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Science and technology

Introduction

Science is part of almost every aspect of our lives: at the flick of a switch, we have light; when we are ill, medicines help us get better; when we want to talk to a friend we just pick up the telephone or send a text message or e-mail. Europe has a long tradition of excellence in research and innovation, having been the birthplace of the industrial revolution. The European Union (EU) is a world leader in a range of cutting-edge industrial sectors – for example, biotechnology, pharmaceuticals, telecommunications or aerospace.

Research and development (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 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 in Europe; it runs from 2007 to 2013 and has a total budget of EUR 50 521 million, with an additional EUR 2 751 million for 2007 to 2011 for nuclear research and training activities to be carried out under the Euratom Treaty. This money is generally intended to finance grants to research actors all over Europe, usually through co-financing research, technological development and demonstration projects. FP7 is made up of four broad programmes – cooperation (collaborative research), ideas (the European Research Council), people (human potential) and capacities (research capacity). Through these programmes, FP7 aims to create European 'poles of excellence' across a wide array of scientific themes, such as information technologies, energy and climate change, health, food, and social sciences. FP7 also foresees direct research at the European Commission's own research institute (the Joint Research Centre (JRC)), whose activities are divided into 17 policy agendas, with an emphasis on understanding the relationship between the environment and health, internal and external security, and support for Europe's 2020 economic growth.

The European Research Area (ERA) was launched at the Lisbon European Council in March 2000. ERA aims to ensure open and transparent trade in scientific and technical skills, ideas and know-how. Europe's research efforts are often described as being fragmented along national and institutional lines. Indeed, individual Member States may find it difficult to play a leading role in important areas of scientific and technological advance as research is increasingly complex, interdisciplinary and expensive.

The ERA was given new impetus in April 2007 with the European Commission's Green paper on the European research area: new perspectives. In May 2008 the ERA was re-launched as part of what has become known as the Ljubljana process, including specific initiatives for five different areas: researchers' careers and mobility; research infrastructures; knowledge sharing; research programmes; and international science and technology cooperation. As a result, in the years through to 2020 the ERA will aim to establish a single European labour market for researchers, as well as single markets for knowledge and for innovative goods and services. Furthermore, the ERA should aim to: encourage trust and dialogue between society and the scientific and technological community; benefit from a strong publicly-supported research and technology base and world-class research infrastructures and capacities across Europe; provide for the joint design of research, education and innovation policies; address major challenges through strategic partnerships; and enable Europe to speak with one voice to its main international partners.

International cooperation forms an integral part of the EU's scientific policy, which includes programmes to enhance Europe's access to worldwide scientific expertise, attract top scientists to work in Europe, contribute to international responses to shared problems, and put research at the service of EU external and development policies. In December

2008, the Competitiveness Council adopted a 2020 vision for the ERA, which foresees the introduction of a 'fifth freedom' for the EU's internal market – namely, the free circulation of researchers, knowledge and technology.

In October 2010, the European Commission launched a Europe 2020 flagship initiative, titled 'innovation union' (COM(2010) 546 final) which sets out a strategic approach to a range of challenges like climate change, energy and food security, health and an ageing population. The proposals seek to use public sector intervention to stimulate the private sector and to remove bottlenecks which stop ideas 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 – for more information, see the subchapter on innovation statistics.

Horizon 2020 is planned as the framework programme for research and innovation after 2013, building upon FP7, the competitiveness and innovation framework programme (CIP) and the European institute of innovation and technology (EIT). A Green paper titled 'From challenges to opportunities: towards a common strategic framework for EU research and innovation funding' (COM(2011) 48) was adopted by the European Commission in February 2011 and proposed major changes to EU research and innovation funding to make participation easier, increase scientific and economic impact and provide better value for money.

Official European statistics on science and technology provide a leading example of cooperation activities between international statistical organisations. In the domain of R & D statistics a joint survey produced by the OECD and Eurostat has been introduced, which is based on the collection of information following guidelines laid out in the Frascati manual. As regards human capital, the OECD, UNESCO and Eurostat are working towards developing internationally comparable indicators on the careers and mobility of doctorate (PhD) holders. Within the domain of innovation statistics, Eurostat conducts a Community innovation survey, which is based on the guidelines laid out within the Oslo manual (jointly produced with other European Commission services and the OECD). Together with the European Patent Office (EPO), the United States Patent and Trademark Office (USPTO) and the OECD, Eurostat has worked towards the improvement of PATSTAT, a harmonised database covering EPO patent applications and USPTO patents granted.

The innovation scoreboard used for assessing innovation performance in the Member States has been reworked to improve international comparability and to include a number of research oriented indicators in line with the purpose of monitoring the implementation of the innovation union; it has been renamed the innovation union scoreboard. This revised tool aims to provide a comparative assessment of the performance of the Member States and the relative strengths and weaknesses of their research and innovation systems. The 2010 scoreboard draws on 25 research and innovation-related indicators grouped into three main categories:

- enablers such as human resources, finance and support, open, excellent and attractive research systems;
- activities of enterprises, such as investment, linkages and entrepreneurship or intellectual assets; and
- outputs, such as innovators and economic effects.

13.1 R & D expenditure

Most European research is funded at the national level, by private and/or public sources. This subchapter presents data on R & D spending within the European Union (EU), according to the sector performing the research and according to the source of funds.

