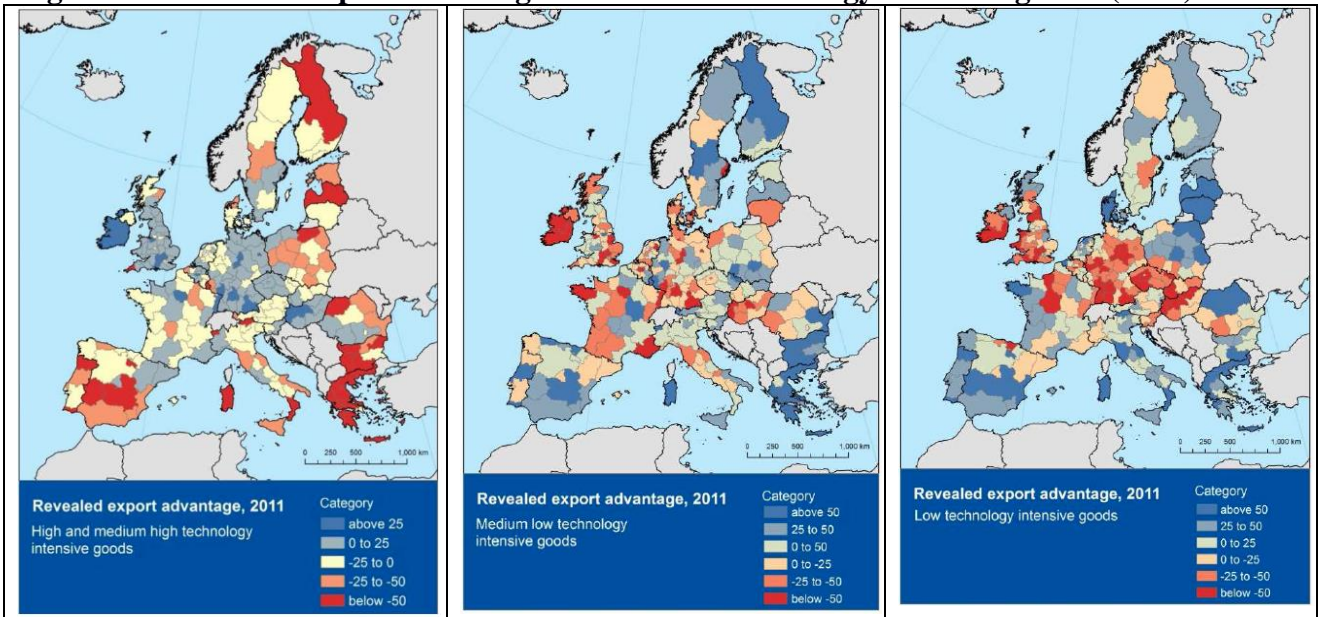
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 1.6: Clusters in EU Member States by enterprises (2011)**



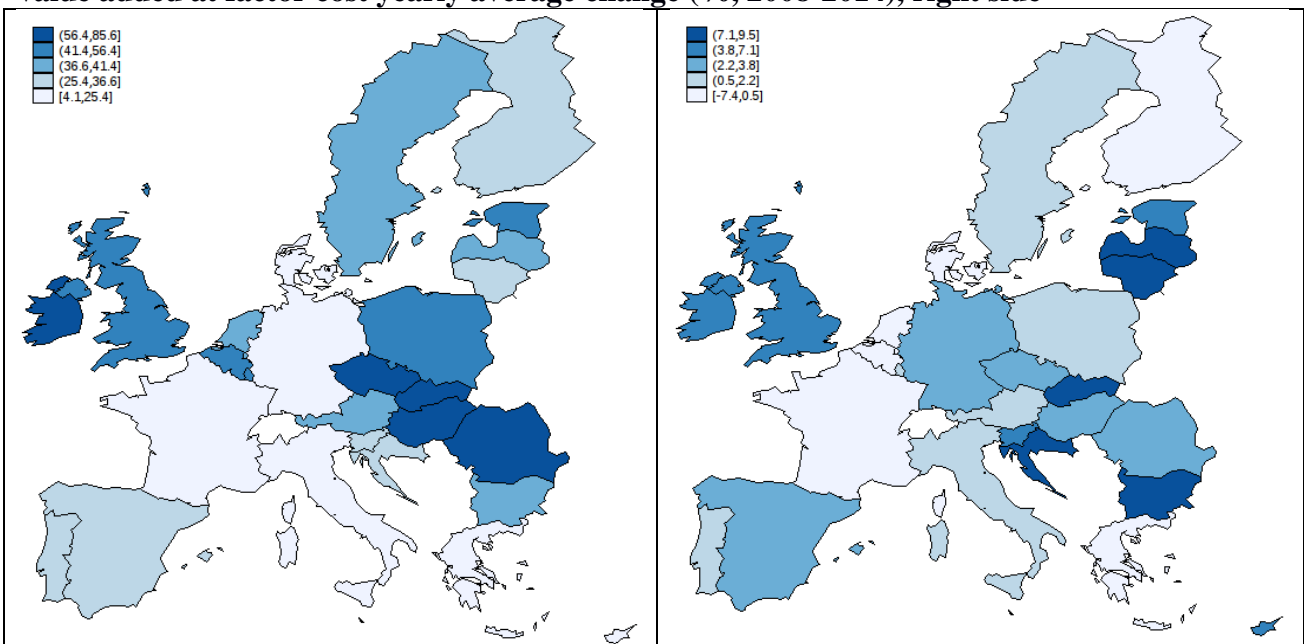
Source: [clusterobservatory.eu](http://clusterobservatory.eu)

**Figure 1.7: Revealed export advantages in different technology-intensive goods (2011)**



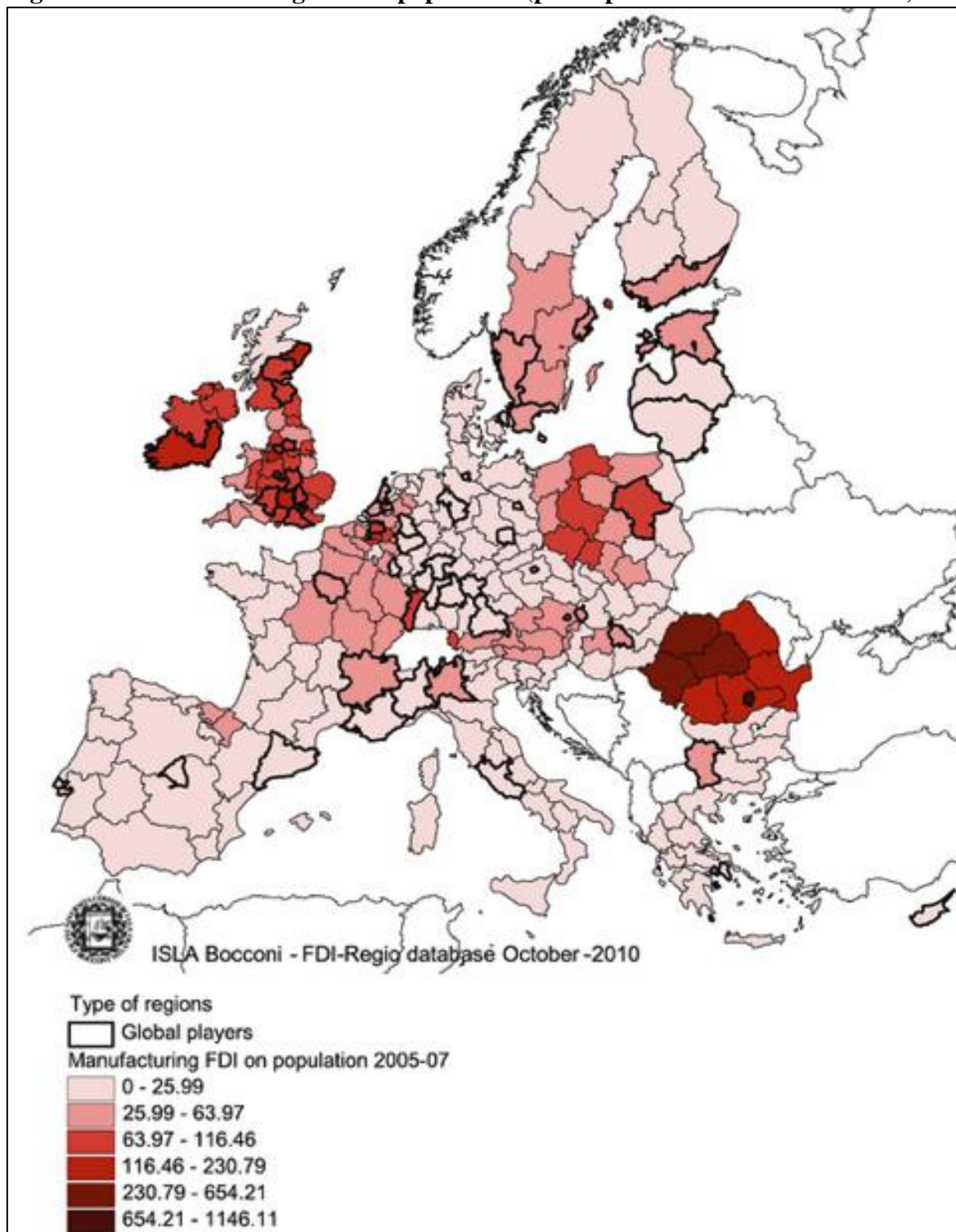
Source: reproduced from Cordes et al. (2016)

**Figure 1.8: Foreign controlled manufacturing firms value added at factor cost, over total manufacturing firms value added (% , 2014), left side; foreign controlled manufacturing firms value added at factor cost yearly average change (% , 2008-2014), right side**



Source: own calculation based on Eurostat (see Annex II for detail)

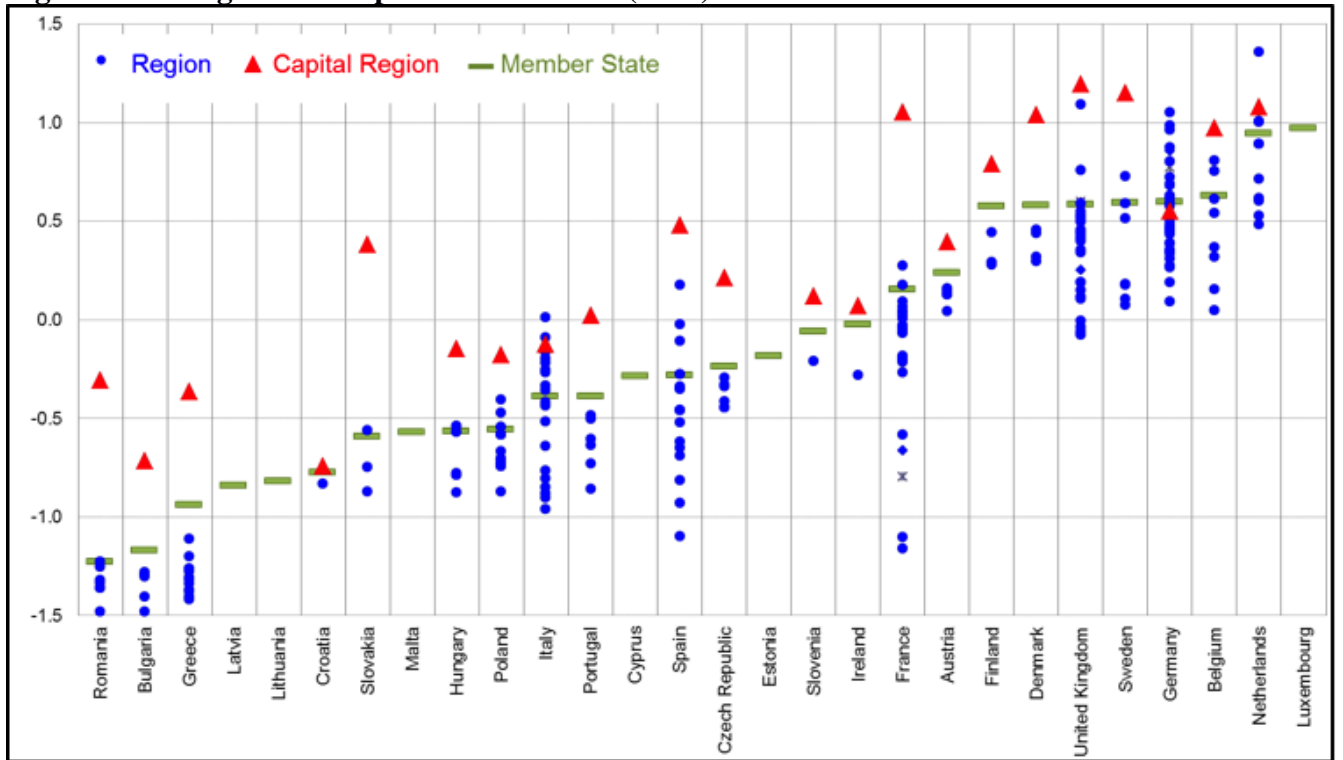
**Figure 1.9: Manufacturing FDI on population (per-capita inward FDI 2005-2007)**



