

Science and technology

11





This chapter presents statistical information that illustrates regional developments for science and technology indicators within the [European Union \(EU\)](#). The domains covered are [research and development \(R & D\)](#), the number of [researchers](#), [human resources in science and technology \(HRST\)](#), employment in [high technology](#) sectors and [patent applications](#).

Main statistical findings

Research and development intensity

Intramural R & D expenditure (GERD) amounted to EUR 256.6 billion across the EU-27 in 2011; this equated to an average of EUR 511 per inhabitant. A decade before, in 2001, R & D expenditure per inhabitant had stood at EUR 370 per inhabitant. There was a steady increase in expenditure per inhabitant during the last decade, aside from a minor contraction in 2009 (which may be linked to lower levels of activity during the financial and economic crisis).

The EU-27 had an R & D intensity of 2.03 % in 2011, in other words expenditure on R & D was equivalent to 2.03 % of gross domestic product (GDP). In the period between 2001 and 2007 there was little change in the EU-27's R & D intensity, as the level of expenditure in relation to GDP lay within a relatively restricted range from a low of 1.82 % to a high of 1.88 %. There followed successive increases, as R & D intensity rose from 1.85 % in 2007 to 1.92 % in 2008 and by a further 0.1 percentage points in 2009 (to reach 2.02 %). Thereafter, there was another period of relative stability as the EU-27's R & D intensity was 2.01 % in 2010 and 2.03 % in 2011.

Map 11.1 shows that 30 of the 260 EU regions for which data are available had an R & D intensity above 3.00 % in 2010. As such, they exceeded the 3 % target set by the Barcelona Council in 2002 and met the objectives of the [Europe 2020](#) strategy. Among these 30 regions, 10 were in Germany, five in the United Kingdom, four in Sweden, three in Denmark and two each in Belgium, France, Austria and Finland. Together, these 30 regions accounted for 38.4 % of all R & D expenditure in the EU-27. Figure 11.1 summarises some information about these R & D-intensive regions. As can be seen, national R & D intensities (shown by the size of the bubbles) were highest among the Nordic countries and these also had the most widespread R & D-intensive regions in that a large proportion of their regions had an R & D intensity above 3.00 % (note that data are only available for three out of five Finnish regions).

The German R & D-intensive regions included a cluster of regions in south-western and south-eastern Germany: [Rhein-hessen-Pfalz](#), [Stuttgart](#), [Karlsruhe](#), [Tübingen](#), [Oberbayern](#), [Mittelfranken](#) and [Darmstadt](#). These regions were also very important in absolute terms (as measured by their level of

R & D expenditure, rather than their R & D intensity), as together they accounted for 13.4 % of all R & D expenditure in the EU-27 in 2009. The other German regions with R & D intensity above 3.00 %, from west to east, were [Braunschweig](#) (with an R & D intensity of 7.99 % — the highest value in the EU-27), [Berlin](#) and [Dresden](#); these three regions together contributed 3.4 % to total R & D expenditure in the EU-27.

The most R & D-intensive region in the United Kingdom in 2009 was [East Anglia](#) (5.57 % — this region includes the area around [Cambridge](#), which has a science park that benefits from close ties with the nearby university). The other R & D-intensive regions (with intensity above 3.00 %) were also in southern England and together these five British regions contributed 4.1 % to total R & D expenditure in the EU-27 in 2009.

Nine of the regions where R & D intensity was over 3 % were located in the [Nordic Member States](#), where the highest R & D intensity was 5.31 % in the Danish capital city region of [Hovedstaden](#). The three Danish and four Swedish regions with R & D intensity above 3.00 % collectively contributed 6.5 % to total R & D expenditure in the EU-27 in 2009 while the two Finnish regions contributed 1.2 % in 2010.

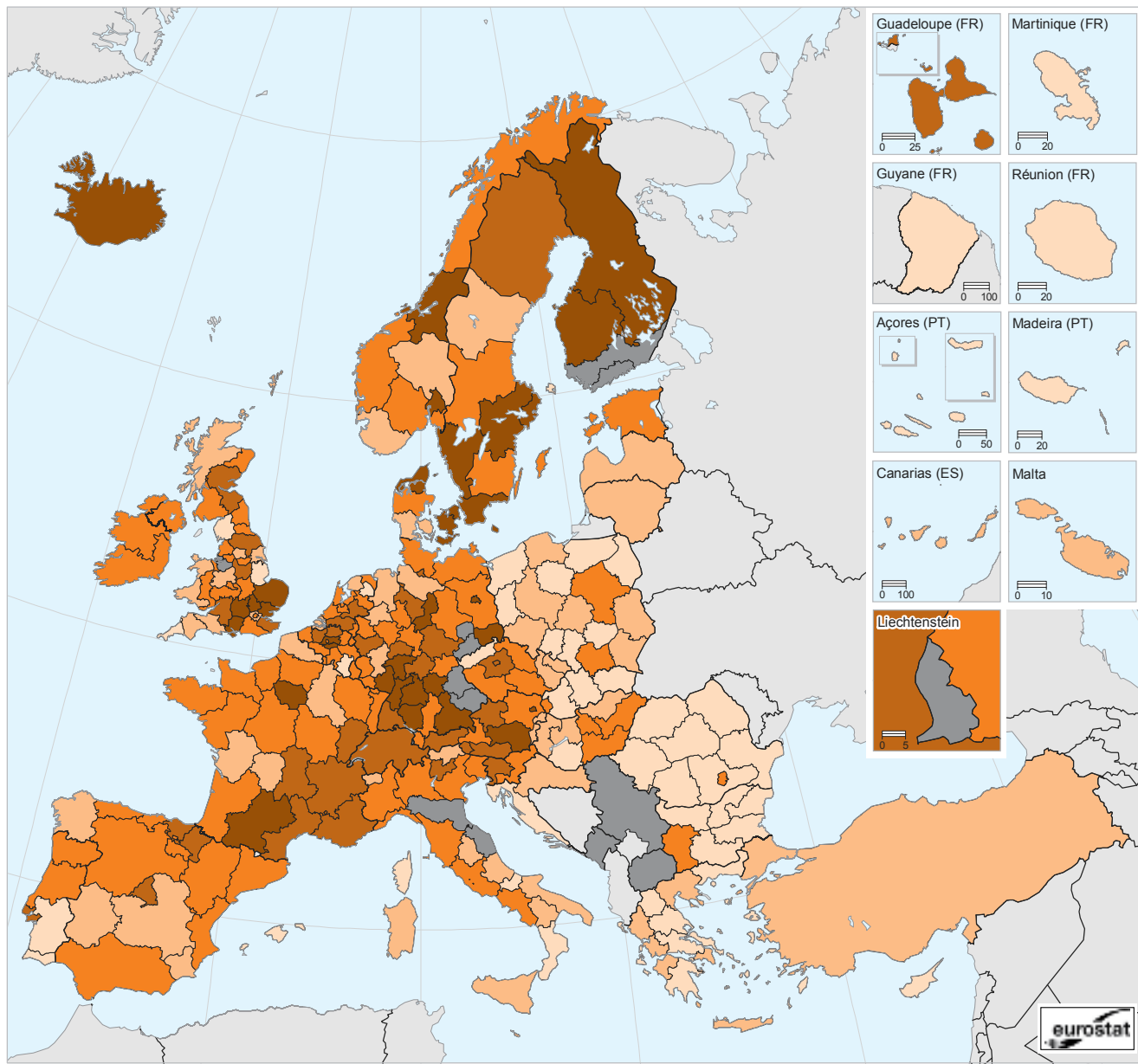
The two Belgian regions with relatively high R & D intensity in 2009 were the [Province/Provincie du Brabant Wallon](#), which was the second most R & D-intensive region in the EU (7.66 % of GDP), and the neighbouring [Province/Provincie Vlaams-Brabant](#) (3.56 %). As well as a large industrial area around the Belgian capital, these regions include the university towns of [Louvain-la-Neuve](#) (which has a science park) and [Leuven](#). In France, the highest R & D intensity in 2009 was recorded in the [Midi-Pyrénées](#) region (4.40 %); this area includes a cluster of R & D-intensive enterprises related to aerospace manufacturing, centred on [Toulouse](#). The second highest R & D intensity in France was recorded in the capital city region of [Île de France](#) (3.02 %). The overall level of R & D expenditure in these two regions was high, particularly in the [Île de France](#), which recorded by far the highest level of R & D expenditure among any of the [NUTS](#) level 2 regions in the EU; it alone contributed 7.1 % to total R & D expenditure in the EU-27 in 2009, and together with the region of [Midi-Pyrénées](#) the share of these two regions was 8.5%. In Austria, the most R & D-intensive regions were [Wien](#) (3.93 %) and [Steiermark](#) (3.87 %), contributing 1.8 % to total R & D expenditure in the EU-27 in 2009.