Framework programmes are the main instrument for funding R & D within the EU. The 7th framework programme (FP7) for research and technological development started in 2007 and is due to continue for a total of seven years. Horizon 2020 is planned as the framework programme for research and innovation after 2013 – see the introduction for science and technology for more information.

The European Research Area (ERA) is composed of all research and development activities, programmes and policies in Europe which involve a transnational perspective. In December 2008, the Competitiveness Council adopted a 2020 vision for the ERA, which foresees the introduction of a 'fifth freedom' – namely, the free circulation of researchers, knowledge and technology.

Main statistical findings

Gross domestic expenditure on R & D (GERD) stood at EUR 236 820 million in the EU-27 in 2009, which marked a 1.2 % decrease on the level of GERD in 2008, but was 50.3 % higher than ten years earlier (1999) – note that these rates of change are in current prices and so reflect price changes as well as real changes in the level of expenditure. In 2008 the level of expenditure on R & D in the EU-27 was 88.5 % of that recorded by the United States, although slightly more than double the level of expenditure in Japan and considerably above R & D expenditure levels in the emerging economies – for example, EU-27 expenditure was 5.3 times as high as in China.

In order to make figures more comparable, GERD is often expressed relative to gross domestic product (GDP) – see Figure 13.1.1 – or in relation to population. The ratio of GERD to GDP increased marginally in the EU-27 during the period up to 2002 reaching a high of 1.87 %, before declining modestly through to 2005 (1.82 %), and climbing again to 1.92 % by 2008 and 2.01 % by 2009. The ratio of GERD to GDP increased between 2008 and 2009 despite a fall in the absolute level of expenditure; this can be explained by GDP falling even more than GERD during the financial and economic crisis. Nevertheless, the EU-27's R & D expenditure relative to GDP remains well below the corresponding shares recorded in Japan (3.44 %) and the United States (2.77 %) in 2008; this pattern has existed for a lengthy period. There was a far higher increase in the relative importance of GERD in the Japanese economy, as its share of GDP rose by 0.42 percentage points during the period 1999 to 2008; note however that Japanese economic growth was also subdued during this period.

One of the key objectives of the EU during the last decade has been to encourage increasing levels of investment, in order to provide a stimulus to the EU's competitiveness. At the Barcelona Council in 2002, the EU agreed to a target of spending at least 3 % of gross domestic product (GDP) on research by 2010, of which two thirds was to be financed by the business sector; most of the EU Member States specified their own targets in national reform programmes. Using this measure, the highest R & D intensity in 2009 was recorded in Finland (3.96 %), Sweden (3.62 %) and Denmark (3.02 %) – see Table 13.1.1. While none of the other Member States reported GERD rising above 3 % of GDP at a national level, R & D intensity also rose to relatively high levels in a number of regions, for example in Baden-Württemberg and Berlin (Germany), the east of England (United Kingdom), and southern Austria. There were eight Member States that reported R & D expenditure accounting for less than 1 % of their GDP in 2009, with Latvia, Cyprus, Romania and Slovakia below 0.5 %. The regions with the lowest R & D intensity were generally in southern and eastern Europe.

The differences in the relative importance of R & D expenditure between countries are often explained by referring to levels of expenditure within the business enterprise sector. Table 13.1.2 shows that the share of R & D conducted within the business enterprise sector was equivalent to 1.25 % of the EU-27's GDP in 2009, compared with 2.70 % in Japan and 2.01 % in the United States (both 2008), while the relative importance of R & D expenditure in the government and higher education sector was broadly similar across all three members of the Triad. An evaluation of the data for the Member States also confirms that those countries with relatively high shares of business enterprise expenditure on R & D – namely, Finland, Sweden, Denmark, Austria and Germany – also reported relatively high levels of total GERD. Apart from Germany, these countries also tended to feature near the top-end of the ranking of expenditure by the higher education sector, where the Netherlands also had a relatively high share of R & D expenditure. Government R & D expenditure relative to GDP was highest in Germany, Slovenia, Finland and France.

A breakdown of R & D expenditure by source of funds shows that more than half (54.7 %) of the total expenditure in 2008 within the EU-27 came from business enterprises, while just over one third (33.9 %) was from government, and a further 8.7 % from abroad. Business-funded R & D accounted for 78.2 % of total R & D expenditure in Japan and 67.3 % in the United States. Table 13.1.3 confirms the relatively important role played by the business enterprise sector as a source of R & D funding in Luxembourg (2007 data), Finland (2009) and Germany (2008), as business-funded R & D accounted for over two thirds of total GERD. In contrast, a majority of the gross expenditure on R & D made in Cyprus and Bulgaria in 2008 and in Poland, Romania, Lithuania and Slovakia in 2009 was funded by the government sector. There were also considerable differences in the source of R & D funding from abroad, with relatively high shares (in excess of 15 % of total GERD) reported in the United Kingdom, Malta, Austria, Ireland and Latvia.

Data sources and availability

Statistics on science, technology and innovation (STI statistics) are based on Decision 1608/2003/ECconcerning the production and development of Community statistics on science and technology. In close cooperation with the Member States, this Decision was implemented by Eurostat in the form of legislative measures and other work. Regulation 753/2004 on statistics on science and technology was adopted in 2004 implementing Decision 1608/2003/EC.