Sources: reproduced from Capello, Fratesi and Resmini (2011), p.101

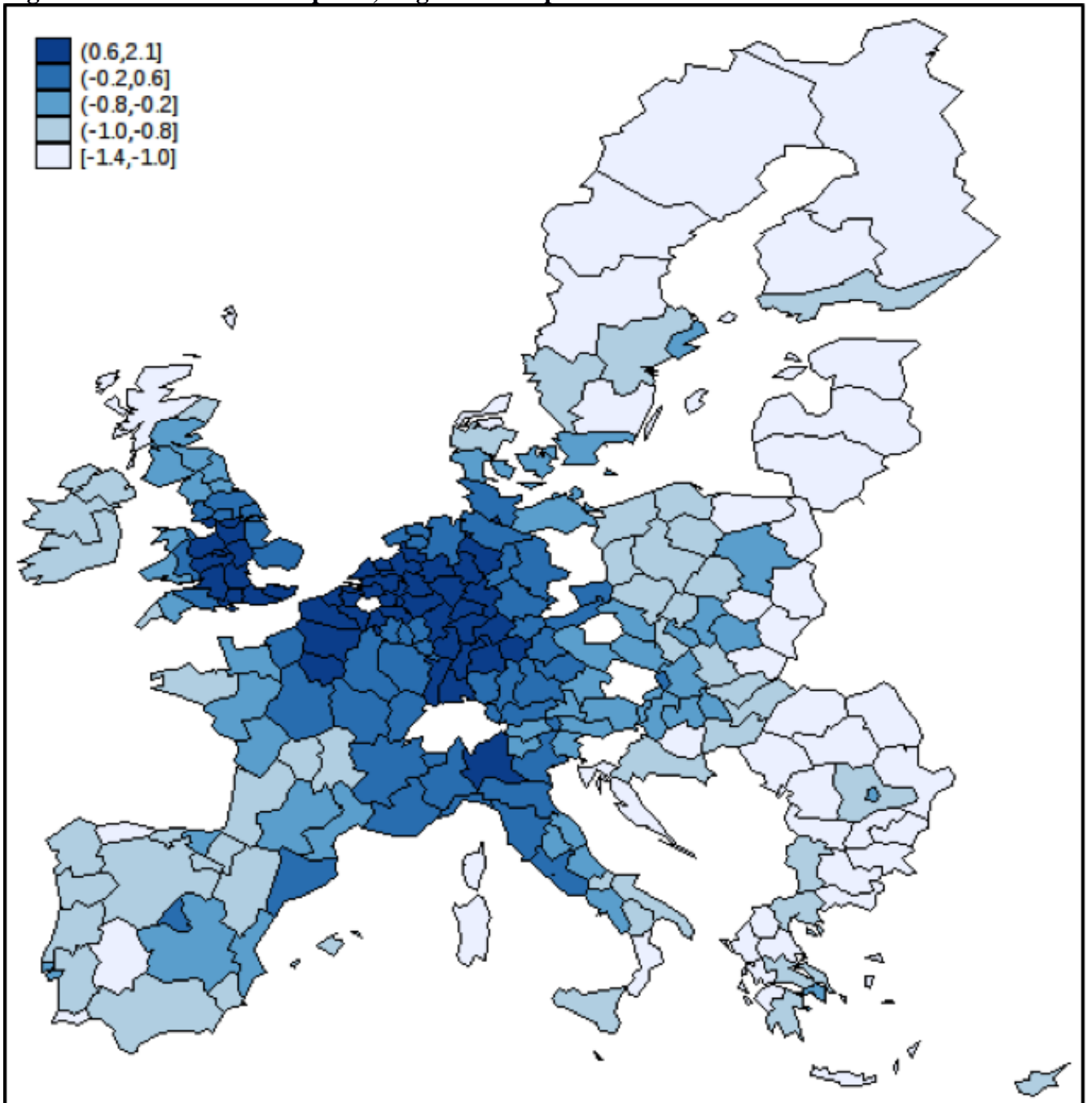


**Figure 1.10: Regional Competitiveness Index (2013)**



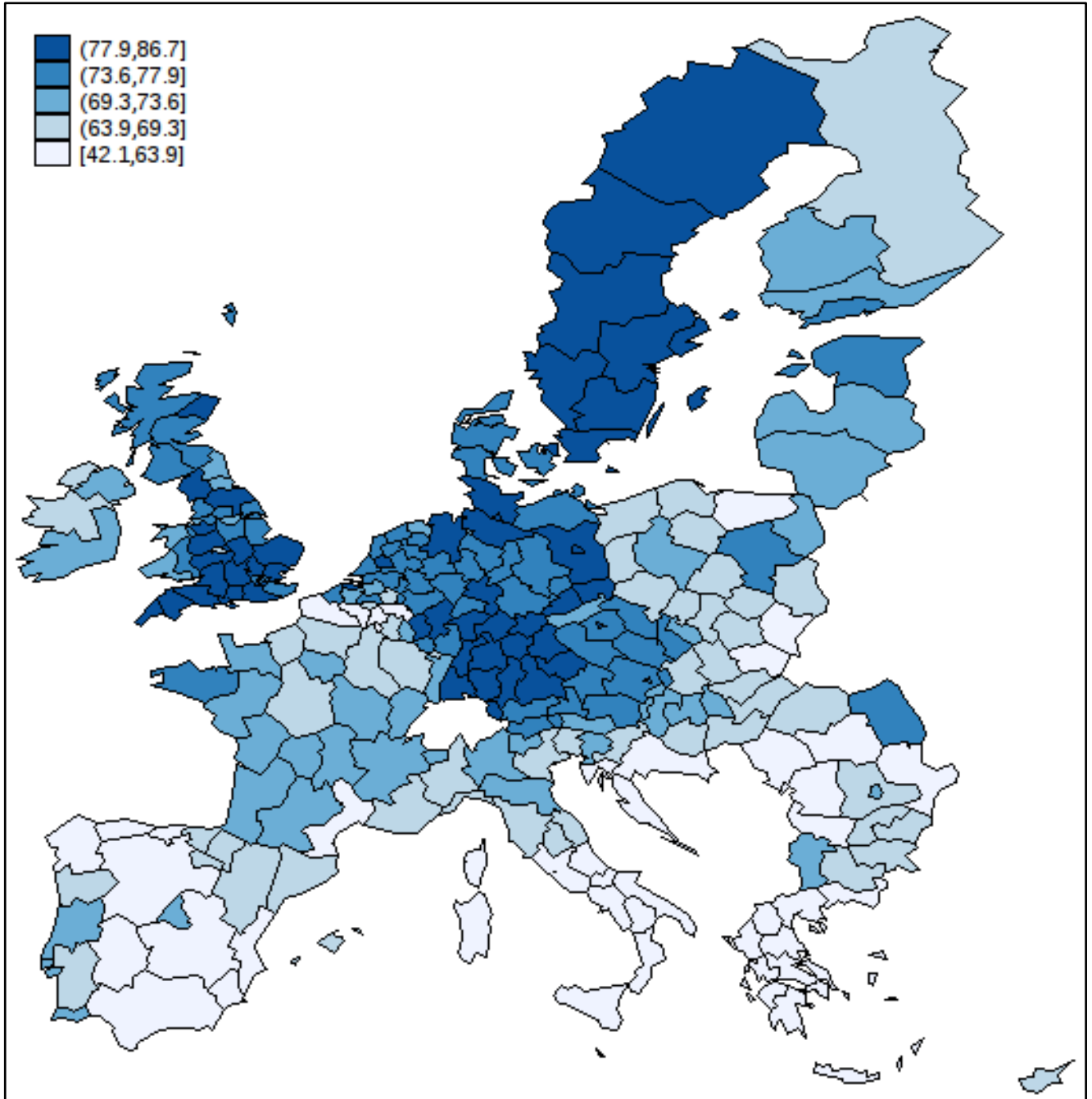
Source: reproduced from European Commission (2013b), p.iii (see Annex II for detail)

**Figure 1.11: Infrastructure pillar, Regional Competitiveness Index 2013**



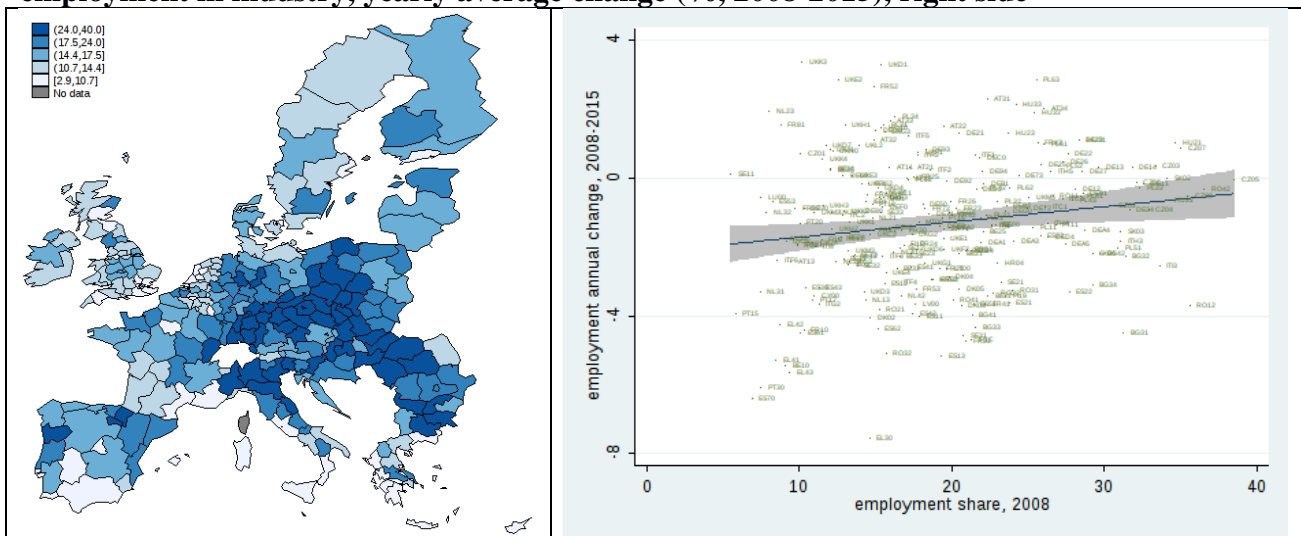
*Source: own calculation based on Eurostat (see Annex II for detail)*

**Figure 1.12: Employment rate of active population in the 20-64 age group (% , 2015)**



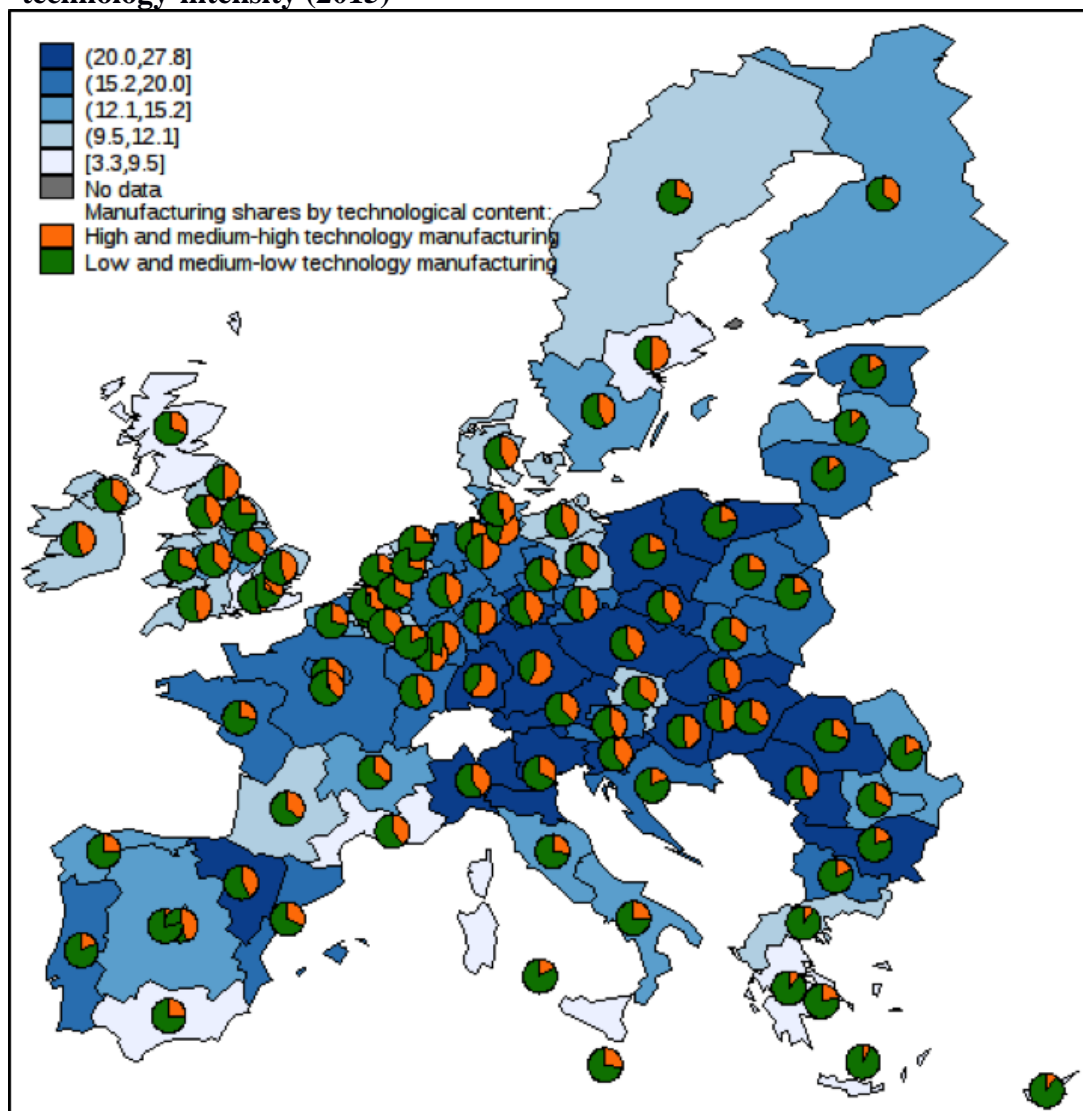
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 1.13: Employment in industry, share of total employment (% , 2015), left side; employment in industry, yearly average change (% , 2008-2015), right side**



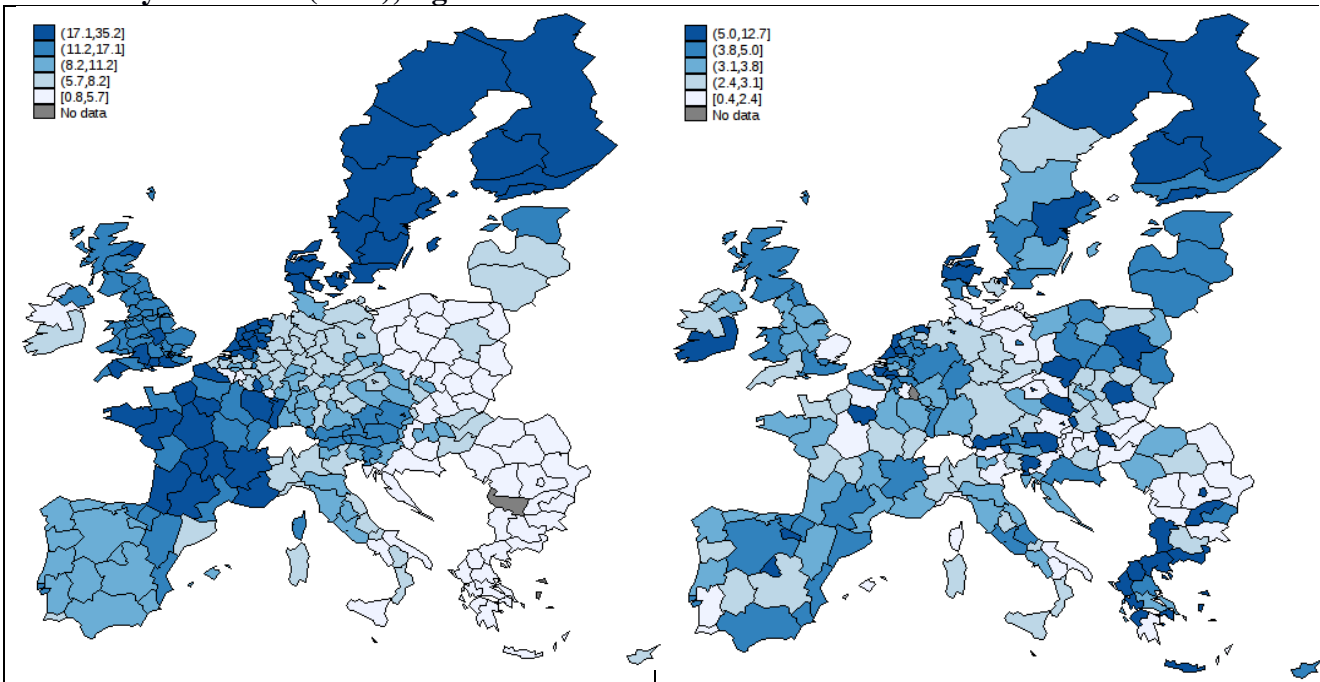
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 1.14: Manufacturing employment share of sectors by technology-intensity (2015)**



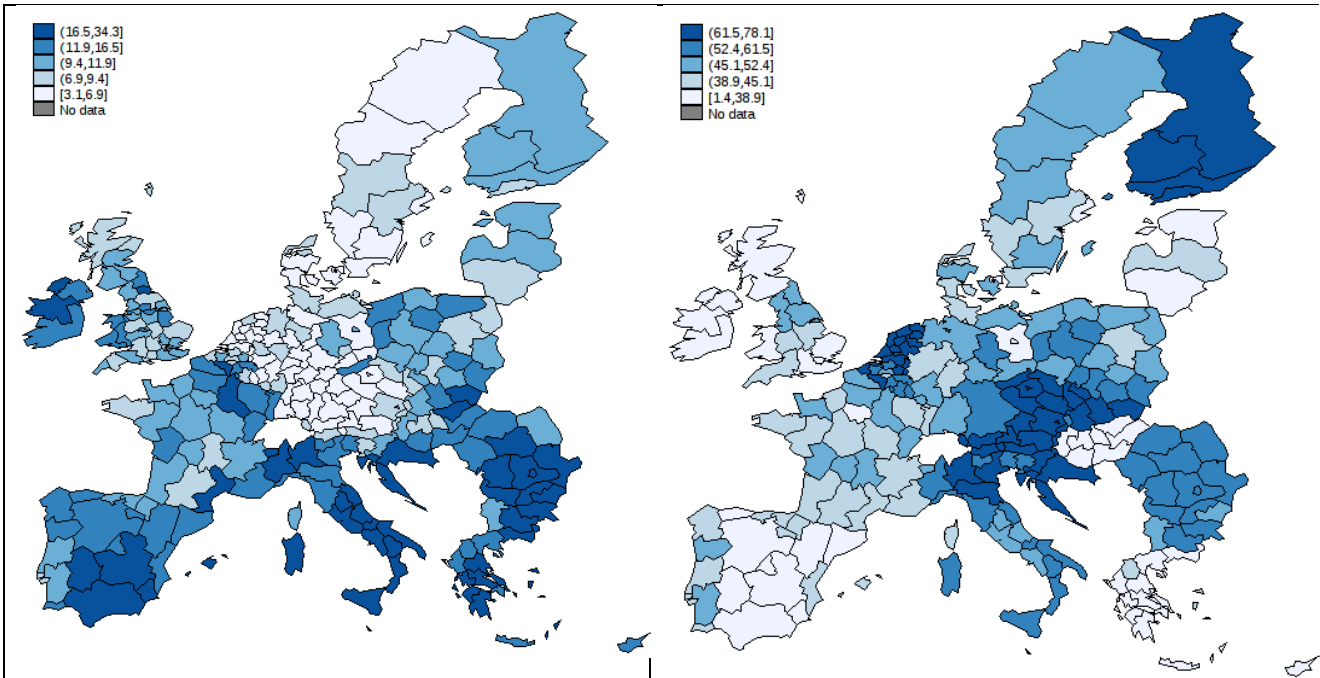
Source: own calculation based on Eurostat (see Annex II for detail).