Among [EFTA](#) countries, Norway had two regions where R & D intensity was above 3.00 % while Iceland had one; no regional data are available for Switzerland where the national rate was 2.87 % in 2008.

Turkey (no regional data available) had an R & D intensity of 0.84 % in 2010, while the Croatian region of [Kontinentalna Hrvatska](#) had an R & D intensity of 0.99 %, far above the intensity recorded for the other Croatian region of [Jadranska Hrvatska](#) (0.24 %).

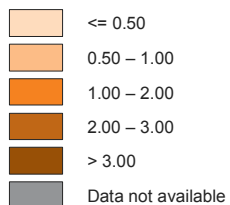


Map 11.1: R & D intensity, by NUTS 2 regions, 2010 ⁽¹⁾
 (total R & D expenditure as a % of GDP)

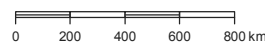


(total R & D expenditure as a % of GDP)

EU-27 = 2.01

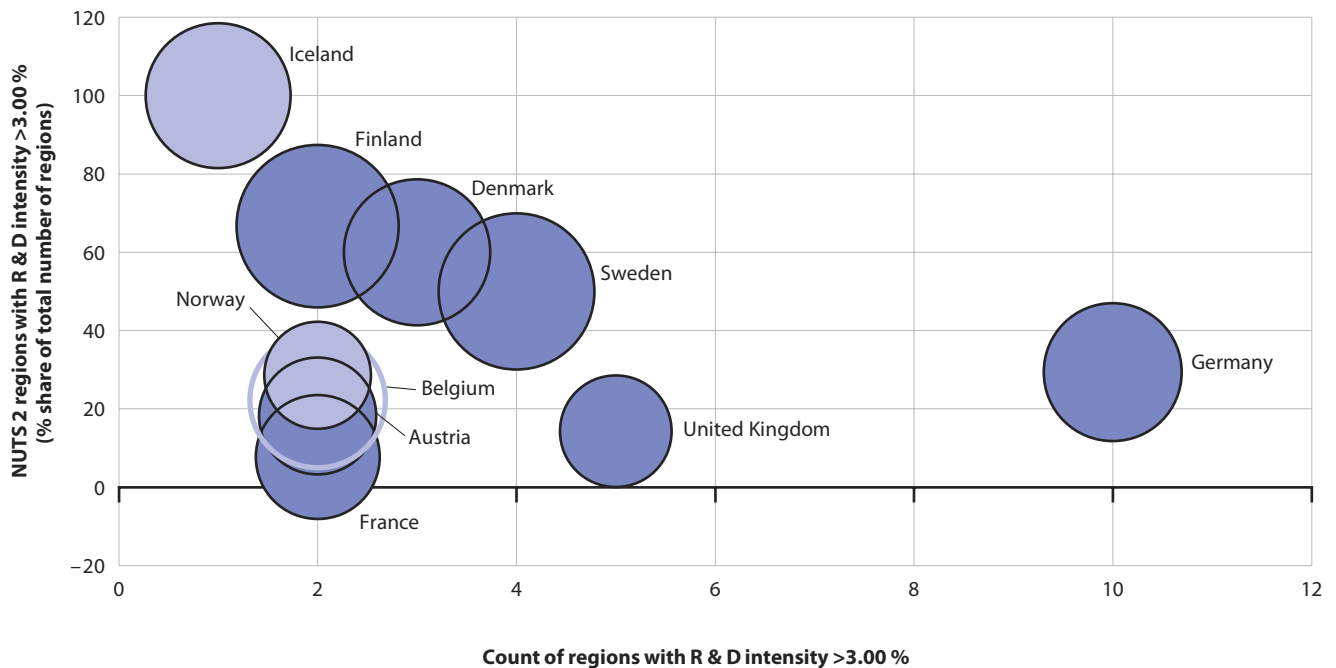


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⁽¹⁾ Belgium, Denmark, Germany, France (except Martinique (FR92), Guyane (FR93) and Réunion (FR94)), the Netherlands, Austria, Sweden, the United Kingdom and Iceland, 2009; Switzerland, 2008; Greece, 2005; Martinique (FR92), Guyane (FR93) and Réunion (FR94), 2002; Switzerland and Turkey, national level.

Source: Eurostat (online data codes: [rd_e_gerdreg](#) and [nama_r_e2gdp](#))

Figure 11.1: Regions with R & D intensity greater than 3.00 %, by NUTS 2 regions, 2010 ⁽¹⁾

⁽¹⁾ The size of the bubble reflects national R & D intensity; countries that are not shown do not have any regions with R & D intensity greater than 3.00 %; Belgium, Denmark, Germany, France (except Martinique (FR92), Guyane (FR93) and Réunion (FR94)), the Netherlands, Austria, Sweden, the United Kingdom and Iceland, 2009; Switzerland, 2008; Greece, 2005; Martinique (FR92), Guyane (FR93) and Réunion (FR94), 2002; Niederbayern (DE22), Oberpfalz (DE23), Chemnitz (DED4), Leipzig (DED5), Emilia-Romagna (ITH5), Marche (ITI3), Helsinki-Uusimaa (FI1B), Etelä-Suomi (FI1C), Cheshire (UKD6) and Merseyside (UKD7), not available.
 Source: Eurostat (online data codes: [rd_e_gerdreg](#), [nama_r_e2gdp](#) and [rd_e_gerdtot](#))

Figure 11.2 summarises the spread of R & D intensities among the regions within each country. The highest and lowest regional R & D intensities are shown by the ends of each bar, while the vertical line within each bar provides information on the national average and the green circles present the level of R & D intensity for each capital city region.

As noted above, the two regions with the highest levels of R & D intensity were located in Germany (Braunschweig) and in Belgium (Province/Provincie du Brabant Wallon). This may explain, at least in part, why these two countries recorded the widest range of regional R & D intensities. Furthermore, the highest regional levels of R & D intensity in Germany and Belgium were between 5 and 6 percentage points above their respective national averages and their highest regional levels of R & D intensity were also considerably above the R & D intensity of each capital city region; this pattern was also true in the United Kingdom and, to a lesser degree, in the Czech Republic, Ireland, Greece, France, Italy, the Netherlands and Sweden.

Those EU Member States with relatively low levels of national R & D intensity tended to display a narrow range of values for R & D intensity across their regions; this was particularly true for Romania, Bulgaria, Greece, Slovakia and Ireland. In half of the 20 EU Member States for which data are available, the capital city region recorded the highest level

of R & D intensity; this was the case for Bulgaria, Denmark, Spain, Hungary, Austria, Poland, Portugal, Romania, Slovenia and Slovakia.