Eurostat's statistics on R & D expenditure are compiled using guidelines laid out in the Frascati manual, published in 2002 by the OECD. R & D expenditure is a basic measure that covers intramural expenditure, in other words, all expenditures for R & D that are performed within a statistical unit or sector of the economy.

The main breakdown of R & D statistics is by four institutional sectors of performance. These four sectors are the business enterprise sector, the government sector, the higher education sector, and the private non-profit sector (the latter is not shown in this subchapter). Gross domestic expenditure on R & D (GERD) is composed of expenditure from each of these four sectors. Expenditure data considers the research spend on the national territory, regardless of the source of funds; data are usually expressed in relation to GDP, otherwise known as R & D intensity. Additional breakdowns of R & D expenditure are available by: source of funds; field of science; type of costs; economic activity (NACE); enterprise size class; type of R & D; socio-economic objectives; and regions (NUTS).

The European Commission compiles three levels of indicators to support research and innovation policymaking. These indicators are generally grouped together as: headline indicators; innovation union scoreboard (or core) indicators; and a comprehensive set of indicators. Within the headline indicators – also referred to as Europe 2020 strategy indicators – is the measure of research intensity (with a 3 % target for investment in research across the EU). The scoreboard (or core) indicators are designed to monitor research and innovation for the Competitiveness Council, while the comprehensive set of indicators are for in-depth economic analytical purposes and Commission services to produce a science, technology and competitiveness report.

Context

The European Commission has through its Europe 2020 flagship initiative, titled 'innovation union', placed renewed emphasis on the conversion of Europe's scientific expertise into marketable products and services, through seeking to use public sector intervention to stimulate the private sector and to remove bottlenecks which stop such ideas reaching the market. Furthermore, the latest revision of the integrated economic and employment guidelines (revised as part of the Europe 2020 strategy for smart, sustainable and inclusive growth) includes a guideline to optimise support for R & D and innovation, strengthening the knowledge triangle and unleashing the potential of the digital economy.

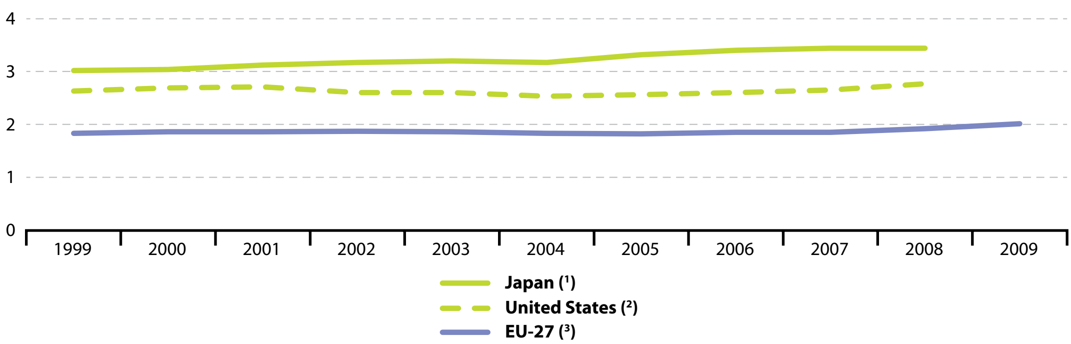
One area that has received considerable attention in recent years is the structural difference in R & D funding between Europe and its main competitors. Policymakers in Europe have tried to increase R & D business expenditure so that it is more in line with relative contributions observed in Japan or the United States. The European Research Area (ERA) is designed to overcome some of these barriers that are thought to have hampered European research efforts, for example, by addressing geographical, institutional, disciplinary and sectoral boundaries.

Studies have been conducted in respect to business enterprises' investment in an annual report, titled the EU's industrial R & D investment scoreboard. This presents information on the top 1 000 research investors whose registered offices are in the EU and the top 1 000 investors registered elsewhere. According to this source Volkswagen (Germany) and Nokia (Finland) were among the global top ten investors in 2010, a group that was led by Roche (Switzerland) and Pfizer (the United States), and also included Novartis (Switzerland).

In December 2008, the Competitiveness Council adopted a 2020 vision for the ERA. According to the opening statement of this vision, all players should benefit from: the 'fifth freedom', introducing the free circulation of researchers, knowledge and technology across the ERA; attractive conditions for carrying out research and investing in R & D intensive sectors; Europe-wide scientific competition, together with the appropriate level of cooperation and coordination. The 2020 vision for the ERA is part of the wider picture of Europe's 2020 strategy for smart, sustainable and inclusive growth.

As part of the EU's 7th framework programme for research and technological development the European Commission announced in July 2011 nearly EUR 7 000 million of investment in research and innovation, with the aim of providing an economic stimulus expected to create around 174 000 jobs in the short-term.

Figure 13.1.1: Gross domestic expenditure on R&D in the Triad, 1999-2009
(% share of GDP)



(1) Break in series, 2008; not available for 2009.
(2) Excludes most or all capital expenditure; 2008, provisional; not available for 2009.
(3) Estimates.