**Figure 1.15: Participation rate in education and training (2015), left side; participation rates in tertiary education (2015), right side**



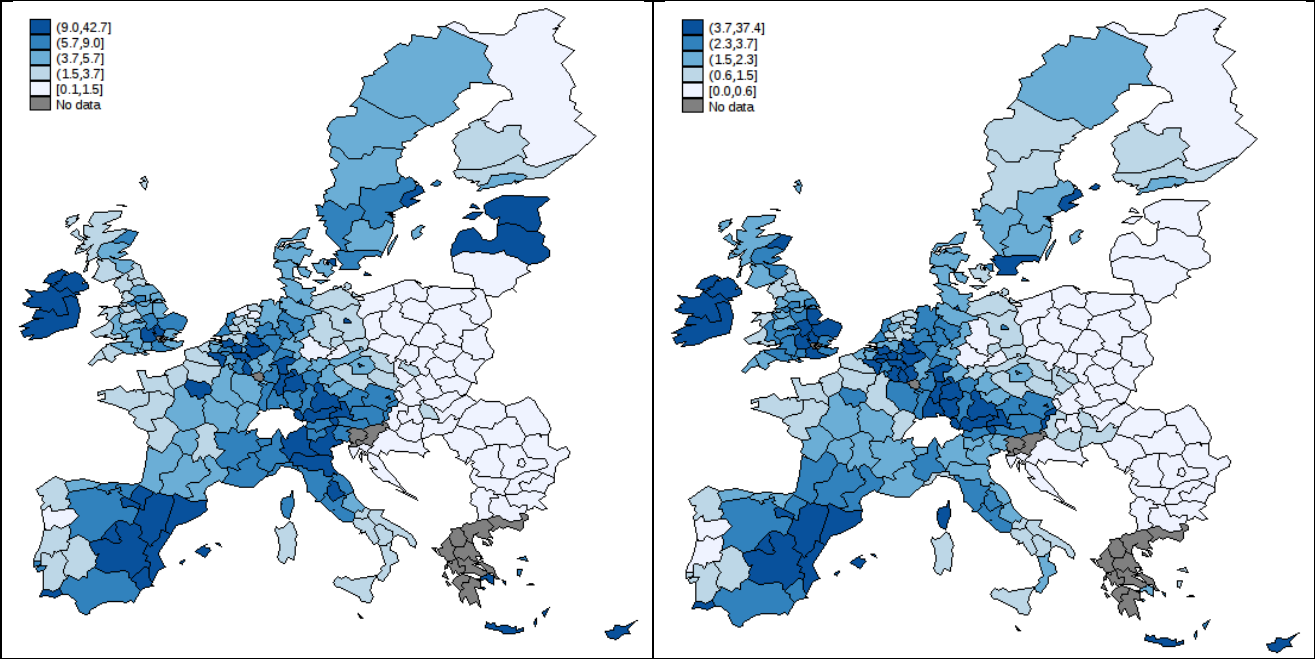
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 1.16: NEET rate for young people aged 15-24 (2015), left side; vocational programmes share in upper secondary education, (2015 or most recent data; NUTS1 for DE and UK), right side**



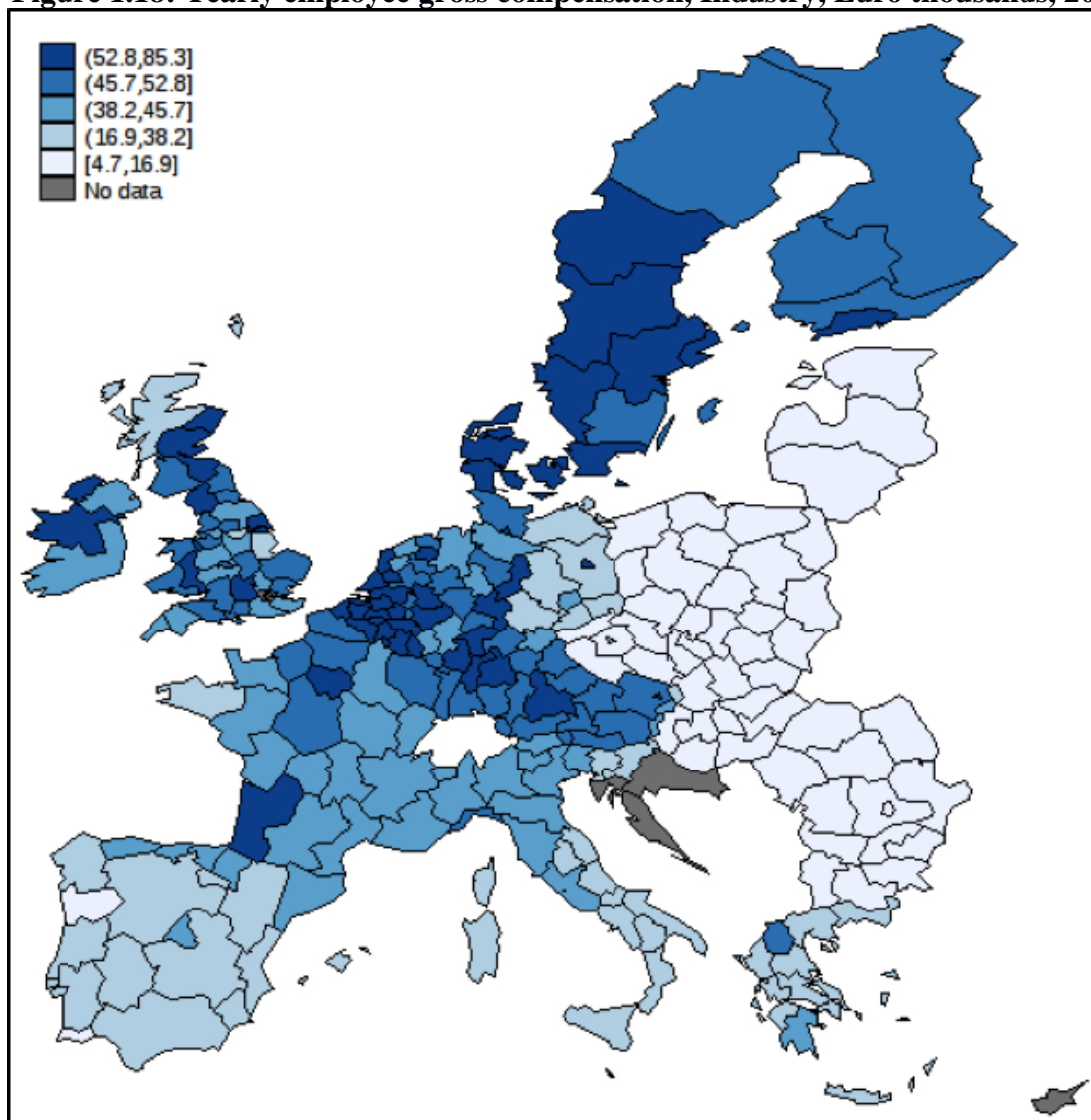
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 1.17: Foreign country total immigrants share (2011), left side; EU-countries immigrants share (2011), right side**



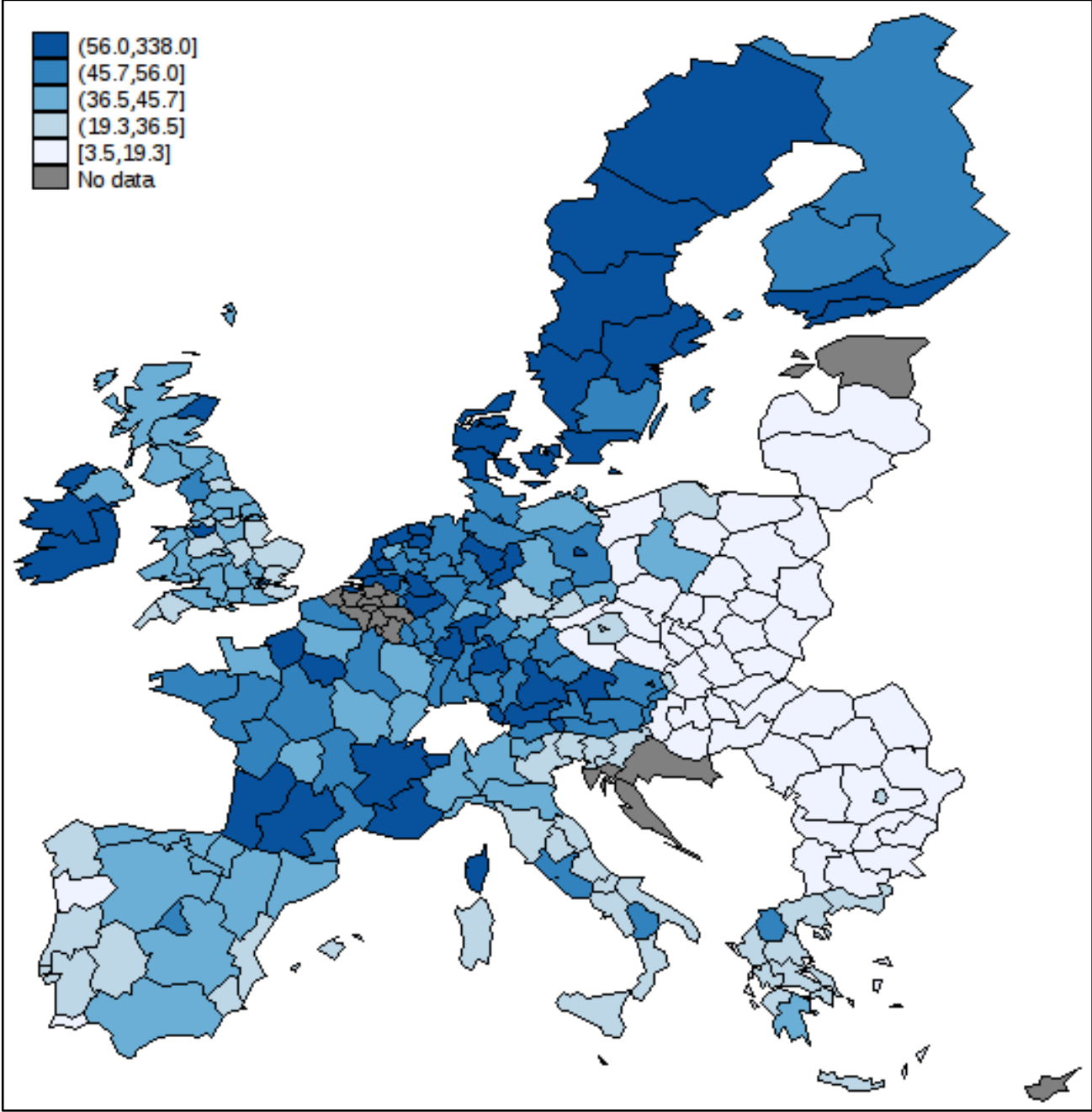
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 1.18: Yearly employee gross compensation, Industry, Euro thousands, 2013**



*Source: own calculation based on Eurostat (see Annex II for detail)*

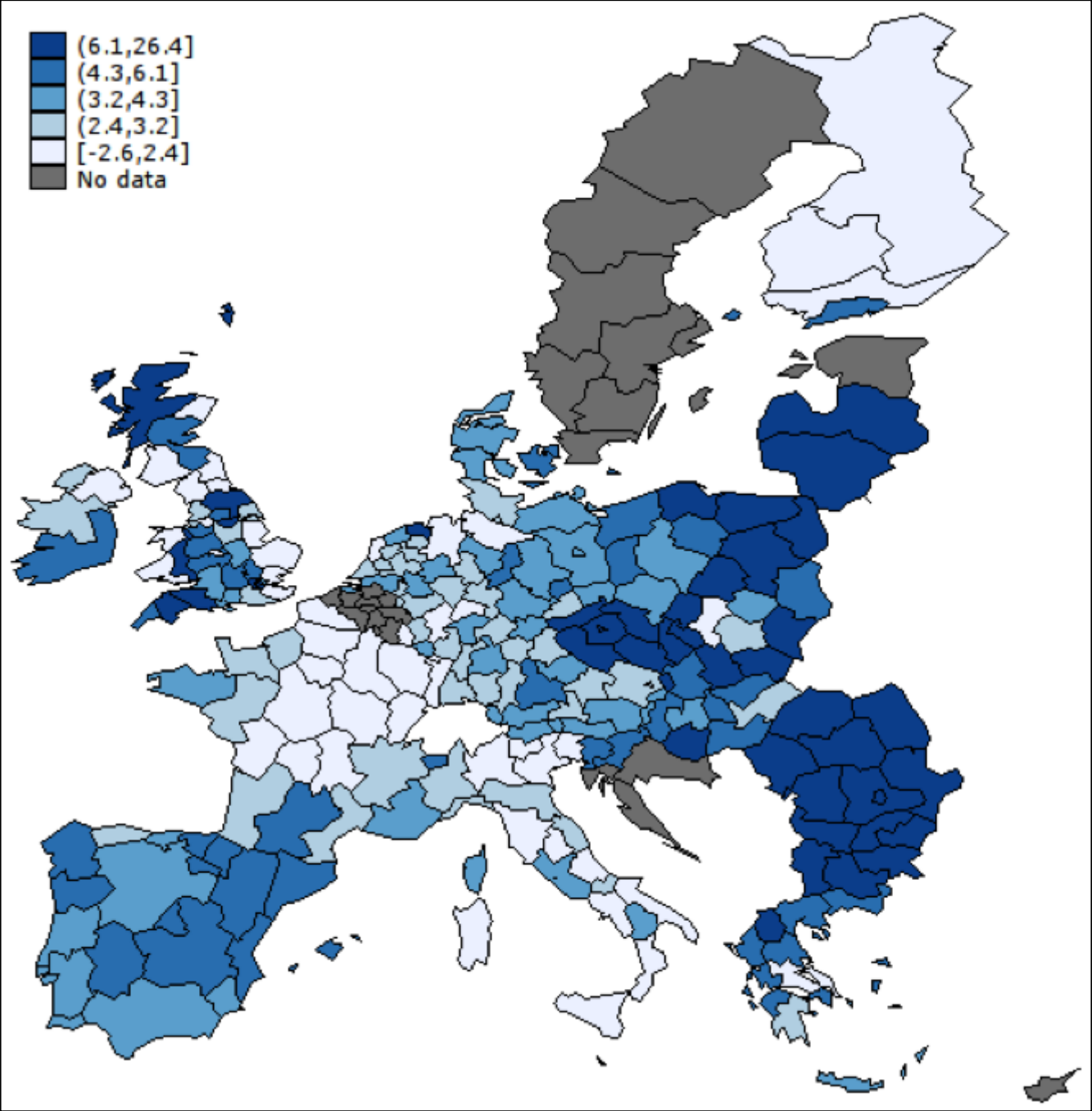
Figure 1.19: Labour productivity, industry, Euro, 2013 (2012 for FR)



Source: own calculation based on Eurostat (see Annex II for detail)