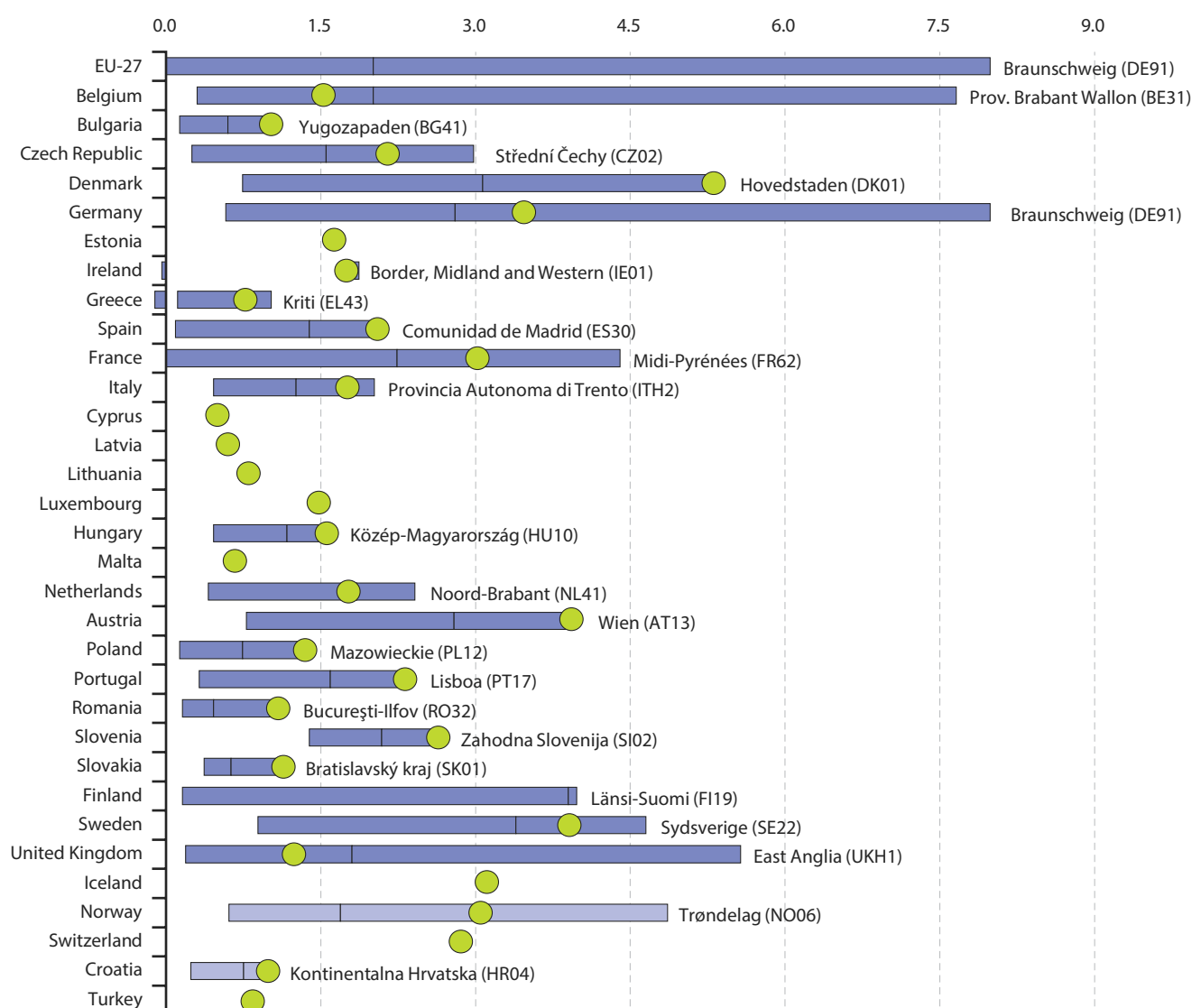
Researchers

Researchers are directly employed within R & D activities and are defined as 'professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and in the management of the projects concerned'. There were an estimated 2.32 million researchers active across the EU-27 in 2009. Their number has grown at a steady pace in recent years, rising from 1.79 million in 2003, with an average rate of growth equal to 4.4 % per year between 2003 and 2009.

An alternative unit of measure for labour input adjusts the number of researchers to take account of different working hours and working patterns. Taking these into account, there were 1.59 million **full-time equivalent** researchers in the EU-27 in 2009.

Map 11.2 provides an overview of the regional distribution of the share of researchers in total employment (measured as a headcount); the EU-27 average was estimated to be 1.07 % in 2009. The regional information for this indicator is generally provided for 2010, although there are a number of exceptions to this rule, principally: Belgium, Denmark, Germany,

Figure 11.2: Regional disparities in R & D intensity, by NUTS 2 regions, 2010 ⁽¹⁾
(R & D expenditure as a % share of GDP)



⁽¹⁾ The graph shows the range from the highest to the lowest region for each country; the black vertical line is the average (mean); the green circular marker is the capital city (for those countries where there is no regional breakdown, the national average is used as the value for the capital region); the name of the region with the highest value is also included; Belgium, Denmark, Germany, France (except Martinique (FR92), Guyane (FR93) and Réunion (FR94)), the Netherlands, Austria, Sweden, the United Kingdom and Iceland, 2009; Switzerland, 2008; Greece, 2005; Martinique (FR92), Guyane (FR93) and Réunion (FR94), 2002; Niederbayern (DE22), Oberpfalz (DE23), Chemnitz (DED4), Leipzig (DED5), Emilia-Romagna (ITH5), Marche (ITI3), Helsinki-Uusimaa (FI1B), Etelä-Suomi (FI1C), Cheshire (UKD6) and Merseyside (UKD7), not available.

Source: Eurostat (online data codes: [rd_e_gerdreg](#) and [nama_r_e2gdp](#))

Luxembourg, the Netherlands, Austria, Sweden, the United Kingdom, Iceland and the former Yugoslav Republic of Macedonia, where the latest reference period is 2009; Switzerland, where the latest reference period is 2008; Greece, where the latest reference period is 2005; and France, where the latest reference period is 2001.

The distribution of researchers was relatively concentrated in a few clustered regions where research intensity was high. As a result, there was a skewed distribution with 170 of the 252 regions for which data are available reporting a share of researchers in total employment that was below the

EU-27 mean of 1.07%, while the median share across all NUTS level 2 regions was 0.77%.

This pattern could be seen in most of the EU Member States, with a small number of regions recording a relatively high share of researchers in total employment — often far above national averages. There were 20 NUTS level 2 regions in the EU where the share of researchers in total employment rose above 2.0%. The highest share was recorded in North Eastern Scotland (4.65%) and this was much higher than in the second ranked region, namely the Slovakian capital city region of Bratislavský kraj (3.73%).



Among the 20 regions with the highest proportion of researchers in total employment, Germany and the United Kingdom each provided four regions, Belgium had three, Denmark and Finland each had two, while there was a sole region from the Czech Republic, Austria, Portugal, Slovakia and Sweden. The majority of these countries were represented by their capital city region, as these accounted for 8 of the 20 regions, the only exceptions being Germany (where the proportion of researchers in total employment stood at 1.82% in Berlin) and Finland (where no data are available for Helsinki-Uusimaa).

At the other end of the range, researchers accounted for less than 0.5% of total employment in 65 NUTS level 2 regions across the EU. These regions were often on the geographic periphery in relatively under-populated areas, for example two regions at the extremities of the United Kingdom — the Highlands and Islands (of Scotland) and Cornwall and Isles of Scilly (in South-West England).

Among EFTA countries, researchers accounted for more than 2.0% of total employment in Iceland (data are for 2009) and the two Norwegian regions of Trøndelag and Oslo og Akershus (the capital city region) in 2010. The proportion of Swiss researchers in total employment was 1.08%, which was very close to the EU-27 average. By contrast, the relative importance of researchers was considerably lower in the [acceding and candidate countries](#) with a 0.88% and 0.65% share in the two Croatian regions of Kontinentalna Hrvatska and Jadranska Hrvatska, a 0.55% share in Turkey (only national level data available) and a 0.29% share for the former Yugoslav Republic of Macedonia.

Human resources in science and technology

Investment in research, development, education and skills are key policy areas for the EU, as they are widely considered essential to economic growth and to the development of a knowledge-based and so-called 'smarter' economy. This has led to an increased interest in the role and measurement of science and technology-related education or work. One way to measure the concentration of highly qualified people is to look at human resources in science and technology (HRST): the [stock of HRST](#) can be used as an indicator to determine how developed the knowledge-based economy is. HRST includes persons who have completed [tertiary education](#) (HRSTE) — for example university degrees — and/or are employed in a science and technology occupation (HRSTO); the subgroup of persons who meet both of these criteria are referred to as core HRST.