Source: Eurostat (online data code: t2020_20), OECD

Table 13.1.1: Gross domestic expenditure on R&D, 1999-2009
(% share of GDP)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EU-27	1.83	1.86	1.86	1.87	1.86	1.83	1.82	1.85	1.85	1.92	2.01
Euro area (EA-16)	1.82	1.83	1.85	1.87	1.87	1.85	1.84	1.87	1.88	1.96	2.05
Belgium	1.94	1.97	2.07	1.94	1.88	1.86	1.83	1.86	1.90	1.96	1.96
Bulgaria	0.55	0.51	0.46	0.48	0.48	0.49	0.46	0.46	0.45	0.47	0.53
Czech Republic	1.14	1.21	1.20	1.20	1.25	1.25	1.41	1.55	1.54	1.47	1.53
Denmark (1)	2.18	2.24	2.39	2.51	2.58	2.48	2.46	2.48	2.58	2.87	3.02
Germany	2.40	2.45	2.46	2.49	2.52	2.49	2.49	2.53	2.53	2.68	2.82
Estonia	0.68	0.60	0.70	0.72	0.77	0.85	0.93	1.13	1.10	1.29	1.42
Ireland	1.18	1.12	1.10	1.10	1.17	1.23	1.25	1.25	1.29	1.45	1.77
Greece	0.60	:	0.58	:	0.57	0.55	0.59	0.58	0.58	:	:
Spain	0.86	0.91	0.91	0.99	1.05	1.06	1.12	1.20	1.27	1.35	1.38
France (2)	2.16	2.15	2.20	2.23	2.17	2.15	2.10	2.10	2.07	2.11	2.21
Italy	1.02	1.05	1.09	1.13	1.11	1.10	1.09	1.13	1.18	1.23	1.27
Cyprus	0.23	0.24	0.25	0.30	0.35	0.37	0.40	0.43	0.44	0.42	0.46
Latvia	0.36	0.44	0.41	0.42	0.38	0.42	0.56	0.70	0.59	0.61	0.46
Lithuania	0.50	0.59	0.67	0.66	0.67	0.75	0.75	0.79	0.81	0.80	0.84
Luxembourg	:	1.65	:	:	1.65	1.63	1.56	1.66	1.58	1.51	1.68
Hungary (3)	0.67	0.79	0.92	1.00	0.93	0.87	0.95	1.00	0.97	1.00	1.15
Malta (3)	:	:	:	0.26	0.26	0.53	0.56	0.61	0.58	0.57	0.54
Netherlands (4)	1.96	1.82	1.80	1.72	1.92	1.93	1.90	1.88	1.81	1.76	1.84
Austria	1.90	1.94	2.07	2.14	2.26	2.26	2.45	2.46	2.52	2.67	2.75
Poland	0.69	0.64	0.62	0.56	0.54	0.56	0.57	0.56	0.57	0.60	0.68
Portugal	0.69	0.73	0.77	0.73	0.71	0.75	0.78	0.99	1.17	1.50	1.66
Romania	0.40	0.37	0.39	0.38	0.39	0.39	0.41	0.45	0.52	0.58	0.47
Slovenia (5)	1.37	1.39	1.50	1.47	1.27	1.40	1.44	1.56	1.45	1.65	1.86
Slovakia	0.66	0.65	0.63	0.57	0.57	0.51	0.51	0.49	0.46	0.47	0.48
Finland	3.17	3.35	3.32	3.37	3.44	3.45	3.48	3.48	3.47	3.72	3.96
Sweden (6)	3.58	:	4.13	:	3.80	3.58	3.56	3.68	3.40	3.70	3.62
United Kingdom	1.82	1.81	1.79	1.79	1.75	1.68	1.73	1.75	1.78	1.77	1.87
Iceland	2.30	2.67	2.95	2.95	2.82	:	2.77	2.99	2.68	2.65	3.10
Norway	1.64	:	1.59	1.66	1.71	1.59	1.52	1.52	1.65	1.64	1.80
Switzerland	:	2.53	:	:	:	2.90	:	:	:	3.00	:
Croatia	:	:	:	0.96	0.96	1.05	0.87	0.75	0.80	0.90	0.84
Turkey	0.47	0.48	0.54	0.53	0.48	0.52	0.59	0.58	0.72	0.72	0.85
Japan (5)	3.02	3.04	3.12	3.17	3.20	3.17	3.32	3.40	3.44	3.44	:
United States	2.63	2.69	2.71	2.60	2.60	2.53	2.56	2.60	2.65	2.77	:

(1) Break in series, 2007.
(2) Break in series, 2000 and 2004.
(3) Break in series, 2004.
(4) Break in series, 2003.
(5) Break in series, 2008.
(6) Break in series, 2005.