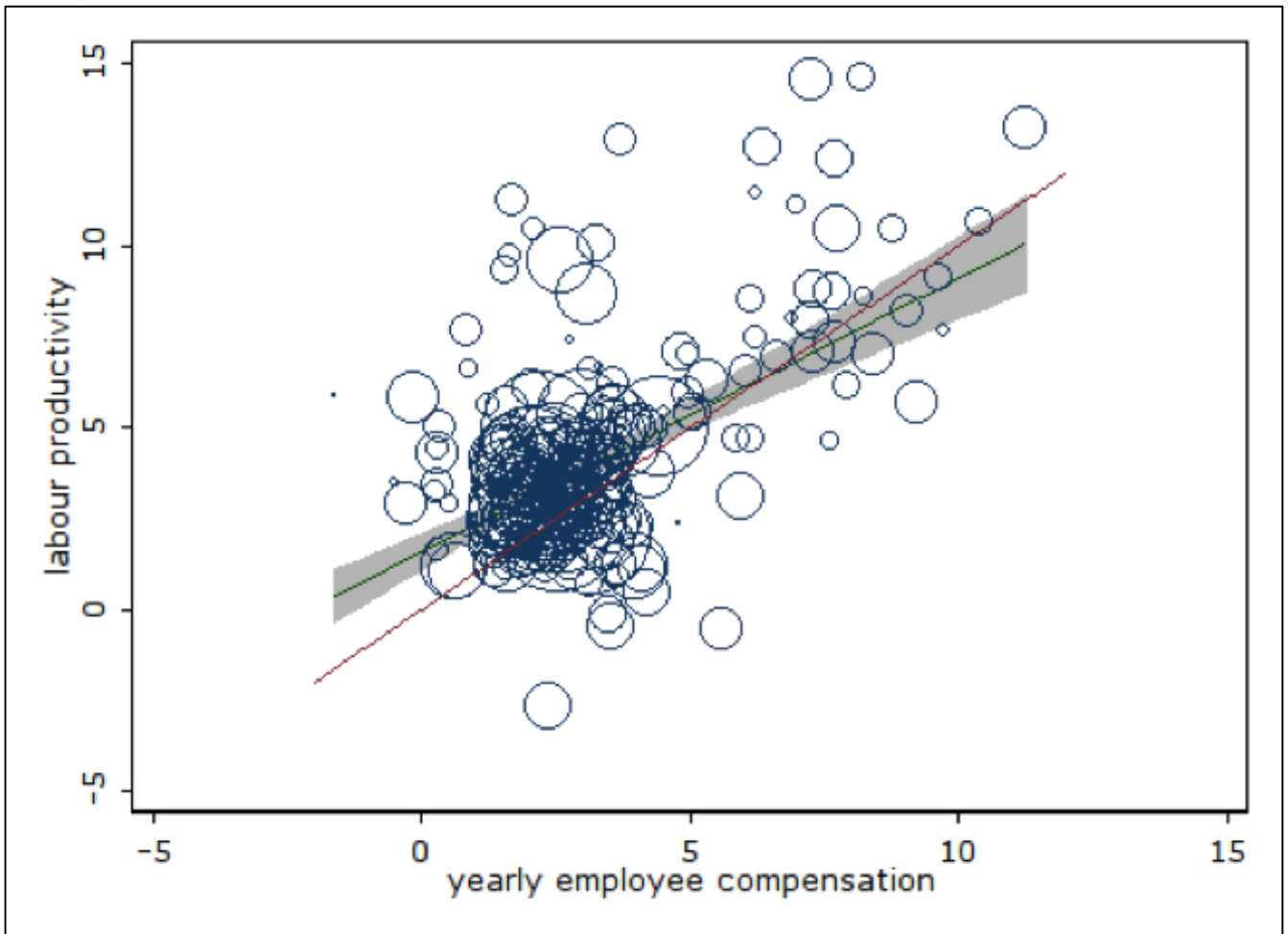


Figure 1.20: Labour productivity, industry, Euro, average yearly change (% , 2001-2013)



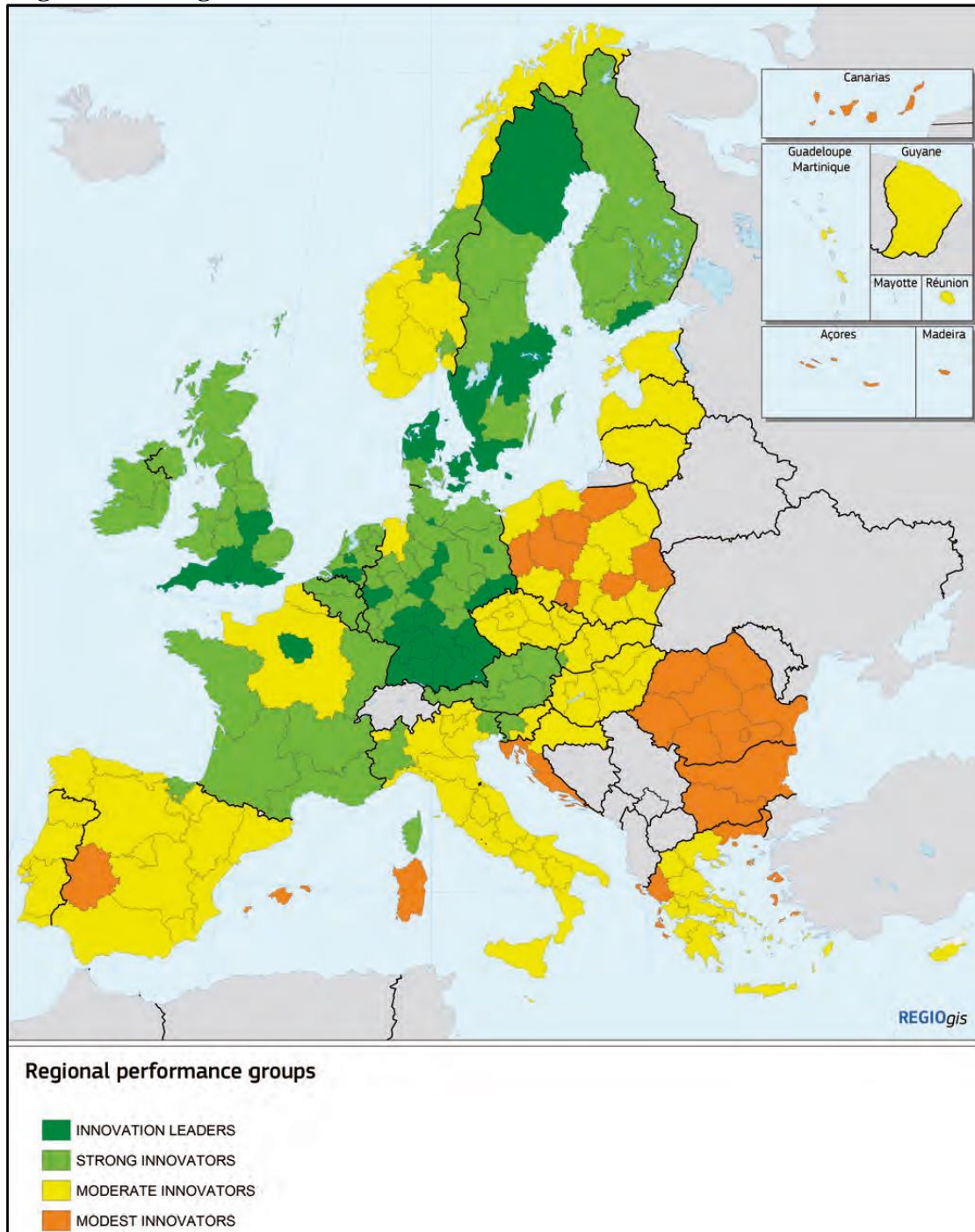
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 1.21: Labour productivity vs. yearly employee compensation, Industry, yearly average change, (% , 2001-2013; size of circles represents the weight of industry over total value added)**



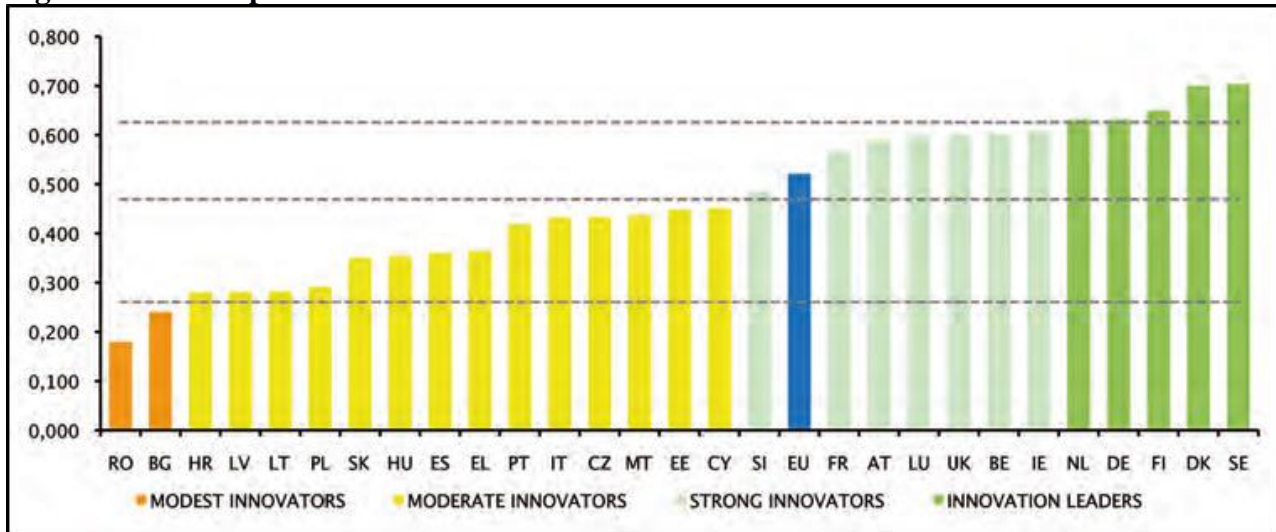
*Source: own calculation based on Eurostat (see Annex II for detail)*

**Figure 1.22: Regional Innovation Scoreboard 2016**



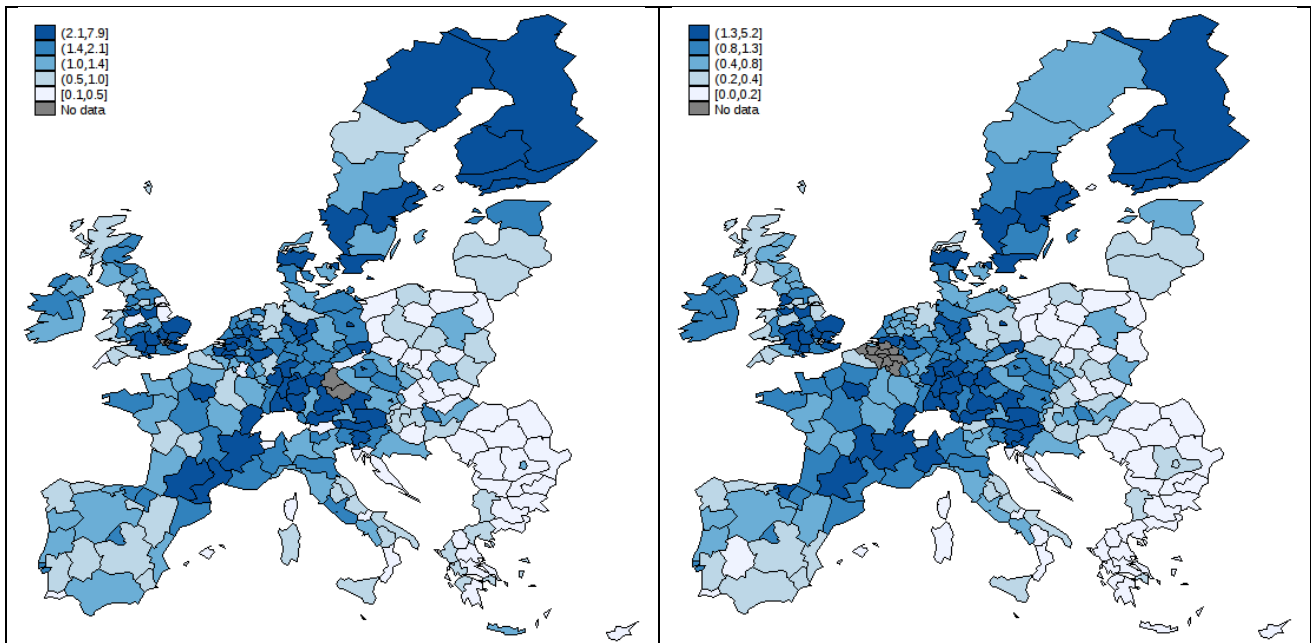
Source: reproduced from European Commission (2016b), p.16

**Figure 1.23: European Innovation Scoreboard 2016**



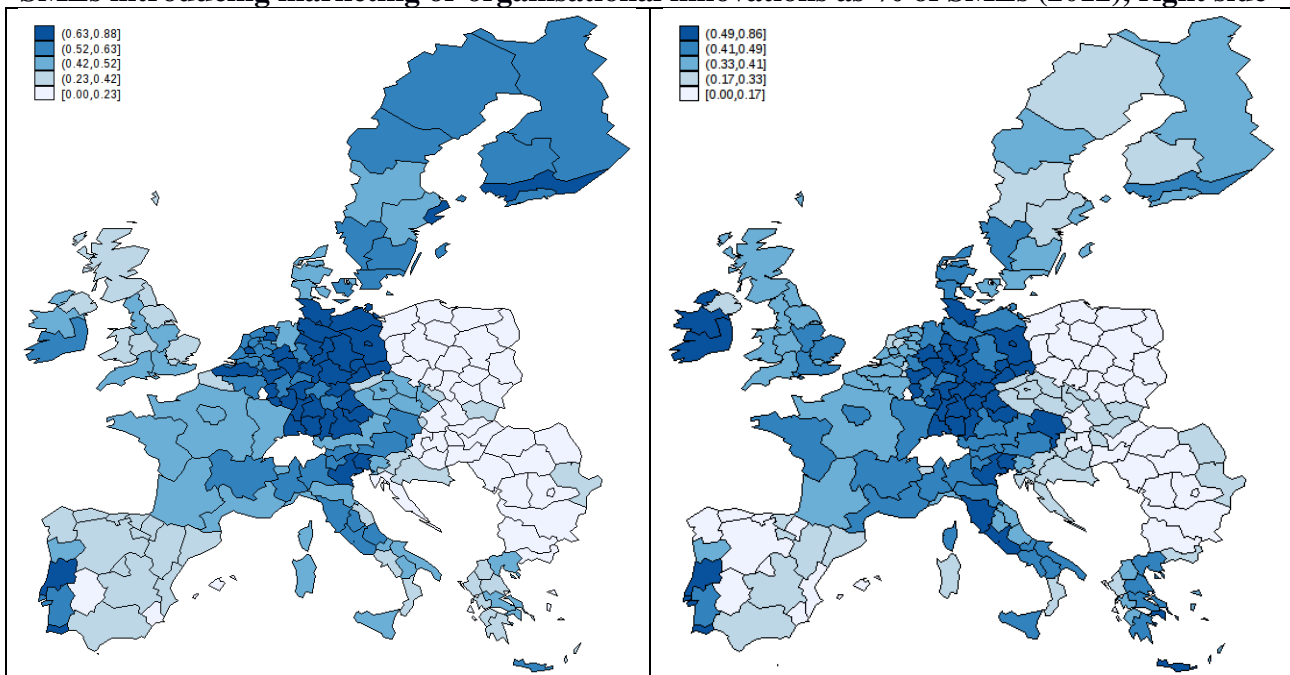
Source: Reproduced from European Commission (2016a), p.12

**Figure 1.24: Total R&D expenditure (GERD), % of GDP (average 2005-2014), left side; business enterprise sector R&D expenditure (GERD), % of GDP (average 2005-2014), right side**



Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 1.25: SMEs introducing product or process innovations as % of SMEs (2012), left side; SMEs introducing marketing or organisational innovations as % of SMEs (2012), right side**



Source: own calculation based on Eurostat (see Annex II for detail)