There were 44.3 million persons in the EU-27 considered as core HRST in 2011. Map 11.3 presents the ratio of core HRST to the economically active population (often referred to as the labour force). Some 18.4% of the EU-27 labour force were categorised as core HRST in 2011. There were 54 out of a total of

258 NUTS level 2 regions for which data are available across the EU where the share of core HRST exceeded 22%. The highest share, by some distance, was recorded for Inner London (41.3%), while the Province/Provincie du Brabant Walloon (Belgium), Luxembourg (covered by the whole country at NUTS level 2), Hovestaden (the capital city region of Denmark) and Stockholm (the capital city region of Sweden) were the only regions to report shares of between 30% and 40%.

Beyond a concentration in most capital city regions, there were also relatively high shares of core HRST in the labour force across a number of regions close to capital cities — for example Province/Provincie Vlaams-Brabant in Belgium, Brandenburg in Germany, Utrecht in the Netherlands, and Berkshire, Buckinghamshire and Oxfordshire in the United Kingdom. The remaining regions that displayed relatively high shares of core HRST were characterised as being largely urbanised, industrial areas — for example, Hamburg, Dresden, Karlsruhe and Stuttgart in Germany, and the País Vasco in Spain.

There were several clusters of regions with relatively high shares of core HRST in the labour force. These included a cluster running from southern Germany into Switzerland and up the Rhine, a cluster that stretched from Luxembourg through Belgium and into the west and north of the Netherlands, and a cluster that ran from south-west France into north-east Spain. More generally, most regions in the Nordic Member States reported a high proportion of core HRST in their labour force.

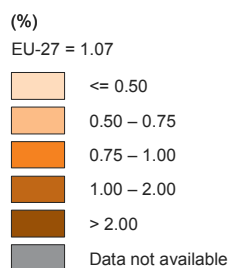
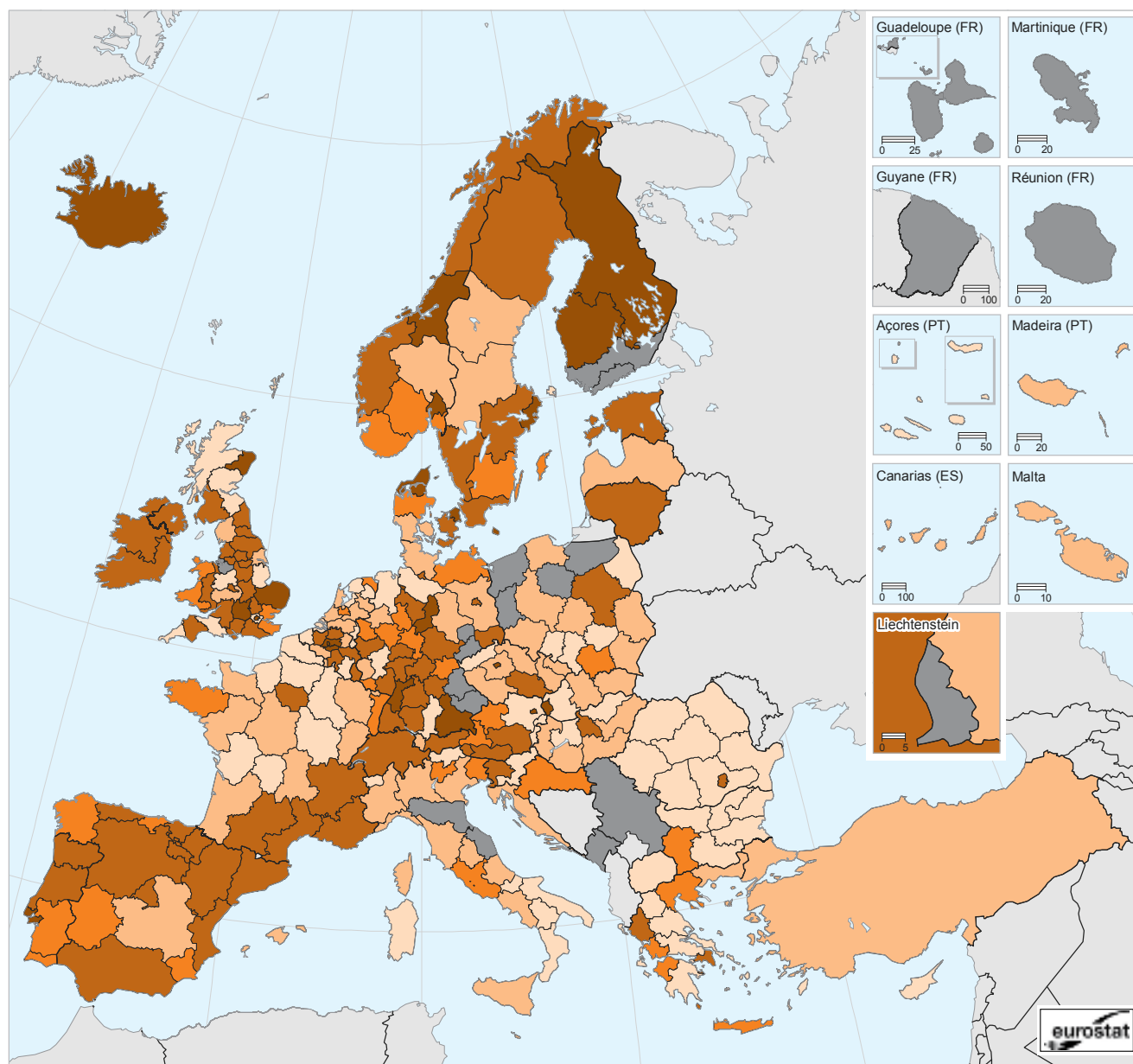
There were nine NUTS level 2 regions where the share of core HRST in the labour force was below 10%. These were widely distributed across southern and eastern Europe, ranging from the Portuguese islands of the Região Autónoma dos Açores, through the Ciudad Autónoma de Ceuta (Spain), to northern Italy (Valle d'Aosta/Vallée d'Aoste and Provincia Autonoma di Bolzano/Bozen), three regions in Romania (Nord-Est, Sud – Muntenia and Sud-Est) and finally the north-western Czech region of Severozápad.

Among the EFTA countries, the highest share of core HRST in the labour force was recorded in the Norwegian capital city region of Oslo og Akershus (34.6%), which was above that recorded in all of the EU-27 regions except for Inner London. Three other Norwegian regions and three Swiss regions recorded shares of core HRST above 22%, the highest being in the Swiss region of Zürich (27.1%).

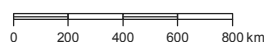
The importance of core HRST in relation to the labour force was lower than the EU-27 average across each of the acceding and candidate countries. The highest shares of core HRST were recorded in the Turkish capital region of Ankara (16.4%), while two Croatian regions of Jadranska Hrvatska and Kontinentalna Hrvatska, İzmir (Turkey) and the former Yugoslav Republic of Macedonia (one region at this level of the NUTS) were the only other regions to record shares in double-digits. The 24 remaining Turkish regions each reported shares of core HRST that were below 10%, falling to a low of 4.9% for the southern region of Gaziantep, Adiyaman, Kilis.