Source: Eurostat (online data code: t2020_20), OECD

Table 13.1.2: Gross domestic expenditure on R&D by sector, 2004 and 2009
(% share of GDP)

	Business enterprise sector (1)		Government sector (2)		Higher education sector (3)	
	2004	2009	2004	2009	2004	2009
EU-27	1.16	1.25	0.24	0.27	0.41	0.48
Euro area (EA-16)	1.17	1.27	0.27	0.29	0.40	0.47
Belgium	1.28	1.32	0.14	0.17	0.40	0.45
Bulgaria	0.12	0.16	0.33	0.29	0.05	0.07
Czech Republic	0.78	0.92	0.28	0.33	0.18	0.28
Denmark	1.69	2.02	0.17	0.09	0.61	0.90
Germany	1.74	1.92	0.34	0.41	0.41	0.49
Estonia	0.33	0.64	0.11	0.16	0.39	0.60
Ireland	0.81	1.17	0.09	0.08	0.33	0.52
Greece (4)	0.17	0.16	0.11	0.12	0.27	0.29
Spain	0.58	0.72	0.17	0.28	0.31	0.39
France	1.36	1.37	0.37	0.36	0.40	0.45
Italy	0.52	0.65	0.20	0.18	0.36	0.40
Cyprus	0.08	0.10	0.13	0.10	0.13	0.20
Latvia	0.19	0.17	0.08	0.11	0.15	0.18
Lithuania	0.16	0.20	0.19	0.20	0.41	0.44
Luxembourg	1.43	1.24	0.18	0.29	0.02	0.15
Hungary	0.36	0.66	0.26	0.23	0.21	0.24
Malta	0.35	0.34	0.01	0.03	0.17	0.17
Netherlands	1.03	0.88	0.26	0.23	0.64	0.73
Austria	1.53	1.94	0.12	0.15	0.60	0.66
Poland	0.16	0.19	0.22	0.23	0.18	0.25
Portugal	0.27	0.78	0.12	0.12	0.27	0.59
Romania	0.21	0.19	0.13	0.17	0.04	0.12
Slovenia	0.94	1.20	0.28	0.39	0.18	0.27
Slovakia	0.25	0.20	0.16	0.16	0.10	0.12
Finland	2.42	2.83	0.33	0.36	0.68	0.75
Sweden	2.63	2.55	0.11	0.16	0.82	0.90
United Kingdom	1.05	1.16	0.18	0.17	0.42	0.50
Iceland	:	1.64	:	0.62	:	0.77
Norway	0.87	0.95	0.25	0.29	0.47	0.57
Switzerland (5)	2.14	2.20	0.03	0.02	0.66	0.72
Croatia	0.44	0.34	0.22	0.23	0.39	0.27
Turkey	0.13	0.34	0.04	0.11	0.35	0.40
Japan (5)	2.38	2.70	0.30	0.29	0.43	0.40
United States (5)	1.76	2.01	0.31	0.29	0.36	0.36

(1) Break in series, Denmark, France, Slovenia and Sweden.
(2) Break in series, Denmark, Sweden and Norway.
(3) Break in series, Denmark, France, Italy, Norway and Japan.
(4) 2007 instead of 2009.
(5) 2008 instead of 2009.

Source: Eurostat (online data code: tsc00001), OECD

Table 13.1.3: Gross domestic expenditure on R&D by source of funds, 2004 and 2009
(% of total gross expenditure on R&D)

	Business enterprises (1)		Government (1)		Abroad (2)	
	2004	2009	2004	2009	2004	2009
EU-27 (3)	*54.2*	*54.7*	*35.1*	*33.9*	*8.4*	*8.7*
Euro area (EA-16) (3)	*55.7*	*56.2*	*36.1*	*34.8*	*6.6*	*7.1*
Belgium (4)	60.2	61.4	24.4	22.2	12.3	13.0
Bulgaria (3)	28.2	30.6	65.8	61.2	5.5	6.8
Czech Republic	52.8	45.8	41.9	43.9	3.7	9.2
Denmark	:	*60.2*	:	*28.4*	:	*8.7*
Germany (3)	66.6	67.3	30.5	28.4	2.5	4.0
Estonia	36.5	*38.4*	44.1	*48.9*	17.0	*11.4*
Ireland	58.6	*50.8*	31.1	*31.5*	8.6	*15.6*
Greece	:	:	:	:	:	:
Spain (3)	48.0	45.0	41.0	45.6	6.2	5.7
France (3)	50.7	50.7	38.7	38.9	8.8	8.0
Italy (3)	:	45.2	:	42.9	:	7.8
Cyprus (3)	18.9	17.8	64.1	64.1	11.5	14.7
Latvia	46.3	36.9	31.2	44.7	22.5	15.4
Lithuania	19.9	21.0	63.1	53.9	10.7	13.1
Luxembourg (4)	:	76.0	:	18.2	:	5.7
Hungary	37.1	46.4	51.8	42.0	10.4	10.9
Malta	:	51.4	:	31.3	:	17.2
Netherlands (4)	:	48.8	:	36.8	:	10.6
Austria	47.2	*44.8*	32.6	*39.1*	19.4	*15.7*
Poland	30.5	27.1	61.7	60.4	5.2	5.5
Portugal (3)	*34.2*	48.1	*57.5*	43.7	*4.8*	3.0
Romania	44.0	34.8	49.0	54.9	5.5	8.3
Slovenia	58.5	*58.0*	30.0	*35.7*	11.1	*6.0*
Slovakia	38.3	35.1	57.1	50.6	4.3	12.8
Finland	69.3	68.1	26.3	24.0	3.2	6.6
Sweden	:	*58.9*	:	*27.3*	:	*10.5*
United Kingdom	44.1	*45.4*	32.9	*30.7*	17.1	*17.7*
Iceland	:	48.5	:	41.4	:	9.9
Norway (4)	:	45.3	:	44.9	:	8.3
Switzerland (3)	69.7	68.2	22.7	22.8	5.2	6.0
Croatia	43.0	39.8	46.6	51.2	2.6	7.0
Turkey	37.9	41.0	57.0	34.0	0.4	1.1
Japan (3)	74.8	78.2	18.1	15.6	0.3	0.4
United States (3)	63.7	*67.3*	30.9	27.1	:	:

(1) Break in series, Denmark, Slovenia, Sweden, Turkey and Japan.
(2) Break in series, Denmark, Slovenia, Finland, Sweden and Japan.
(3) 2008 instead of 2009.
(4) 2007 instead of 2009.