**Table 2.1: The five groups of manufacturing**

**Manufacturing is diverse: We identify five broad groups with very different characteristics and requirements**

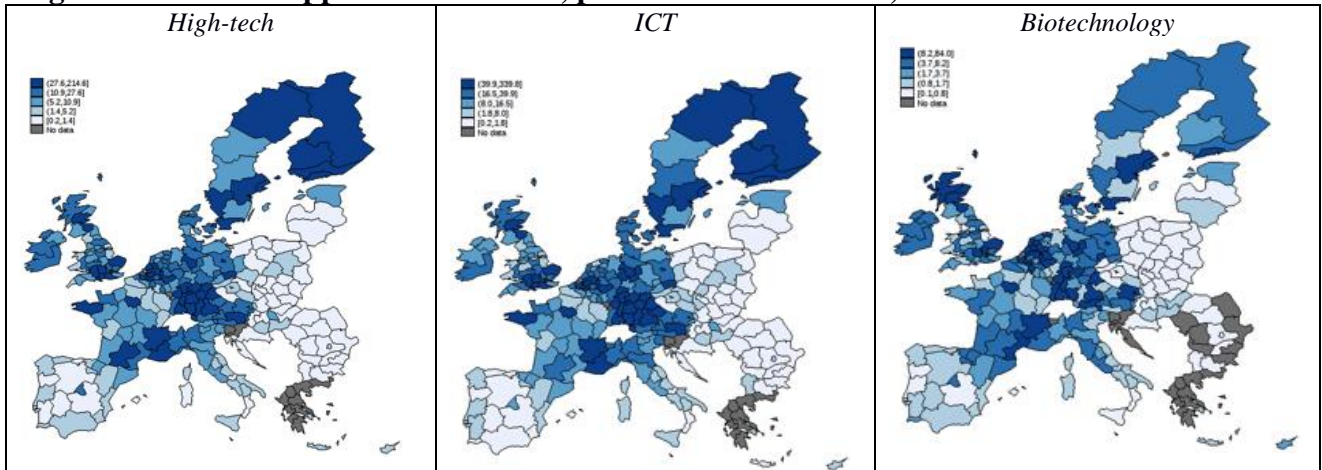
● % of global manufacturing value added

■ High  
■ Upper-middle  
■ Lower-middle  
■ Low

Group	Industry	R&D intensity	Labor intensity	Capital intensity	Energy intensity	Trade intensity	Value density
Global innovation for local markets (34)	Chemicals	High	Low	High	Low	Low	High
	Motor vehicles, trailers, parts	High	Low	Low	Low	Low	High
	Other transport equipment	High	Low	Low	Low	Low	High
	Electrical machinery	High	Low	Low	Low	Low	High
	Machinery, equipment, appliances	High	Low	Low	Low	Low	High
Regional processing (28)	Rubber and plastics products	Low	High	Low	Low	Low	High
	Fabricated metal products	Low	High	Low	Low	Low	High
	Food, beverage, and tobacco	Low	High	Low	Low	Low	High
	Printing and publishing	Low	High	Low	Low	Low	High
Energy-/resource-intensive commodities (22)	Wood products	Low	Low	High	High	Low	Low
	Refined petroleum, coke, nuclear	Low	Low	High	High	Low	Low
	Paper and pulp	Low	Low	High	High	Low	Low
	Mineral-based products	Low	Low	High	High	Low	Low
	Basic metals	Low	Low	High	High	Low	Low
Global technologies/innovators (9)	Computers and office machinery	High	Low	Low	Low	High	High
	Semiconductors and electronics	High	Low	Low	Low	High	High
	Medical, precision, and optical	High	Low	Low	Low	High	High
Labor-intensive tradables (7)	Textiles, apparel, leather	Low	High	Low	Low	High	Low
	Furniture, jewelry, toys, other	Low	High	Low	Low	High	Low

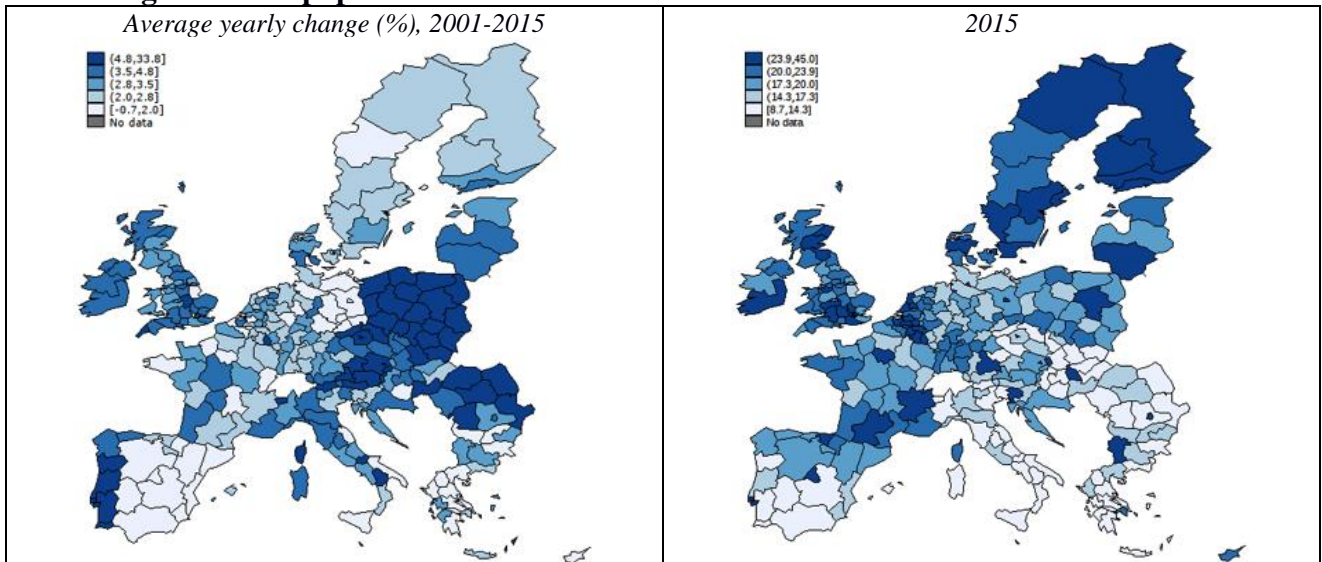
Source: reproduced from McKinsey & Company (2012), p.5.

**Figure 2.1: Patents applications to EPO, per million inhabitants, 2002-2013**



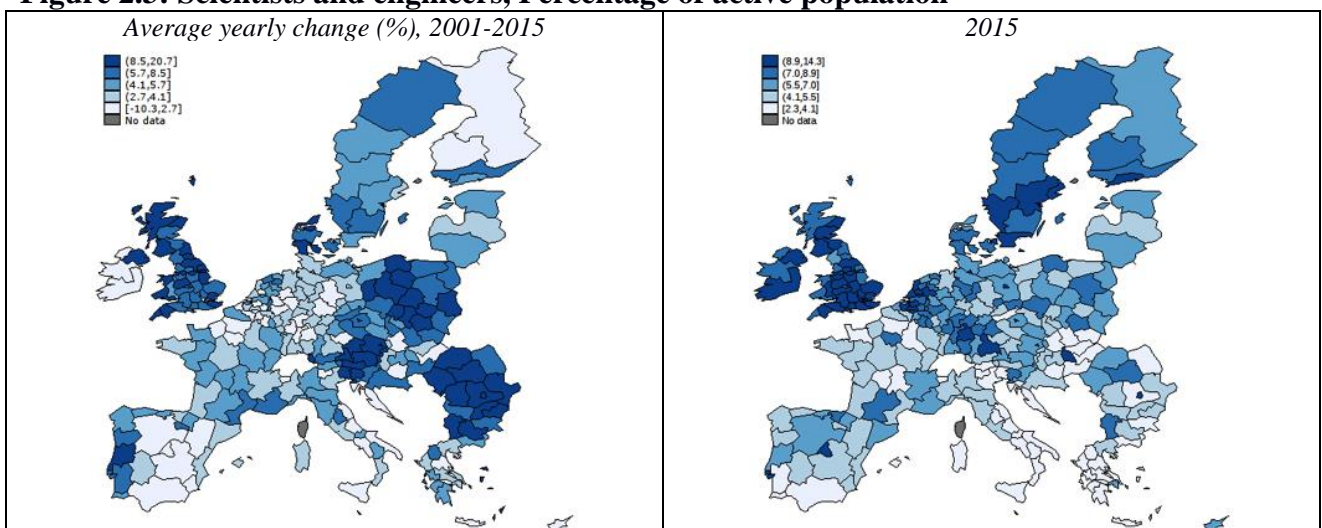
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 2.2: Persons with tertiary education (ISCED) and employed in science and technology, Percentage of active population**



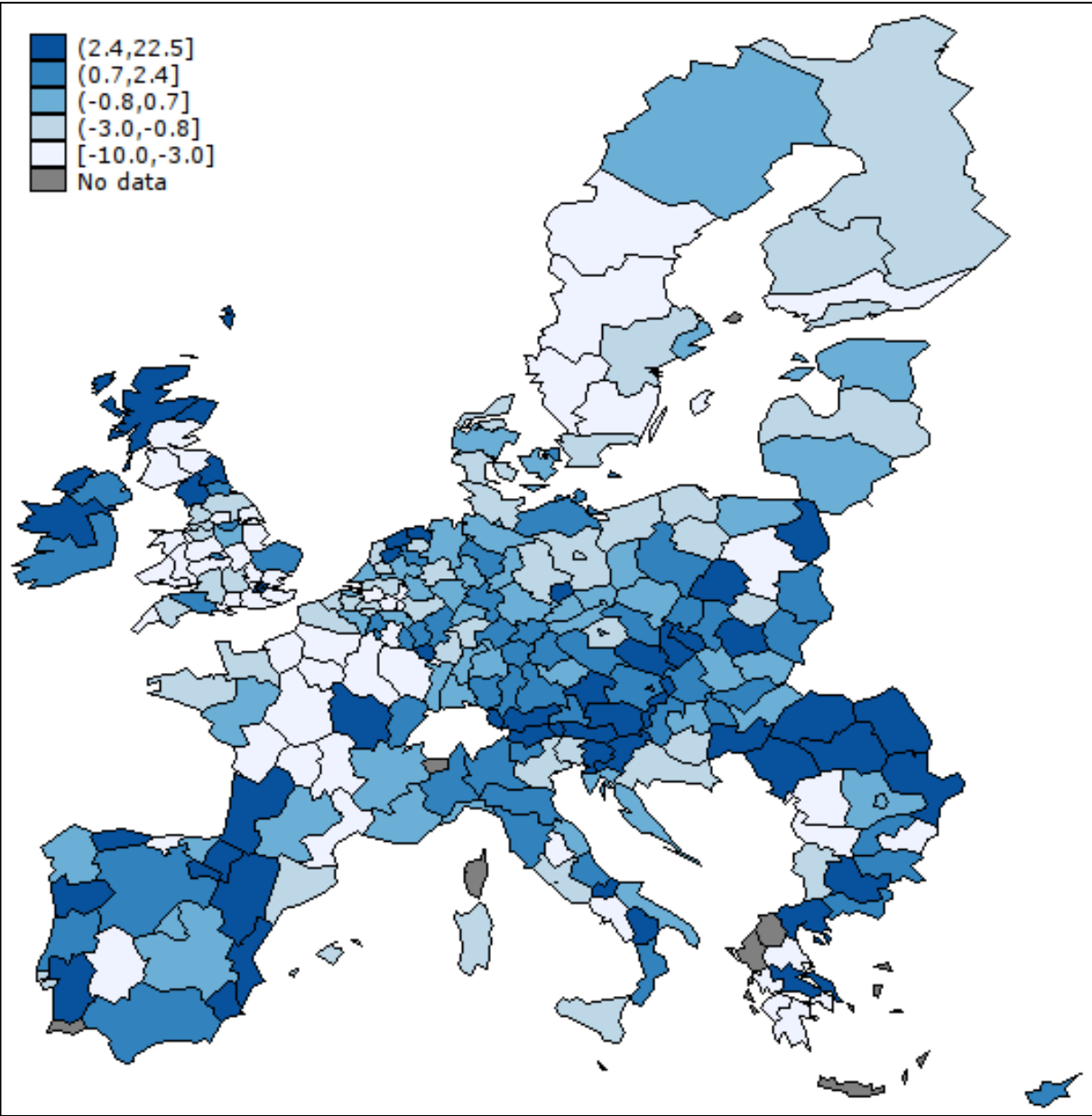
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 2.3: Scientists and engineers, Percentage of active population**



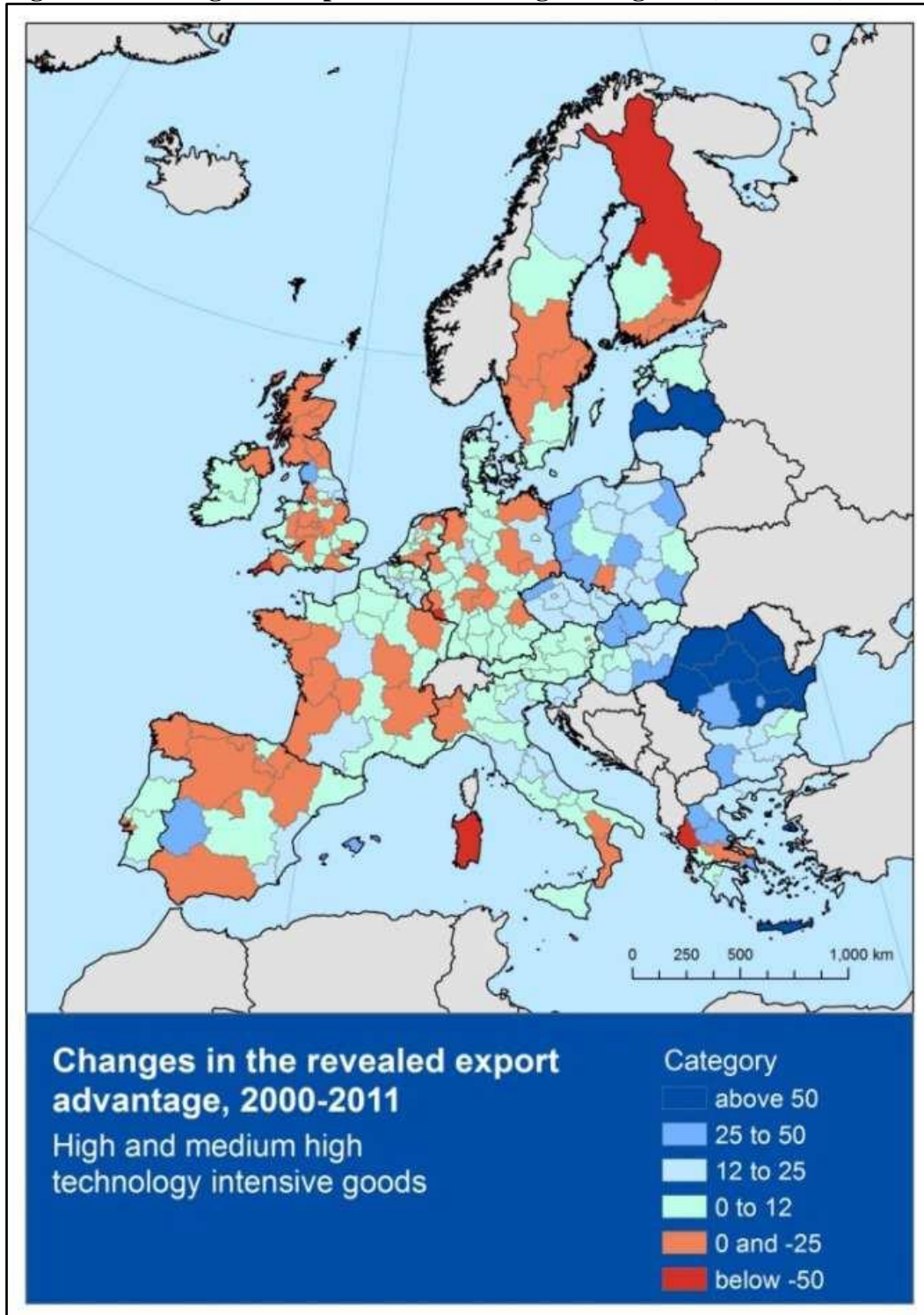
Source: own calculation based on Eurostat (see Annex II for detail)