Map 11.2: Share of researchers in total persons employed, by NUTS 2 regions, 2010 ⁽¹⁾
(%)



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Cartography: Eurostat — GISCO, 05/2013

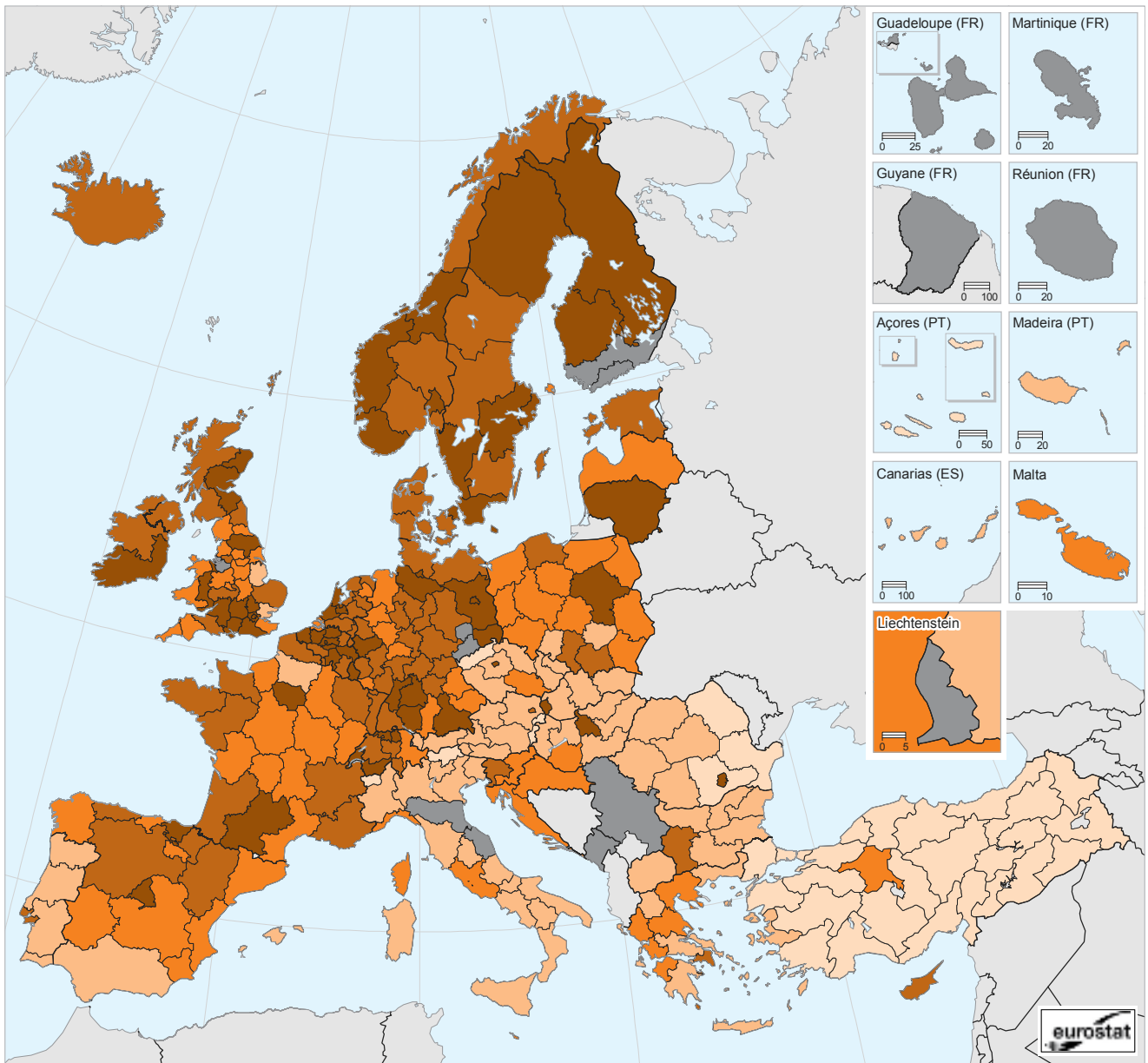


⁽¹⁾ EU-27, Belgium, Denmark, Germany, Luxembourg, the Netherlands, Austria, Sweden, the United Kingdom, Iceland and the former Yugoslav Republic of Macedonia, 2009; Switzerland, 2008; Greece, 2005; France, 2001; Switzerland and Turkey, national level; EU-27, Ireland, the Netherlands and the United Kingdom, estimates.

Source: Eurostat (online data code: [rd_p_persreg](#))

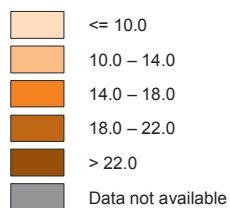


Map 11.3: Human resources in science and technology core (HRSTC), by NUTS 2 regions, 2011 ⁽¹⁾
 (% of the economically active population)



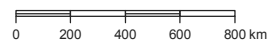
(% of the economically active population)

EU-27 = 18.4



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Cartography: Eurostat — GISCO, 05/2013



⁽¹⁾ Turkey, 2010.

Source: Eurostat (online data code: [hrst_st_rcat](#))

Figure 11.3 shows the 10 regions within the EU that experienced the most rapid growth in their respective shares of core HRST relative to their labour force between 2006 and 2010 (measured in percentage point terms); note this temporal comparison has not been extended to cover 2011 due to a break in series between 2010 and 2011.

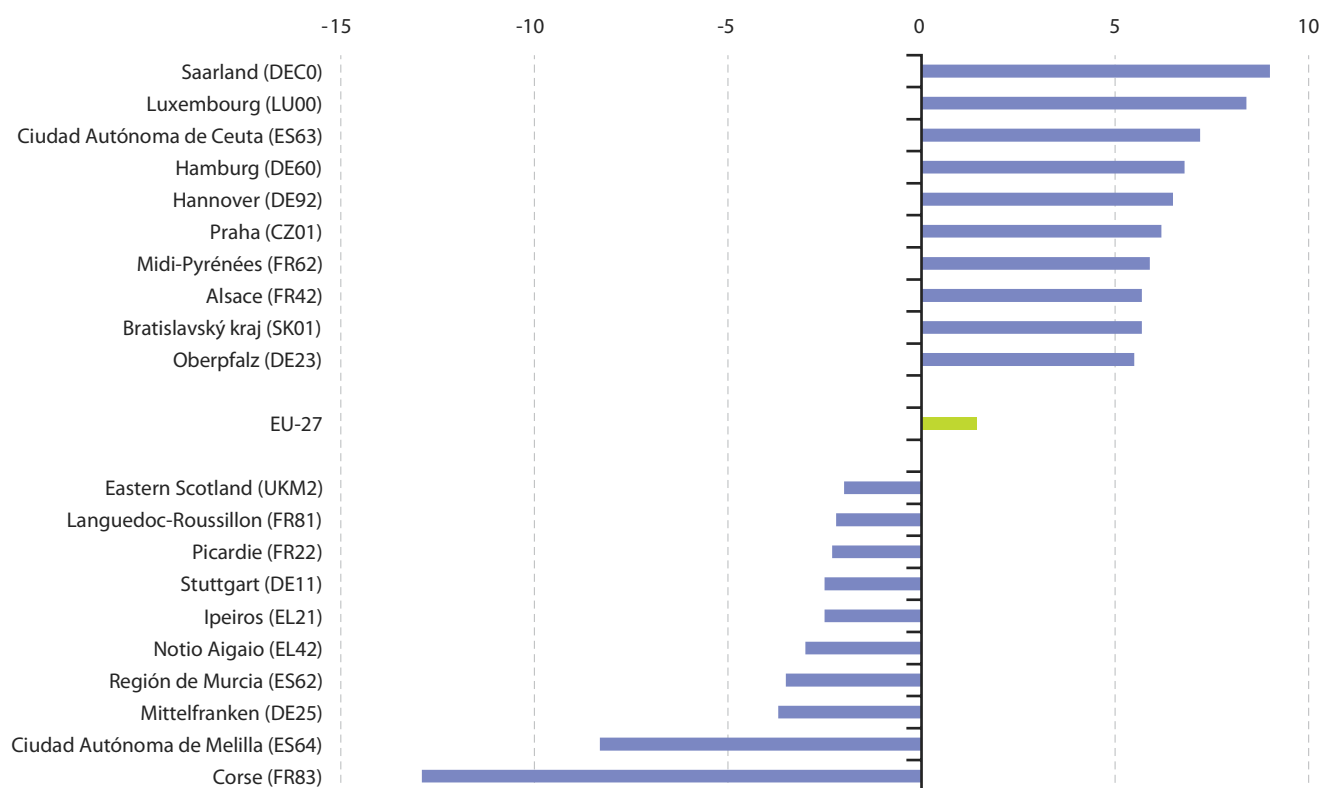
During the period 2006–10, the proportion of human resources in core HRST rose across the whole of the EU-27 from 15.5% to 16.9%. Three of the regions with the most rapid growth in core HRST were clustered around the border area where Germany, France and Luxembourg meet: namely, Saarland (Germany), Luxembourg (one region at NUTS level 2) and Alsace (France). Among the 10 regions with the fastest growth there were three more from Germany, namely the regions including the northern cities of Hamburg and Hannover and the south-eastern region of Oberpfalz (which borders onto the Czech Republic). Continuing over the border, another region with rapid growth in core HRST was Praha (the capital city region of the Czech Republic), and the same was also true for the capital city region (Bratislavský kraj) of its neighbour Slovakia. The top 10 was completed by the

south-western French region of the Midi-Pyrénées and the Ciudad Autónoma de Ceuta (Spain).