Source: Eurostat (online data code: tsiir030), OECD

13.2 R & D personnel

This subchapter analyses data on research and development (R & D) personnel, researchers and human resources in science and technology in the European Union (EU). Statistics on human resources in science and technology are a key indicator for measuring the knowledge-based economy and its developments. These statistics can show the supply of, and demand for highly qualified science and technology specialists.

Main statistical findings

R & D personnel

The number of researchers in the EU-27 has increased in recent years. There were 1.6 million researchers (full-time equivalents (FTE)) employed in the EU-27 in 2009 (see Table 13.2.1), which marked an increase of almost 466 000 (or 41.6 %) when compared with 2000.

A breakdown of R & D personnel in the EU-27 by institutional sector in 2009 shows that more than two fifths of the total were concentrated in the business enterprise sector (44 %) and the higher education sector (42 %) and 12 % in the government sector. The relative importance of the different institutional sectors varied considerably across the Member States, with business enterprises accounting for more than three fifths of all researchers in Austria, Sweden and Denmark. Bulgaria reported that nearly half (49 %) of its researchers were employed within the government sector, far more than the next highest share recorded in Romania (30 %). More than two thirds of all researchers working in Latvia, Slovakia and Lithuania were employed within the higher education sector.

R & D personnel from all sectors together made up more than 1.9 % of the labour force in Finland, Luxembourg, and Denmark in 2009. Aside from these three Member States, this share ranged from less than 0.5 % in Romania, Cyprus, Poland and Latvia to just over 1.5 % in Sweden and France, with the EU-27 average estimated around 1.1 %. A gender breakdown shows that men accounted for 71 % of the EU-27's workforce of researchers in 2008, the same as in 2007, and 2 percentage points lower than in 2000. The share of women in the total number of researchers in 2008 was close to half in Latvia, Lithuania and Bulgaria, as well as in Croatia.

Human resources in science and technology

Human resources in science and technology (HRST) provide a broad measure of the supply of, and demand for, people highly qualified in science and technology. Some 66.8 million people were employed in the EU-27 within science and technology occupations in 2010; this amounted to 31.0 % of total employment. Between 2007 and 2010 there was an increase in the relative importance of HRST within the EU-27 workforce, as their share rose by 1.1 percentage points. The HRST 'core' – which is made up of people within science and technology occupations who possess a tertiary level education (for example, university graduates) – amounted to 40.7 million persons in 2010 (or 18.9 % of the total number of persons employed).

Persons in HRST occupations accounted for around two fifths of the workforce in Sweden, Denmark and the Netherlands in 2010 and just over half in Luxembourg. The lowest shares were recorded in Portugal and Romania where persons in HRST occupations accounted for slightly less than one fifth of total employment. Concerning core HRST, in other words persons simultaneously in HRST occupations and having completed a tertiary level of education, the range between countries was similar: in Romania some 12.6 % of total employment was core HRST in 2010, while at the other end of the scale the share rose to 32.9 % in Luxembourg (see Table 13.2.2).

Within the EU-27 there were 14.3 graduates in mathematics, science and technology fields of education per 1 000 persons aged 20 to 29 years in 2009, with particularly high ratios in France, Romania, Finland and Lithuania (see Table 13.2.3). This ratio should be interpreted with care as some graduates may be foreigners who return home following their studies and so push up the ratio in the country where they studied and pull down the ratio in their country of origin; this may explain to a large extent the very low ratios recorded in two of the smallest Member States, Cyprus and Malta.

A similar but more specific measure of a country's potential research capability is provided by the number of doctoral students (see Table 13.2.4). There were 525 800 doctoral students in the EU-27 in 2007, compared with levels of 457 400 in the United States and 74 400 in Japan (these latter two figures are for 2009). In relative terms, the broad subject group of science, mathematics, computing, engineering, manufacturing and construction-related studies accounted for more than one third (36.4 %) of the doctoral students in the EU-27 in 2007, a proportion that was somewhat higher than in Japan (31.6 %, again for 2009) but lower than in the United States (38.1 %, also for 2009).

Women accounted for 47.8 % of doctoral students in the EU-27 in 2007, a share that was not too dissimilar from that recorded in the United States, where women were on a par with men (50.0 % in 2009); in contrast, men accounted for a much higher share of doctoral students in Japan (68.8 % in 2009). The gender split of doctoral students across the Member States was typically quite balanced in 2009: women accounted for more than half of all the doctoral students in the Baltic Member States, Portugal, Finland, Italy, Spain, Poland, Bulgaria and Slovenia, and at least 40 % of all doctoral students in the remaining Member States for which data are available, with the exception of Malta.