**Figure 2.4: High and medium high-technology manufacturing, Percentage of total employment, average yearly change (% , 2008-2015)**



*Source: own calculation based on Eurostat (see Annex II for detail)*

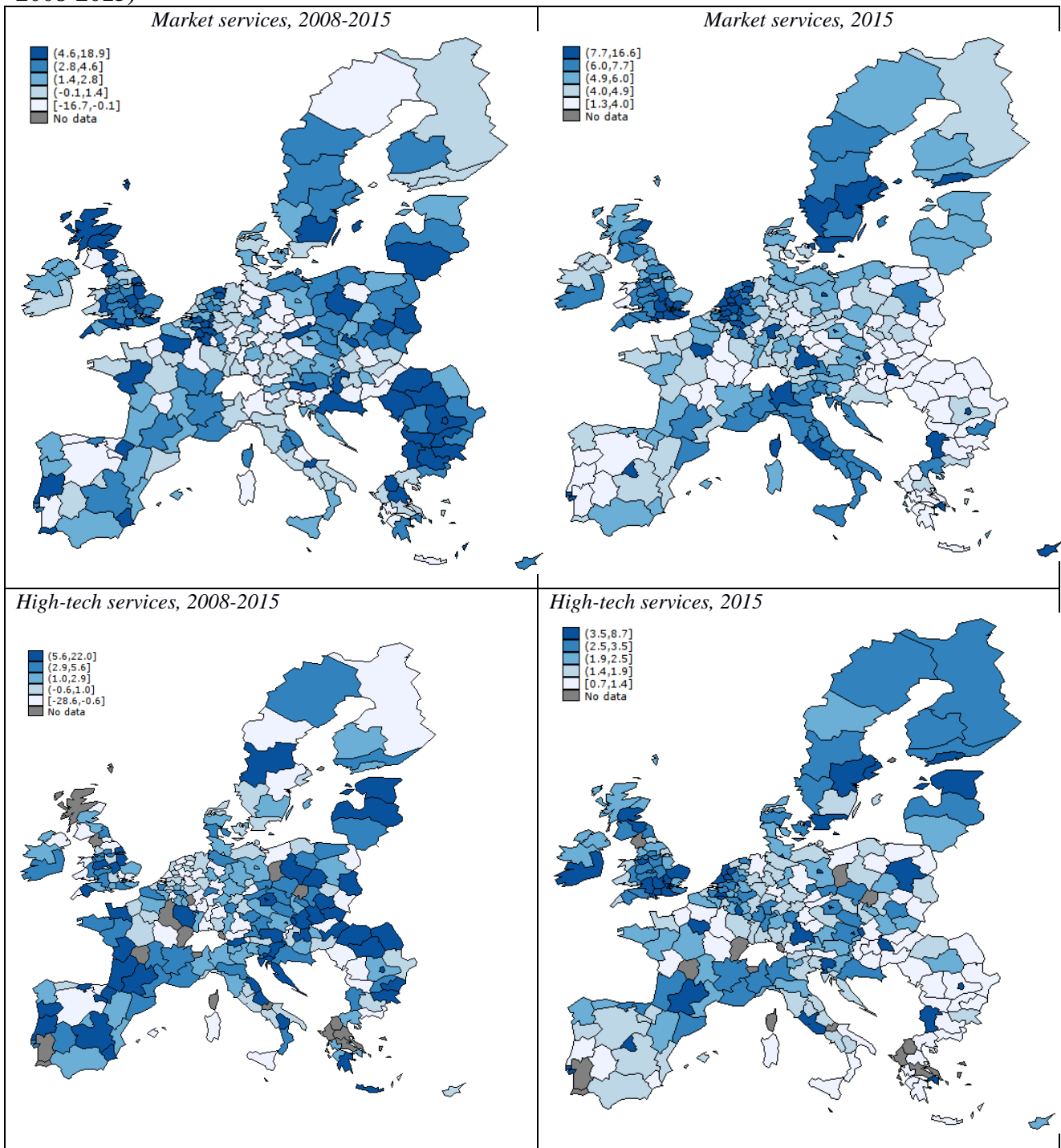
**Figure 2.5: Change in competitiveness for high-tech goods (2000-2011)**



Source: reproduced from Cordes et al. (2016)

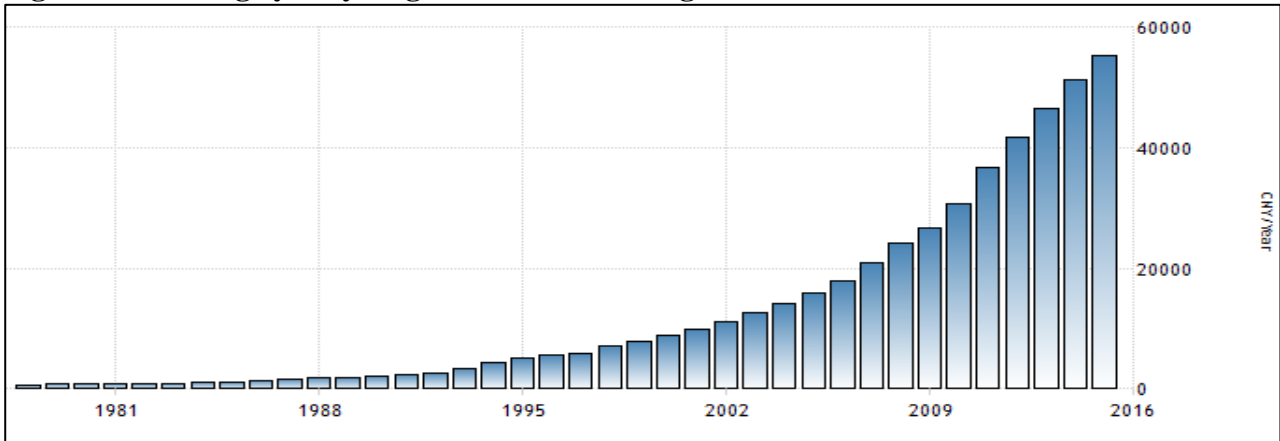


**Figure 2.6: Knowledge-intensive services, average yearly change in total employment (% , 2008-2015)**



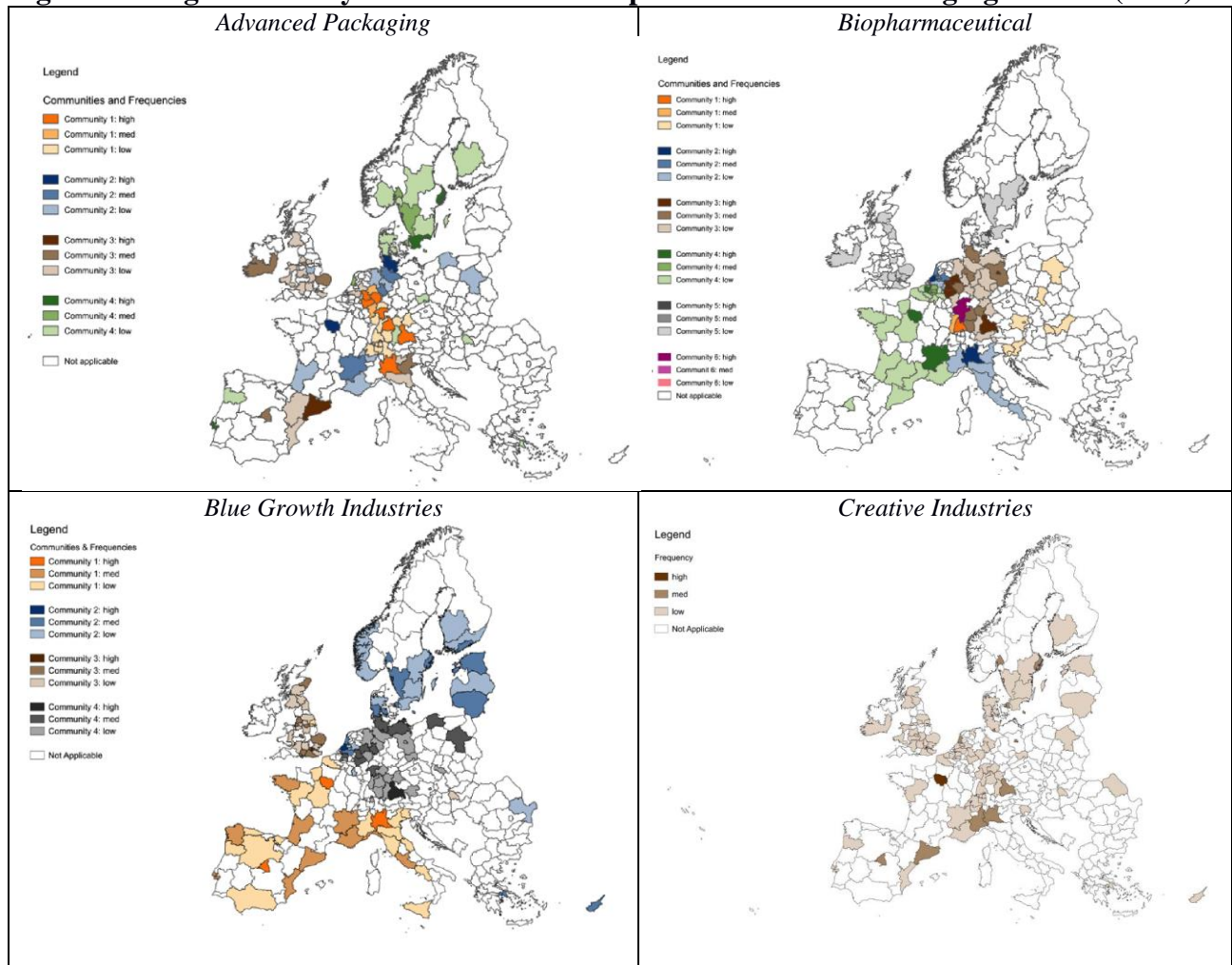
Source: own calculation based on Eurostat (see Annex II for detail)

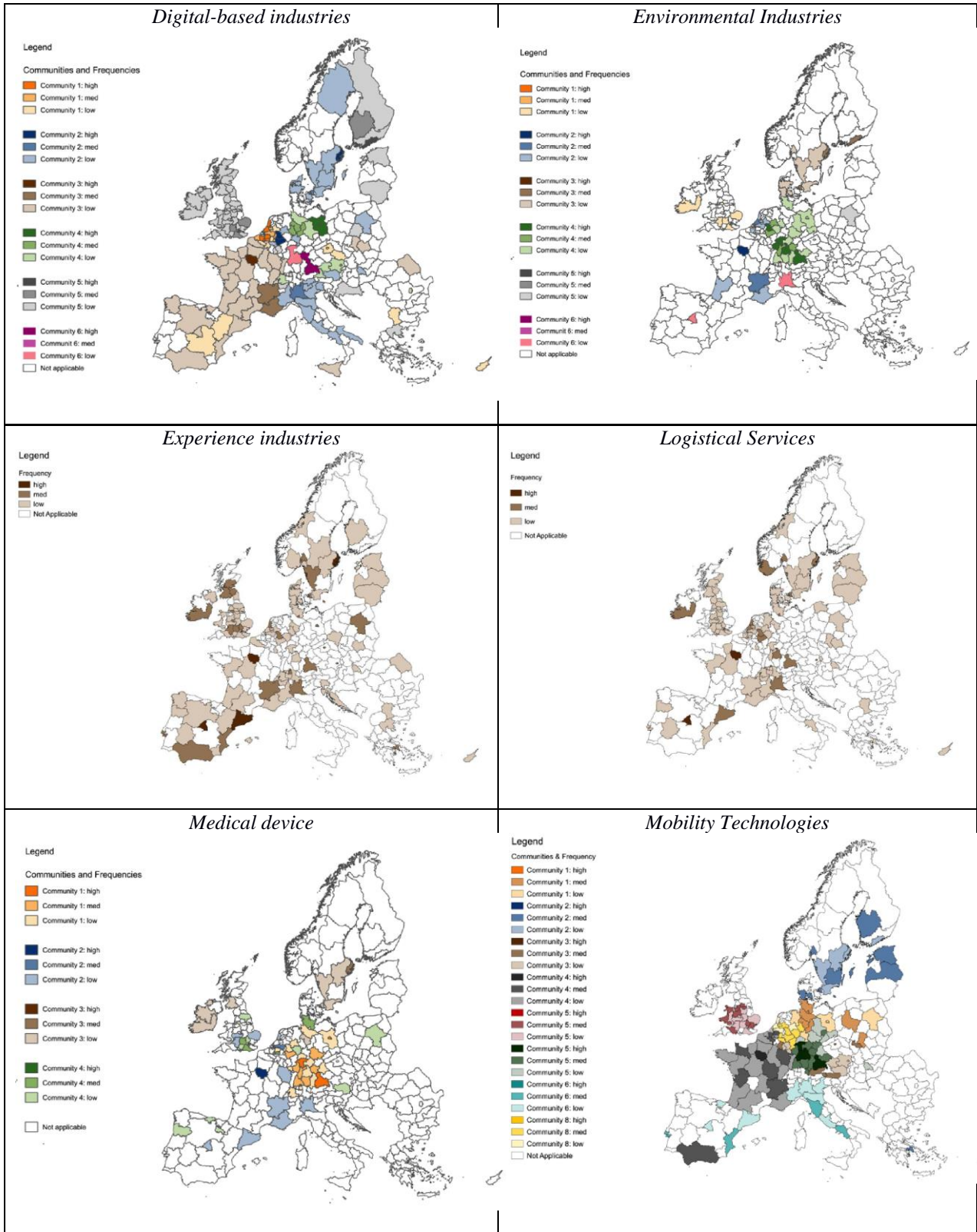
**Figure 2.7: Average yearly wages in manufacturing in China**



Source: National Bureau of Statistics of China

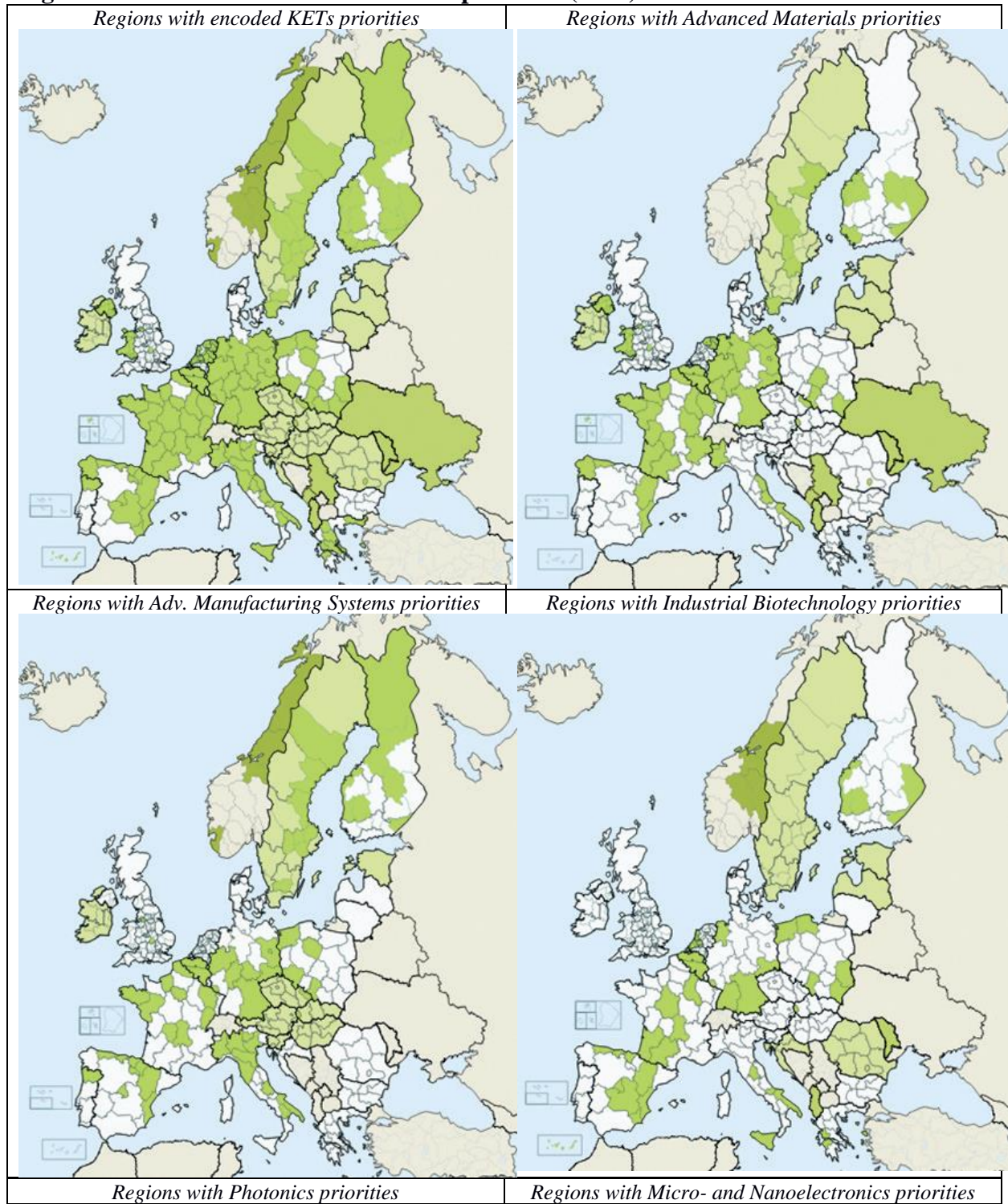
**Figure 2.8 Regions with dynamic cross-sectoral patterns related to emerging clusters (2014)**