Employment in high-tech sectors

High-tech sectors include **high-tech manufacturing** and **high-tech knowledge-intensive services**, based on the activity classification **NACE**. The distinction between manufacturing and services is made due to the existence of two different methodologies. While R & D intensities are used to distinguish between high, medium-high, medium-low and low technology manufacturing industries, for services the proportion of the workforce that has followed a tertiary education is used to distinguish between knowledge-intensive services and less knowledge-intensive services. The service sector as a whole accounted for 69.6% of total employment in the EU-27 in 2011, while manufacturing accounted for 15.7% of total employment (a share that has consistently fallen in recent years as the European economy has become increasingly based on tertiary activities).

Figure 11.3: Human resources in science and technology core (HRSTC) as a percentage of the economically active population, NUTS 2 regions with the highest and lowest rates of change, 2006–10 ⁽¹⁾ (percentage points difference between 2010 and 2006)



⁽¹⁾ Denmark, 2007–10; Ciudad Autónoma de Melilla (ES63), Corse (FR83) and Valle d'Aosta/Vallée d'Aoste (ITC2), data lacks reliability due to reduced sample size, but publishable.
Source: Eurostat (online data code: [hrst_st_rcat](#))



Looking more closely at the high-tech areas of the economy, there were 5.9 million persons employed across the EU-27 within high-tech knowledge-intensive services in 2011, and a further 2.4 million working in the high-technology manufacturing sector. These figures equated to 2.7% and 1.1% respectively of the total EU-27 workforce in 2011, such that when combined these high-tech sectors accounted for 3.8% of EU-27 employment.

Figure 11.4 shows the regional disparities in the high-tech sectors' share of total employment in 2011. This figure plots the highest and lowest regional employment shares, as well as the national average and the share of each capital city region. Among those countries that have more than one NUTS level 2 region, the employment share of high-tech sectors varied quite substantially — with the highest ranges being recorded for those EU Member States where at least one region had a relatively high proportion of employment concentrated within high-tech sectors.

Urban regions, especially capital city regions or regions situated close to capitals, often exhibited the highest shares of employment in high-tech sectors. All of the 24 multi-region countries shown in Figure 11.4 reported that the employment share of high-tech sectors in their capital city region was above the national average. Furthermore, in 18 of these 24 countries, the capital city region had the highest regional share of employment in high-tech sectors; the exceptions were Belgium, Germany, the Netherlands, the United Kingdom, Switzerland and Turkey.

Considering the 223 NUTS level 2 regions in the EU-27 for which data are available for 2011, the share of employment in high-tech sectors was highest in Berkshire, Buckinghamshire and Oxfordshire (where there is a high propensity for enterprises engaged in information and communications technology and life sciences to locate along the M4 corridor to the west of London in the United Kingdom), followed by the Province/Provincie Brabant Wallon (which includes a large science park in Louvain-la-Neuve, just to the south of Brussels, Belgium) and the capital city regions of Hovedstaden (Denmark), Praha (the Czech Republic), Stockholm (Sweden) and Île de France (France). These were the only regions where 8% or more of total employment in 2011 was in high-tech sectors.

Unlike for other science, technology and innovation indicators, the share of total employment in high-tech sectors was generally not characterised by clusters of regions. Rather, the highest shares of employment in high-tech sectors in 2011 were from 12 different Member States: the United Kingdom was the only Member State with multiple regions in the top 15, as besides Berkshire, Buckinghamshire and Oxfordshire, a relatively high proportion of those employed in the southern English regions of Bedfordshire and Hertfordshire, Inner London, and Hampshire and Isle of Wight worked in high-tech sectors.

Among those countries with no regional breakdown available, Malta (5.7%), Finland (5.6%) and Estonia (4.1%) were the only Member States to report employment in high-tech sectors above the EU-27 average; this was also the case in Iceland (5.2%).

Ireland was the only multi-region EU Member State to report that even its lowest regional share of employment in high-tech sectors was above the EU-27 average (3.8%), as 4.9% of those employed in the Border, Midland and Western region worked in high-tech sectors. The same was true in Switzerland, as Ostschweiz (4.2%) recorded the lowest regional share of employment in high-tech sectors across the seven level 2 Swiss regions.

There were six regions in the EU where 1% or less of total employment was in high-tech sectors in 2011. Three of these regions were in Romania (Sud-Est, Nord-Est and Sud-Vest Oltenia), while there was a single region from each of Greece (Dytiki Ellada), Spain (Región de Murcia) and Poland (Swietokrzyskie). There were 19 regions in Turkey where the share of employment in high-tech sectors did not rise above 1%.