Data sources and availability

Statistics on science, technology and innovation (STI statistics) are based on Decision 1608/2003/EC concerning the production and development of Community statistics on science and technology. In close cooperation with the Member States, this Decision was implemented by Eurostat in the form of legislative measures and other work. Regulation 753/2004 was adopted in 2004 implementing Decision 1608/2003/EC.

Statistics on R & D personnel are compiled using guidelines laid out in the Frascati manual, published in 2002 by the OECD. R & D personnel include all persons employed directly within R & D, as well as persons supplying direct services to R & D, such as managers, administrative staff and clerical staff. For statistical purposes, indicators on R & D personnel who are mainly or partly employed on R & D are compiled as head counts (HC) and as full-time equivalents (FTEs). Researchers are a sub-category of R & D personnel and are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, and in the management of the projects concerned.

Statistics on HRST are compiled using guidelines laid out in the Canberra manual, prepared in cooperation between the OECD, European Commission, UNESCO and the International Labour Organisation, and published in 1995. HRST are defined on the basis of education and/or occupation. HRST based on education are persons having successfully completed tertiary education in one or more of seven broad fields: natural sciences, engineering and technology, medical sciences, agricultural sciences, social sciences, humanities, and other fields. HRST based on occupation are persons who are employed in science and technology occupations as professionals or technicians. Persons who fulfil both education and occupation criteria are classified as the HRST 'core'. Tertiary education is defined as levels 5a, 5b or 6 of the 1997 version of the international standard classification of education (ISCED). In 2007 a review of ISCED began and, at the time of writing, it is expected that the revised version will be presented to UNESCO's General Conference in November 2011. Among other changes, the revised ISCED proposes four levels of tertiary education compared with two categories in the current version.

Science and technology occupations are covered by major groups 2 and 3 of the international standard classification of occupations (ISCO-88).

HRST data can be broken down by sex, age, region, sector of activity, occupation, educational attainment and fields of education (although it should be noted that not all combinations are possible). Data relating to stocks of HRST provide information on the characteristics of the current labour force.

Information on HRST flows from education are obtained from a UNESCO/OECD/Eurostat questionnaire on education and this can be used to provide a measure of the current and future supply of HRST from the education system, in terms of actual inflows (graduates from the reference period) and potential inflows (students participating in higher education during the reference period). Science and technology graduates are defined as the number of new graduates from all public and private institutions completing science and technology-related graduate and post-graduate studies in the reference year; the number of graduates is expressed relative to the total number of persons aged 20-29 years.

Indicators based on the number of doctoral students give an idea of the extent to which countries will have researchers at the highest level of education in the future. The data relate to the number of students in the reference year; they do not refer to the number of new graduates or to the total number (stock) of graduates in the labour market that year. The number of doctoral students is measured as students enrolled in ISCED level 6: this level concerns tertiary programmes which lead to the award of an advanced research degree, for example, a doctorate in economics. These programmes should be devoted to advanced study and original research and are not based on course-work alone; studies at the doctoral level usually require 3 to 5 years.

Context

The European Research Area (ERA) is composed of all research and development activities, programmes and policies in Europe which involve a transnational perspective. In May 2008, the European Commission adopted a Communication to launch an initiative titled, 'better careers and more mobility: a European partnership for researchers'. The goal of this initiative is to improve the mobility of researchers and to enhance the diffusion of knowledge throughout Europe, by: balancing demand and supply for researchers at a European level; helping create centres of excellence; and improving the skills of researchers in Europe.

In December 2008, the competitiveness Council adopted a 2020 vision for the ERA. According to the opening statement of this vision, all players should benefit from: the 'fifth freedom', introducing the free circulation of researchers, knowledge and technology across the ERA; attractive conditions for carrying out research and investing in R & D intensive sectors; Europe-wide scientific competition, together with the appropriate level of cooperation and coordination. The 2020 vision for the ERA is part of the wider picture of Europe's 2020 strategy for smart, sustainable and inclusive growth.

As part of the EU's 7th framework programme for research and technological development (FP7) the European Commission announced in July 2011 nearly EUR 7 000 million of investment in research and innovation, with the aim of providing an economic stimulus expected to create around 174 000 jobs.

In the FP7 the Marie Curie actions have been regrouped and reinforced within the specific programme titled people. Entirely dedicated to human resources in research, this programme has an overall budget of more than EUR 4 700 million over a seven-year period until 2013. Within this programme, efforts will be made to increase participation by women researchers, by encouraging equal opportunities in all Marie Curie actions, by designing the actions to ensure that researchers can achieve an appropriate work/life balance and by facilitating resuming a research career after a break. A number of groups are actively promoting greater sex equality. Among others these include the European association for women in science, engineering and technology (WiTEC), and the European platform of women scientists (EPWS). Horizon 2020 is planned as the framework programme for research and innovation after 2013 – see the introduction for science and technology for more information.