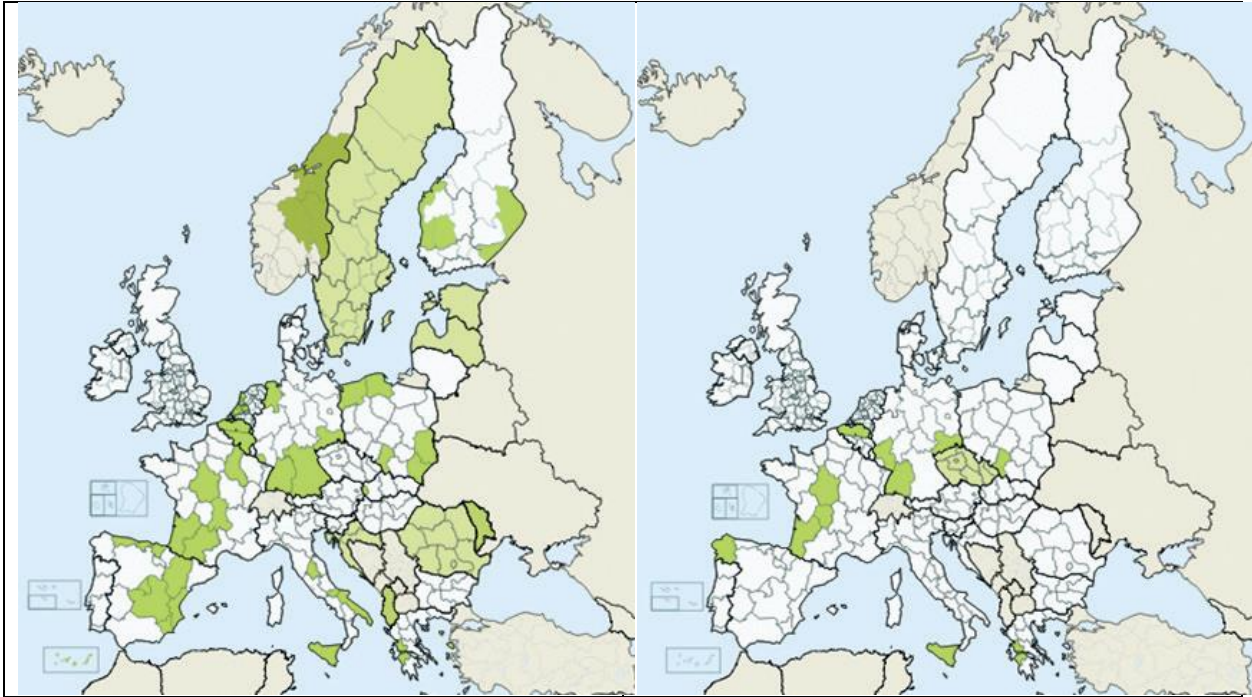




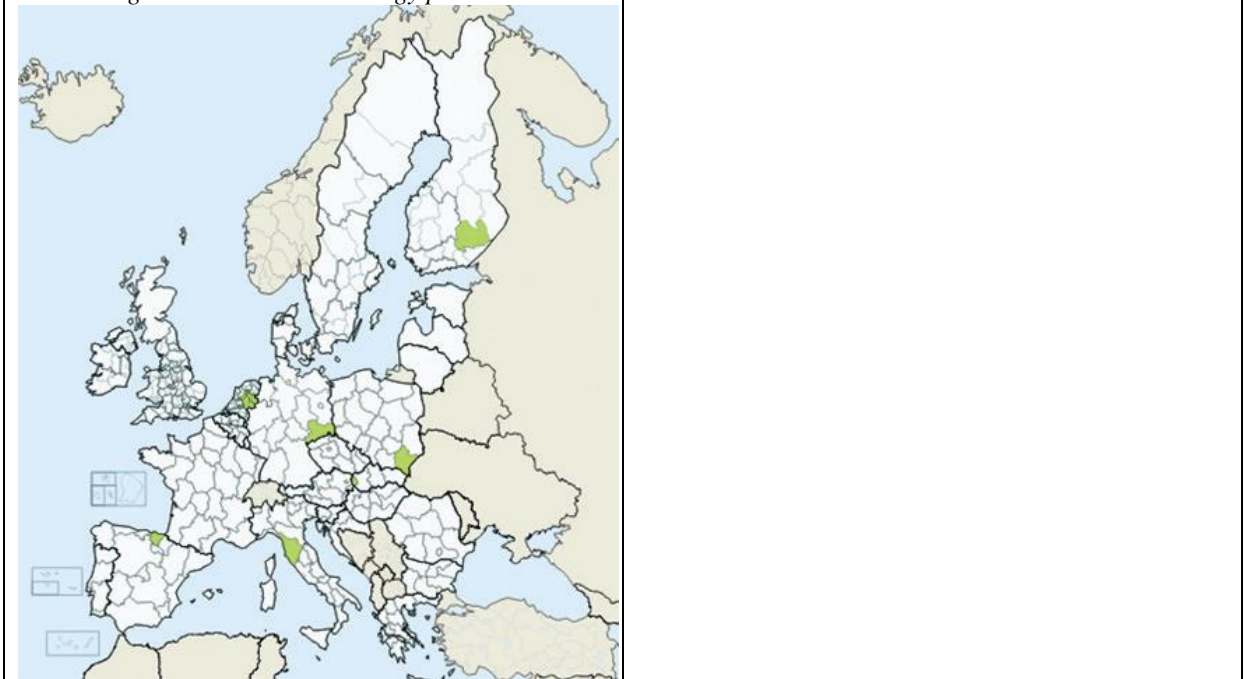
Source: reproduced from European Commission (2015a)

**Figure 2.9 Distribution of KETs-related priorities (2015)**



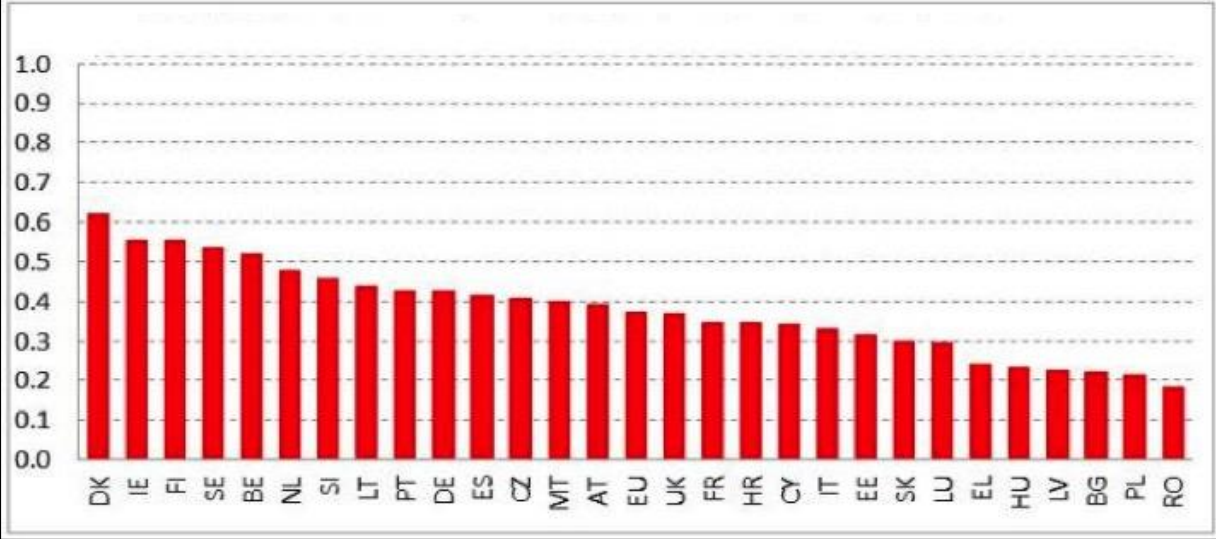


*Regions with Nanotechnology priorities*



*Source: reproduced from High-Level Expert Group on Key Enabling Technologies (2015)*

**Figure 2.10 Integration of digital technology by businesses (2017)**



Source: reproduced from European Commission (2017a)

## Annex II. Methodology

The figures presented in Chapter 1 and Chapter 2 were mainly collected and constructed from the regional statistics by NUTS classification dataset provided by Eurostat. Table A.1 presents the data sources for all Figures included in Chapter 1 and Chapter 2.

The thematic maps are based on the GISCO - the Geographic Information System of the Commission - NUTS 2013 data provided by Eurostat geodata portal<sup>186</sup>. The choice to represent geographical data by means of statistical maps has been made to focus on the location concept which best represent the relevance and geographical patterns. In most cases, observations – whether they are NUTS2 or NUTS1 units - or European countries - if regional data were not available - are grouped into five classes, which represent the unweighted quintiles for that specific distribution of interest. By doing so, no subjective judgment in defining groups and classifying observations was taken, so that each group includes twenty percent of the available observations for that specific measure.

Whenever we refer to industry, the NACE revision 2 sectors from B to E are included; therefore a narrow definition is adopted, which actually is ‘Industry excluding construction’. With respect to Services we only include the NACE revision 2 sectors from G to N, the ones belonging to business economy, excluding the public sector. See Table A.2 for the broad structure of NACE Rev. 2 classification.

Eurostat uses the aggregation of the manufacturing sectors according to their technological intensity and based on NACE Rev. 2 at 2-digit level for compiling aggregates related to high-technology, medium-high-technology, medium-low-technology and low-technology, as shown in Table A.3.. Following a similar approach as for manufacturing, Eurostat classifies Services as knowledge-intensive services (KIS) or as less knowledge-intensive services (LKIS), where each is sub-divided in further sub-sectors (see table A.4), as we do in Chapter 3.

Important information used for Chapter 2, Chapter 3 and the regional experiences in Boxes 4.1-4.5 contained in Chapter 4, derive from consultation with the following academics and experts:

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<sup>186</sup> We acknowledge EUROSTAT and GISCO - the Geographic Information System of the Commission – for the usage of the geographical data, © EuroGeographics for the administrative boundaries.

- Mr Grzegorz Drozd (European Commission, DG for Internal Market, Industry, Entrepreneurship and SMEs, F/1 Innovation Policy and Investment for Growth), consulted in relation to the industries of the future, key challenges for LRAs and the role of the RIS3 strategy;
- Prof. Marco Cucculelli (Marche Polytechnic University, IT), consulted in relation to the industries of the future;
- Prof. Pietro Alessandrini (Marche Polytechnic University, IT), consulted in relation to the key challenges for LRAs;
- Prof. David Bailey (Aston University, UK), consulted in relation to the industries of the future with a focus on automotive sector and reshoring;
- Ms Katharina Wolf, consulted in relation to the regional case of Saxony (Box 4.2), key challenges for LRAs and industries of the future;
- Ms Aurelie Petillon, consulted in relation to the regional case of Nord-Pas-de-Calais (Box 4.3 and 4.4) and key challenges for LRAs promoting bioeconomy;
- Mr Maciej Grodzicki, consulted in relation to the regional case of Podkarpackie Voivodeship (Box 4.1) and key challenges for eastern industrial regions;
- Mr Allan Nordby Ottesen, consulted in relation to the regional case of Southern Denmark (Box 4.5), key challenges for LRAs and industries of the future.

**Table A.1: Figures and data sources**

<b>Title</b>	<b>Description</b>	<b>Source</b>
Figure 1.1: Industry share of total value added by region, (% , 2013)	Gross value added at basic prices, ratio of regional industry to regional total	Eurostat (nama_10r_3gva)
Figure 1.2: Regional industry share of total European industrial value added, (% , 2013)	Gross value added at basic prices, ratio of regional industry to European industry	Eurostat (nama_10r_3gva)
Figure 1.3: Industry value added growth (by region, % yearly average change, 2002-2014), left side. Industry value added average yearly growth 2008-2014 vs. industry value added share in 2008, right side	Gross value added at basic prices; yearly growth for industry averaged for the period 2002-2014 (left panel) and 2008-2014 (right panel), regions from BE missing 2002 and 2003 data, regions from AT, CZ, DE, EL, FI, FR, HR, IE, IT, LT, LV, NL, PL, PT, RO and SE missing 2014 data	Eurostat (nama_10r_3gva)



<p>Figure 1.4: Industry and services value added (by region, % yearly change 2002-2014)</p>	<p>Gross value added at basic prices; yearly growth for industry and services averaged for the period 2002-2014, regions from BE missing 2002 and 2003 data, regions from AT, CZ, DE, EL, FI, FR, HR, IE, IT, LT, LV, NL, PL, PT, RO and SE missing 2014 data</p>	<p>Eurostat (nama_10r_3gva)</p>
<p>Figure 1.5: Net business population growth in industry, (% 2012-2014), left side; average size of newly born enterprises, industry (2011-2014)</p>	<p>Left side: average yearly net business population growth (number of enterprise births - number of enterprise deaths / number of active enterprises), regions from AT, DK, HR and LT missing 2014 data, regions from PT missing 2012 data, regions from CZ missing 2012 and 2013 data; Right side: average size of active enterprises (number of persons employed in the reference period (t) divided by the number of active enterprises in t), regions from AT, DK, HR and LT and PT15, PT17 and PT20 missing 2014 data, regions from CZ and PT missing 2012 and 2011 data, regions from FI missing 2011 data. Missing data in both panels for regions from BE, CY, DE, EE, EL, FR, IE, LU, LV, MT, NL, PL, SE, SI and UK</p>	<p>Eurostat (bd_hgnace2_r3)</p>
<p>Figure 1.8: Foreign controlled manufacturing firms value added at factor cost, over total manufacturing firms value added (% 2014), left side. Foreign controlled manufacturing firms value added at factor cost yearly average change (% 2008-2014), right side.</p>	<p>Value added at factor cost for manufacturing firms (sector C NACE rev. 2). Left panel: share of total manufacturing firms value added for 2014, 2013 for BE and FI, 2012 for IE, 2008 for MT. Right panel: yearly average change for period 2008-2014, except BE 2010-2013, CY 2008-2010 and 2013-2014, EL 2012-2014, FI 2008-2013, HR 2010-2014, IE 2008-2012, LU 2010-2014, MT 2008-2010.</p>	<p>Eurostat (fats_g1a_08)</p>
<p>Figure 1.9: Employment rate of active population, in the 20-64 age group, (% 2015)</p>	<p>Employed people to active population ratio for people aged between 20 and 64 years</p>	<p>Eurostat (lfst_r_lfe2emprr)</p>
<p>Figure 1.10: Regional Competitiveness Index, 2013</p>	<p>The RCI is an overall composite index of competitiveness by weighting and aggregating eleven dimensions (or pillars), 2013. Missing data for AT12, AT13, BE10, BE24, BE31, CZ01, CZ02, DE30, DE40, DED4, DED5, FI1B, NL23, NL32, SI03, SI04, UKD6, UKD7, UKH2, UKH3, UKI3, UKI4, UKI5, UKI6, UKI7</p>	<p>European Commission (Joint Research Centre and Directorate-General for Regional and Urban Policy), European Commission (2013b)</p>