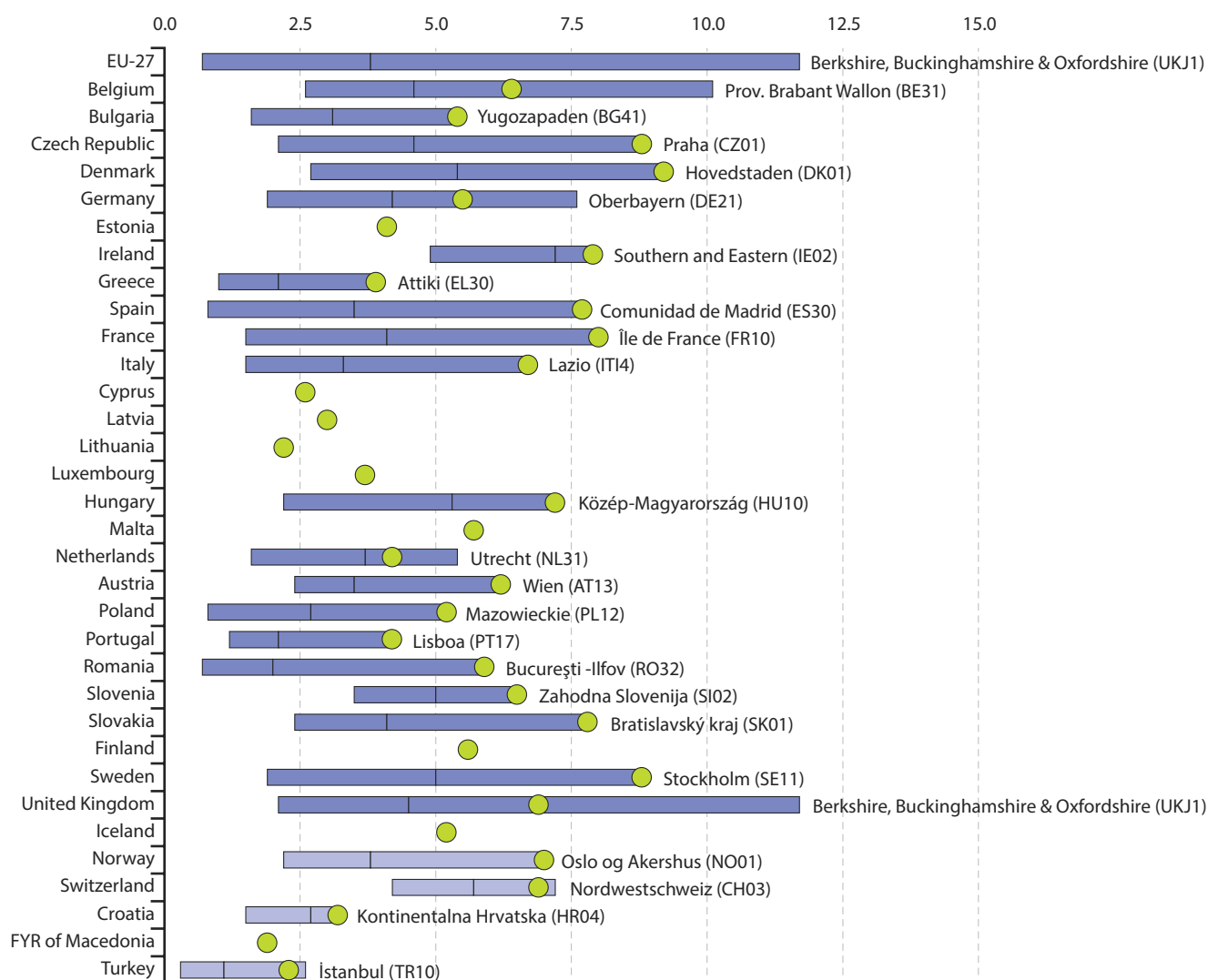
Patents

Patent counts can provide a measure of **invention** and **innovation** and a time series of data is available for an analysis by region. However, care should be taken in interpreting the data as not all inventions are patented and patent propensities vary across activities and enterprises; furthermore, patented inventions vary in technical and economic value. Patent applications tend to be clustered geographically in a limited number of regions and this is especially true for high-tech activities.

Regional statistics for patent applications to the **European Patent Office (EPO)** build on information from addresses of inventors; this is not always the place (region) of invention as inventors do not necessarily live in the same region as the one in which they work; this discrepancy is likely to be higher when smaller geographical units are used.

Across the EU-27, there were in excess of 55 000 patent applications made to the EPO in 2009, equivalent to an average of 111.0 per million inhabitants. Map 11.4 shows that technological activity in the form of patent applications was very much concentrated in the centre of the EU. There were 158 NUTS level 3 regions in the EU (out of a total of 1 199 regions with data available) that had more than 250.0 patent applications per million inhabitants in 2009 and 26 of these regions had more than 500.0 patent applications per million inhabitants. Among the top 26 regions were 24 German regions as well as one region each from France and the Netherlands. The high degree of innovative activity in these 26 regions had a considerable impact on the EU-27 average. By contrast, the distribution of regions was heavily skewed in favour of those with relatively low levels of innovative activity,

Figure 11.4: Employment in high-tech sectors as a share of total employment, highest and lowest NUTS 2 regions, 2011 ⁽¹⁾ (%)



⁽¹⁾ High-tech sectors = high-technology manufacturing plus high-tech knowledge-intensive services (KIS); the graph shows the range from the highest to the lowest region for each country; the black vertical line is the average (mean); the green circular marker is the capital city (for those countries where there is no regional breakdown, the national average is used as the value for the capital region); the name of the region with the highest value is also included; the graph is based on available information (some regions are unreliable or not available); the latest data for some regions refers to 2008, 2009 or 2010.

Source: Eurostat (online data code: [htec_emp_reg2](#))

as witnessed by the median value of 60.9 patent applications per million inhabitants across all NUTS level 3 regions in the EU, far below the EU-27 mean of 111.0.

The highest number of patent applications per million inhabitants was recorded in the German region of Erlangen, Kreisfreie Stadt (1 435.8), while the third highest number (1 228.9) was registered in the neighbouring Bavarian region of Erlangen-Höchstadt. Erlangen is home to a number of research institutes, a university and various offices of the Siemens engineering group. The second highest number of patent applications relative to population size) in 2009 was recorded

in the Dutch region of Zuidoost-Noord-Brabant (1 381.3), while Heidenheim in Germany (1 059.2) was the only other region to report more than 1 000 patent application per million inhabitants. The one French region in the group of 26 regions that reported above 500.0 patent applications per million inhabitants was Isère (513.8) in the south-east of France; this region includes Grenoble where a number of large semiconductor and IT-related enterprises are located.

Aside from Germany, the Netherlands and France, the highest ratio of patent applications per million inhabitants in the



remaining EU Member States was recorded in the western Austrian region of Rheintal-Bodenseegebiet (442.2 patent applications per million inhabitants). Continuing down the ranking, the next Member States to figure were Denmark (Nordsjælland, 345.2), Sweden (Västmanlands län, 343.5), the United Kingdom (Cambridgeshire CC, 336.5) and Finland (Helsinki-Uusimaa, 307.9).

There were 26 NUTS level 3 regions in the EU reporting 1.0 patent applications per million inhabitants or less. These were spread across eight different EU Member States, with the highest number of regions from Romania (10 regions), Poland (six), Portugal (three), Bulgaria and Spain (both two), while there was a single region with one patent application per million inhabitants or less from each of Greece, Hungary and Lithuania.

The concentration of patent activity in central Europe extended beyond the EU's borders, with both Liechtenstein (1 202.3 patent applications to the EPO per million inhabitants) and Switzerland (393.3) reporting a much higher degree of patent activity than the EU-27 average in 2009. By contrast, the concentration of patent applications to the EPO made from Iceland (65.9 per million inhabitants) and Norway (89.0) was well below the EU-27 average, and this ratio fell considerably lower for the acceding and candidate countries for which data are available, as there was an average of 6.2 patent applications per million inhabitants in Croatia and 4.0 applications per million inhabitants in Turkey.

Data sources and availability

Eurostat collects [statistics on research and development \(R & D\)](#) under the legal requirements of Commission Regulation (EC) No 753/2004, which determines datasets, analysis (breakdowns), frequency and transmission delays. The methodology for national R & D statistics is laid down in the 'Frascati manual: proposed standard practice for surveys on research and experimental development' (OECD, 2002), which is also used by many non-member countries.

Statistics on human resources in science and technology (HRST) are compiled annually, based on microdata extracted from the [EU labour force survey \(EU LFS\)](#). The basic methodology for these statistics is laid down in the [Canberra manual \(OECD, 1995\)](#), which lists all HRST concepts.

Data on high-technology manufacturing industries and knowledge-intensive services are compiled annually, based on data collected from a number of official sources (such as the EU LFS and [structural business statistics \(SBS\)](#)). The technology level of manufacturing activities is defined in terms of their R & D intensity (the ratio of R & D expenditure relative to value added).

For manufacturing, four groups are identified, depending on the level of R & D intensity: high, medium-high, medium-low and low-technology manufacturing sectors. High-technology manufacturing covers the manufacture of: basic pharmaceutical products and pharmaceutical preparations; computer, electronic and optical products; and air and spacecraft and related machinery.

For services, the activities are classified into knowledge-intensive services (KIS) and less knowledge-intensive services (LKIS). The former is then divided into high-tech knowledge-intensive services, knowledge-intensive financial services, knowledge-intensive market services (other than high-tech and financial services), and other knowledge-intensive services. High-tech knowledge-intensive services include motion pictures, video and television programme production, sound recording and music publishing activities, programming and broadcasting, telecommunications, computer programming, consultancy and related activities, information service activities, and research and development.

Data on patent applications to the EPO are compiled on the basis of microdata from the EPO. The patent data reported include patent applications filed at the EPO during the reference year, classified by the inventor's region of residence and in accordance with the [international patents classification of applications \(IPC\)](#). Patent data are regionalised using procedures linking postcodes and/or place names to NUTS level 2 and 3 regions. Patent statistics published by Eurostat are almost exclusively based on the EPO worldwide statistical patent database, [Patstat](#).