<p>Figure 1.11: Infrastructure pillar, Regional Competitiveness Index 2013</p>	<p>Third dimension or Infrastructure pillar from the RCI, 2013. Missing data for AT12, AT13, BE10, BE24, BE31, CZ01, CZ02, DE30, DE40, DED4, DED5, FI1B, NL23, NL32, SI03, SI04, UKD6, UKD7, UKH2, UKH3, UKI3, UKI4, UKI5, UKI6, UKI7</p>	<p>European Commission (Joint Research Centre and Directorate-General for Regional and Urban Policy), European Commission (2013b)</p>
<p>Figure 1.12: Employment rate of active population in the 20-64 age group (%, 2015)</p>	<p>Employed people to active population ratio for people aged between 20 and 64 years</p>	<p>Eurostat (lfst_r_lfe2emprt)</p>
<p>Figure 1.13: Employment in industry, share of total employment, (%, 2015), left side. Employment in industry, yearly average change (%, 2008-2014), right side</p>	<p>Employed people in industry. Left panel: missing data for ES63, ES64, FI20, FR83. Right panel: missing data for EL51, EL52, EL53, EL54, EL61, EL62, EL63, EL64, EL65, ES63, ES64, FI20, FR83, SI03, SI04, UKI3, UKI4, UKI5, UKI6 and UKI7</p>	<p>Eurostat (lfst_r_lfe2en2)</p>
<p>Figure 1.14: Manufacturing employment share of sectors by technology- intensity</p>	<p>Thematic map by manufacturing employment share of total employment for NUTS1 regions, missing data for FI2 and PT3; pie charts for employment by technological classification of manufacturing activities, missing data for PT2</p>	<p>Eurostat (htec_emp_reg2)</p>
<p>Figure 1.15: Participation rate in education and training (2015), left side. Participation rates in tertiary education (2015), right side</p>	<p>Left panel: people participating in education and training from labour force surveys (last four weeks), missing data for BG31, EL41 and FRA5. Right panel: people enrolled in education levels from 5 to 8, International Standard Classification of Education (ISCED 2011), 2014 for regions from BE, CZ, EE, EL, HR, IT and SE, NUTS1 regions for DE and UK, missing data for LU00</p>	<p>Eurostat (trng_lfse_04 and educ_uoe_enra15)</p>
<p>Figure 1.16: NEET rate for young people aged 15-24, 2015, left side. Vocational programmes share in upper secondary education, 2015 or most recent data (NUTS1 for DE and UK), right side</p>	<p>Left panel: people aged 15-24 not employed and not in education or training from labour force surveys (last four weeks). Right panel: people in education level 35 (ISCED 2011), NUTS1 regions for DE and UK, 2014 for regions from BE, CY, CZ, EE, EL, HR, IT, LU and SE, 2013 for regions from IE</p>	<p>Eurostat (edat_lfse_22 and educ_uoe_enra13)</p>

<p>Figure 1.17: Foreign country total immigrants share (2011), left side. EU-countries immigrants share, (2011), right side.</p>	<p>Immigrants to total population ratio, census data. Left panel: total immigrants, missing data for EL, SI, UKI3, UKI4, UKI5, UKI6 and UKI7. Right panel: immigrants from other European countries, missing data for EL, SI, UKI3, UKI4, UKI5, UKI6 and UKI7</p>	<p>Eurostat (cens_11ctzo_r2)</p>
<p>Figure 1.18: Yearly employee compensation, Industry, Euro thousands, 2013</p>	<p>Total gross yearly wages in industry divided by people employed in industry from national accounts, 2012 for regions from FR and UK, missing data for CY00, HR03, HR04, UKI3, UKI4, UKI5, UKI6 and UKI7</p>	<p>Eurostat (nama_10r_2coe and nama_10r_3empers)</p>
<p>Figure 1.19: Labour productivity, industry, Euro, 2013</p>	<p>Gross value added at basic prices for industry, divided by the total hours worked by employed people in industry, from national accounts, 2012 for FR, missing data for regions from BE, CY, EE and HR</p>	<p>Eurostat (nama_10r_3gva and nama_10r_2emhrw)</p>
<p>Figure 1.20: Labour productivity, industry, Euro, average yearly change, %, 2001-2013</p>	<p>Average yearly percentage change of gross value added at basic prices for industry, divided by the total hours worked by employed people in industry, from national accounts, missing data for regions from BE, CY, EE, HR and SE</p>	<p>Eurostat (nama_10r_3gva and nama_10r_2emhrw)</p>
<p>Figure 1.21: Labour productivity vs. Yearly employee compensation, Industry, yearly average change, %, 2001-2013</p>	<p>Average yearly percentage change of gross value added at basic prices for industry, divided by the total hours worked by employed people in industry, and average yearly percentage change of Total gross yearly wages in industry divided by people employed in industry from national accounts, missing data for regions from BE, CY, EE, HR, SE and London's regions for UK</p>	<p>Eurostat (nama_10r_3gva, nama_10r_2emhrw, nama_10r_2coe and nama_10r_3empers)</p>
<p>Figure 1.24: Total R&amp;D expenditure (GERD), % of GDP, average 2005-2014, left side. Business enterprise sector R&amp;D expenditure (GERD), % of GDP, average 2005-2014, right side.</p>	<p>The Research and Development expenditures data are collected through sample or census surveys, from administrative registers or through a combination of sources. Left panel: R&amp;D from all the institutional sectors (business enterprise, government, higher education, and private non-profit), missing data for DE22, DE23, UKI3, UKI4, UKI5, UKI6 and UKI7. Right panel: R&amp;D from the business enterprise sector only, missing data for regions from BE</p>	<p>Eurostat (rd_e_gerdreg)</p>

<p>Figure 1.25: SMEs introducing product or process innovations as percentage % of SMEs, left side. SMEs introducing marketing or organisational innovations as percentage % of SMEs, right side.</p>	<p>Number of Small-Medium Enterprises innovating products and processes or marketing and organisation, 2012 or most recent year. NUTS1 regions for AT, BE, BG, FR and UK, missing data for CY, EE, LT, LU, LV and MT</p>	<p>Eurostat, Community Innovation Survey</p>
<p>Figure 2.1: Patents applications to EPO, per million inhabitants, 2002-2013</p>	<p>Based on the International Patent Classification (IPC). High-Tech includes: Computer and automated business equipment; micro-organism and genetic engineering; aviation; communications technology; semiconductors; lasers. Regions with missing averaged data: EL41 EL51 EL52 EL53 EL54 EL61 EL62 EL63 EL64 EL65 ES63 ES64 SI03 SI04 UKI3 UKI4 UKI5 UKI6 UKI7. There are four ICT groups: Telecommunications, Consumer electronics, Computers, office machinery and other ICT. Regions with missing averaged data: EL41 EL51 EL52 EL53 EL54 EL61 EL62 EL63 EL64 EL65 ES63 ES64 SI03 SI04 UKI3 UKI4 UKI5 UKI6 UKI7. Biotechnology relates to IPS sectors belonging to: Biogenetics, Medicine and analysing materials. Regions with missing averaged data: BG31 BG33 BG34 EL41 EL51 EL52 EL53 EL54 EL61 EL62 EL63 EL64 EL65 ES63 ES64 FI20 HR03 ITC2 PT20 RO21 RO22 RO41 RO42 SI03 SI04 UKI3 UKI4 UKI5 UKI6 UKI7.</p>	<p>Eurostat (pat_ep_rtec, pat_ep_rict, pat_ep_rbio)</p>
<p>Figure 2.2: Persons with tertiary education (ISCED) and employed in science and technology, Percentage of active population</p>	<p>ISCED levels 5 and above. Active population is the sum of employed and unemployed people. Average yearly change as the mean value for the yearly growth rates.</p>	<p>Eurostat (hrst_st_rcat)</p>
<p>Figure 2.3: Scientists and engineers, Percentage of active population</p>	<p>Sub-group of Persons employed in science and technology: individuals employed as Science and engineering professionals (ISCO-08 COM code 21); Health professionals (ISCO-08 COM code 22); or Information and communications technology professionals (ISCO-08 COM code 25). Missing 2015 data for FI20 and FR83.</p>	<p>Eurostat (hrst_st_rcat)</p>

Figure 2.4: High and medium high-technology manufacturing, Percentage of total employment, average yearly change (%), 2008-2015	Average yearly percentage change of manufacturing employment shares by technological classification of manufacturing activities, 2008-2015, missing data for EL41, EL42, EL43, EL53, EL54, EL62, ES63, ES64, FI20, FR83, ITC2 and PT15	Eurostat (htec_emp_reg2)
Figure 2.5: Knowledge-intensive services, average yearly change, %, 2008-2015	Average yearly percentage change of services employment shares by knowledge intensity classification of services activities, 2008-2015, missing data for AT34, DEB2, EL41, EL53, EL54, EL61, EL62, EL64, FI20, FR21, FR43, FR63, FR83, ITC2, ITF2, PL43, PL52, PT15, PT18, UKD1 and UKM6	Eurostat (htec_emp_reg2)

**Table A.2 - Broad Structure of NACE Rev. 2**

<b>Section</b>	<b>Title</b>	<b>Divisions</b>
A	Agriculture, forestry and fishing	01 – 03
B	Mining and quarrying	05 – 09
C	Manufacturing	10 – 33
D	Electricity, gas, steam and air conditioning supply	35
E	Water supply; sewerage, waste management and remediation activities	36 – 39
F	Construction	41 – 43
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	45 – 47
H	Transportation and storage	49 – 53
I	Accommodation and food service activities	55 – 56
J	Information and communication	58 – 63
K	Financial and insurance activities	64 – 66
L	Real estate activities	68
M	Professional, scientific and technical activities	69 – 75
N	Administrative and support service activities	77 – 82
O	Public administration and defence; compulsory social security	84
P	Education	85
Q	Human health and social work activities	86 – 88
R	Arts, entertainment and recreation	90 – 93
S	Other service activities	94 – 96

T	Activities of households as employers; undifferentiated goods-and services-producing activities of households for own use	97 – 98
U	Activities of extraterritorial organisations and bodies	99

**Table A.3 – Manufacturing by its technological content**

<b>Manufacturing Industries</b>	<b>NACE Rev. 2 codes – 2-digit level</b>	
High-technology	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
	26	Manufacture of computer, electronic and optical products
Medium-high-technology	20	Manufacture of chemicals and chemical products
	27 to 30	Manufacture of electrical equipment; Manufacture of machinery and equipment n.e.c.; Manufacture of motor vehicles, trailers and semi-trailers; Manufacture of other transport equipment
Medium-low-technology	19	Manufacture of coke and refined petroleum products
	22 to 25	Manufacture of rubber and plastic products; Manufacture of other non-metallic mineral products; Manufacture of basic metals; Manufacture of fabricated metals products, excepts machinery and equipment
	33	Repair and installation of machinery and equipment
Low technology	10 to 18	Manufacture of food products, beverages, tobacco products, textile, wearing apparel, leather and related products, wood and of products of wood, paper and paper products, printing and reproduction of recorded media
	31 to 32	Manufacture of furniture; Other manufacturing

**Table A.4 – Services aggregation according to their knowledge intensity**

<b>Knowledge-based services</b>	<b>NACE Rev. 2 codes – 2-digit level</b>	
Knowledge-intensive market services (excluding high-tech and financial services)	50 to 51	Water transport; Air transport
	69 to 71	Legal and accounting activities; Activities of head offices, management consultancy activities; Architectural and engineering activities, technical testing and analysis
	73 to 74	Advertising and market research; Other professional, scientific and technical activities

	78	Employment activities
	80	Security and investigation activities
High-tech knowledge-intensive services	59 to 63	Motion picture, video and television programme production, sound recording and music publish activities; Programming and broadcasting activities; Telecommunications; computer programming, consultancy and related activities; Information service activities
	72	Scientific research and development
Less knowledge-intensive market services	45 to 47	Wholesale and retail trade; Repair of motor vehicles and motorcycles (section G)
	49	Land transport and transport via pipelines
	52	Warehousing and support activities for transportation;
	55 to 56	Accommodation and food service activities (section I);
	68	Real estate activities (section L);
	77	Rental and leasing activities;
	79	Travel agency, tour operator reservation service and related activities;
	81	Services to buildings and landscape activities;
	82	Office administrative, office support and other business support activities;
95	Repair of computers and personal and household goods;	





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# **Annex IV. Main findings, recommendations and policy options (Power Point presentation)**



## ***Key challenges for European industry and their territorial implications***



### *Which approach?*

- There is no one-size-fits-all approach;
- Developing an industrial policy pulled by vision and pushed by competition.

### *Path renewal...?*

- Weak strategic co-operation with the private sector;
- Scarce emphasis on the needs of smaller enterprises to favour existing technology transfer;
- Presence of institutional legacy and ossified networks.

### *...or path formation/creation?*

- Higher costs, higher risks and give rise to destructive competition;
- Need for greater investments and policy initiative efforts;
- Weak absorptive capacity;
- Research and educational organisations strongly linked to the old industrial specialisation;
- Weak long-term perspective and willingness to take risks within the political system.

## ***Key challenges for European industry and their territorial implications***



### *What dampens industrial enterprise efficiency in the use of inputs?*

- Lack of investment in R&D;
- Weak education and training system;
- Brain-drain of skilled workers;
- Weak incentives to take on higher-skilled workers;
- Lack of absorption capacity for regions that lag behind in terms of innovation capacity;
- Weak willingness to jointly address diverse responsibilities.

### *Are industrial enterprises globally connected?*

- Weak capacity to reach new fast growing markets outside the EU
- Weak economic and institutional environment to attract FDI;
- large financial investments required for SMEs to participate in international markets;
- Complicated or costly foreign taxation or cross-border complaints and disputes;
- Limited use of e-commerce and scarce information about the potential export market;
- Reshoring or offshoring?

## ***Key challenges for European industry and their territorial implications***



*Are institutional capabilities adapted to new industrial challenges?*

- Lack of comprehensive and coordinated strategy;
- Weak attitude to look at industry not as a source of mass employment in traditional production work, but as a critical driver of innovation, productivity and competitiveness;
- High regulatory barriers that dampen entrepreneurial initiatives;
- High fragmentation of policy initiatives;
- Weak accountability and transparency mechanisms.

## ***Conclusions and recommendations***



- **Establishing a close and strategic co-operation with a private sector** that is rapidly evolving towards more 'hybrid' models of production, is less place-based and is surrounded by increasingly complex market dynamics;
- Adopt **descriptive and predictive analytical techniques to better understand and forecast the dynamics of local industrial sectors** and use European Commission or OECD indicators for benchmarking and comparison;
- **Enhancing cooperation networks** that include local institutions, enterprises and institutes of higher education is essential;
- Incentivising not only the production of **knowledge**, but also its **transfer to enterprises and its application to production process**;
- **Increasing the use of financial instruments** instead of grants to deliver public financial support to ensure that better quality projects are supported;

## *Conclusions and recommendations*



- **Diversifying and ‘rebranding’** the local economy strategically;
- Favouring local enterprise **connections with international markets**, either as a source of new investment (outward and inward) and new consumers;
- Encouraging the **exploitation of clusters** to generate new synergies and integration mechanisms with services activities;
- Establishing **coordinated projects and initiatives with other EU regions**;
- **Avoiding overlapping actions** as well as fragmentation, so each initiative has a specific industrial focus and targeted beneficiaries;
- **Stimulating customers to change behaviours and habits**, moving towards products with particular prerequisites.