Context

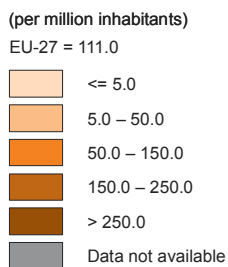
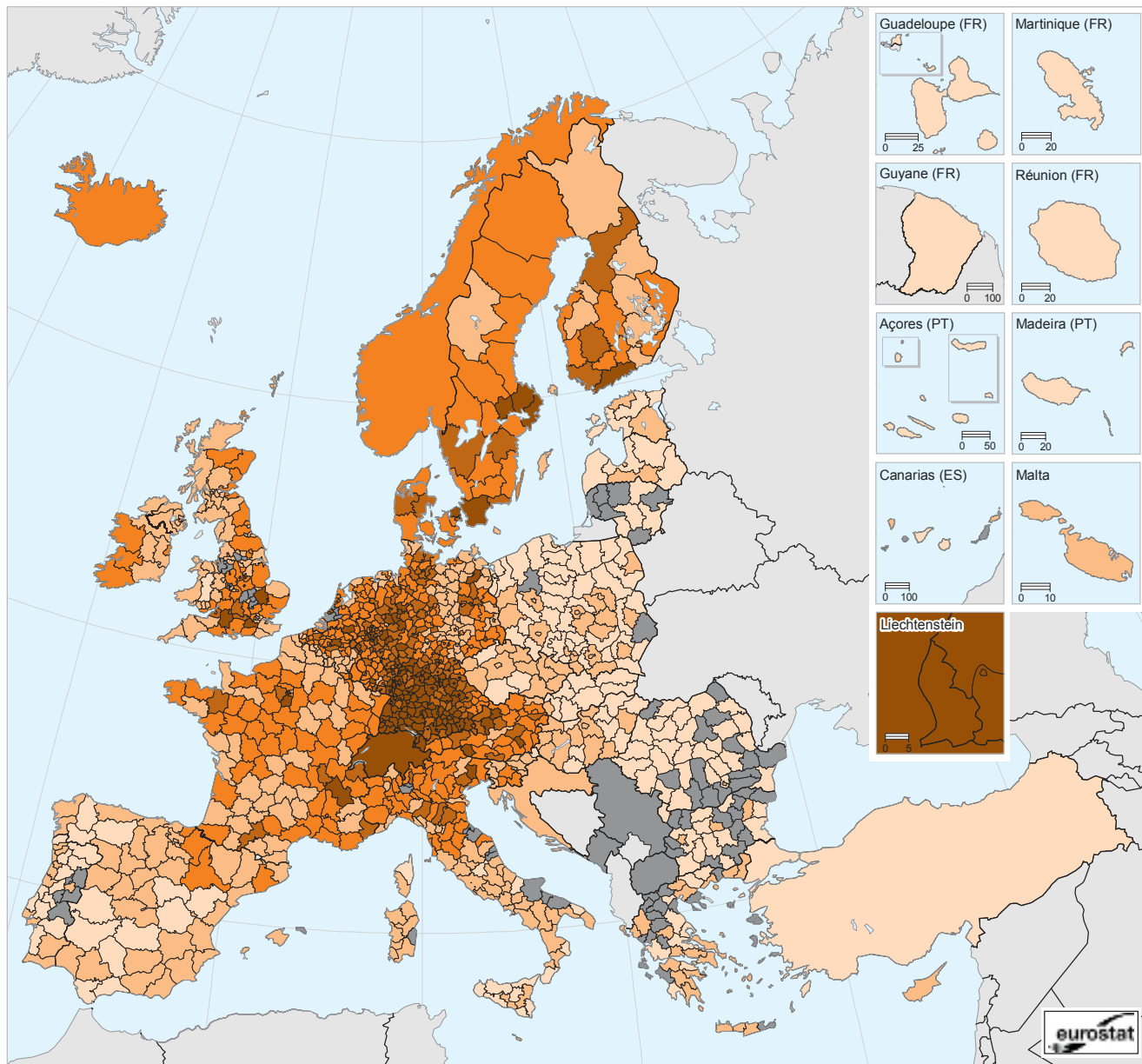
R & D is often considered as one of the driving forces behind growth and job creation. However, its influence extends well beyond the economic sphere, as it can, among others, potentially resolve environmental or international security threats, ensure safer food or lead to the development of new medicines to fight illness and disease.

Since their launch in 1984, the EU's framework programmes for research have played a leading role in multidisciplinary research activities. The [seventh framework programme for research and technological development \(FP7\)](#) is the EU's main instrument for funding research; it runs from 2007 to 2013 and has a budget of EUR 50.5 billion, with an additional amount of up to EUR 5.25 billion for nuclear research and training activities to be carried out under the [Euratom Treaty](#).

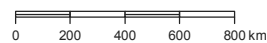
Europe's research efforts have often been described as being fragmented along national and institutional lines. The [European research area \(ERA\)](#) was launched at the [Lisbon European Council](#) in March 2000 and aims to ensure open and



Map 11.4: Patent applications to the EPO, by NUTS 3 regions, 2009 ⁽¹⁾
(per million inhabitants)



Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat
Cartography: Eurostat — GISCO, 05/2013



⁽¹⁾ Provisional; EU-27, estimate; for a limited number of regions the latest data is for 2006, 2007 or 2008; Iceland, Liechtenstein, Norway, Switzerland, Croatia and Turkey, national level and estimates.

Source: Eurostat (online data code: [pat_ep_rot](#))



transparent trade in scientific and technical skills, ideas and know-how; it sets out to create a unified research area that is open to the world that promotes the free movement of researchers, knowledge and technology. In May 2008, the ERA was relaunched as part of what has become known as the [Ljubljana process](#), which included specific initiatives for five different areas: researchers' careers and mobility; research infrastructures; knowledge sharing; research programmes; and international science and technology cooperation. A [European Commission](#) communication titled 'A reinforced European research area partnership for excellence and growth' (COM(2012) 392 final) is designed to ensure the completion of the ERA by 2014, focusing on five key priority areas for reform:

- more effective national research systems;
- optimal transnational cooperation and competition;
- an open labour market for researchers;
- gender equality and gender mainstreaming in research, and;
- optimal circulation and transfer of scientific knowledge.

In October 2010, the European Commission launched a Europe 2020 flagship initiative, titled the 'Innovation union' (COM(2010) 546 final); this sets out a strategic approach to a range of challenges like climate change, energy and food security, health and an ageing population; it is hoped that the promotion of innovation will turn ideas into jobs, green growth and social progress. The innovation union seeks to use public sector intervention to stimulate the private sector and to remove bottlenecks which stop ideas from reaching the market (such as access to finance, fragmented research systems and markets, under-use of public procurement for innovation, and speeding-up harmonised standards and technical specifications). European innovation partnerships (EIPs) form part of the innovation union and are designed to act as a framework to address major societal challenges,

bringing together activities and policies from basic research through to market-oriented solutions.

To avoid an 'innovation divide' between the strongest innovating regions in the EU and other regions, the European Commission intends to assist EU Member States to use the remaining Structural Funds programmed for 2007–13 for research and innovation projects. In 2011, the European Commission launched a [research programme on public sector and social innovation](#) and a pilot study for developing a [European public sector innovation scoreboard](#).

[Horizon 2020](#) is the framework programme for research and innovation after 2013, providing a simplification of existing innovation funding by building upon the previous framework programmes for research and technological development as well as the competitiveness and innovation framework programme (CIP) and the European Institute of Innovation and Technology (EIT). As such, Horizon 2020 will be the financial instrument for implementing the innovation union, and it is planned to have a budget of EUR 80 billion for the period 2014–20. In November 2011 the European Commission adopted a communication on '[Horizon 2020 — The framework programme for research and innovation](#)' (COM(2011) 808 final), which is designed to promote research and innovation in the EU in support of the Europe 2020 strategy. The framework is composed of proposals for a series of implementing regulations in the following areas:

- a framework programme for research and innovation (2014–20);
- a set of rules for participation and dissemination in Horizon 2020;
- a specific programme for implementing Horizon 2020, and;
- a proposal for research and training programmes in relation to the Euratom Treaty for the period 2014–18.