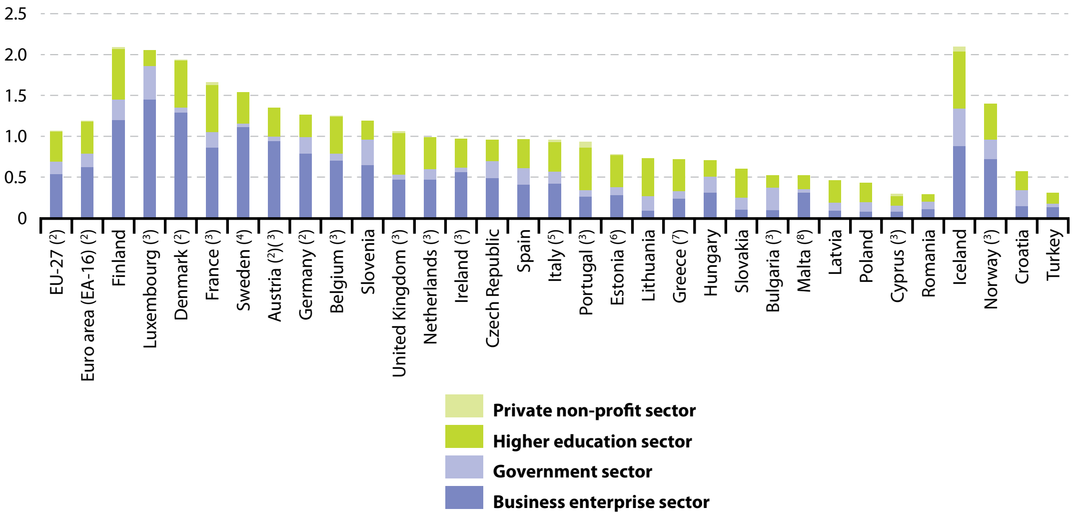
Table 13.2.1: Researchers, by institutional sector, 2009 ([1])

	Total	Business enterprise sector		Government sector		Higher education sector	
	(1 000 FTE)	(1 000 FTE)	(% of total)	(1 000 FTE)	(% of total)	(1 000 FTE)	(% of total)
EU-27	*1 584.9*	*702.6*	*44*	*196.5*	*12*	*668.0*	*42*
Euro area (EA-16)	*1 101.9*	*526.2*	*48*	*146.5*	*13*	*416.3*	*38*
Belgium	*37.2*	*17.4*	*47*	*2.8*	*8*	*16.6*	*45*
Bulgaria	*12.0*	*1.7*	*14*	*5.8*	*49*	*4.4*	*37*
Czech Republic	28.8	12.7	44	6.3	22	9.7	34
Denmark	*35.3*	*21.8*	*62*	*1.3*	*4*	*12.0*	*34*
Germany	*311.5*	*180.0*	*58*	*49.0*	*16*	*82.5*	*26*
Estonia	*4.3*	*1.3*	*30*	0.5	*12*	2.4	*56*
Ireland	*14.9*	*7.8*	*53*	*0.6*	*4*	*6.5*	*44*
Greece ([2])	*20.8*	*6.1*	*29*	*2.2*	*11*	*12.4*	*59*
Spain	133.8	46.2	34	24.2	18	63.2	47
France	289.5	146.9	51	*29.2*	*10*	109.2	38
Italy	*101.8*	*38.4*	38	*16.5*	*16*	43.1	*42*
Cyprus	*0.8*	*0.2*	*26*	*0.1*	*13*	*0.4*	*54*
Latvia	3.6	0.3	9	0.7	20	2.6	72
Lithuania	8.5	1.1	13	1.7	20	5.7	67
Luxembourg	*2.4*	*1.4*	*57*	*0.7*	*27*	*0.4*	*15*
Hungary	20.1	9.0	45	4.9	25	6.2	31
Malta	0.5	*0.2*	*49*	*0.0*	*8*	*0.2*	*43*
Netherlands	*46.7*	*20.3*	*44*	*6.8*	*15*	*19.5*	*42*
Austria	*34.5*	*21.8*	*63*	*1.5*	*4*	*11.0*	*32*
Poland	61.1	9.8	16	13.2	22	38.1	62
Portugal	*45.9*	*10.8*	*24*	*3.4*	*7*	*28.1*	*61*
Romania	19.3	6.1	32	5.7	30	7.3	38
Slovenia	*7.4*	*3.3*	*44*	*2.2*	*29*	*2.0*	*27*
Slovakia	13.3	1.6	12	2.8	21	8.9	67
Finland	40.8	23.6	58	4.5	11	12.3	30
Sweden	*46.8*	*29.3*	*63*	1.5	*3*	*15.9*	*34*
United Kingdom	*243.3*	*83.3*	*34*	*8.4*	*3*	*147.6*	*61*
Iceland	2.9	1.1	39	0.5	19	1.1	39
Norway	*26.6*	*13.3*	*50*	*4.4*	*16*	*9.0*	*34*
Switzerland ([3])	25.1	10.3	41	0.5	2	14.3	57
Croatia	6.9	1.3	19	2.0	29	3.6	52
Turkey	57.8	21.0	36	5.7	10	31.0	54
Japan ([3])	656.7	492.8	75	32.1	5	123.5	19
United States ([2])	*1 412.6*	1 130.5	*80*	:	:	:	:

([1]) Shares do not sum to 100 % due to estimates, the exclusion of private non-profit sector data from the table and the conversion of data to a count in terms of FTE.
([2]) 2007.
([3]) 2008.

Source: Eurostat (online data code: tsc00004), OECD

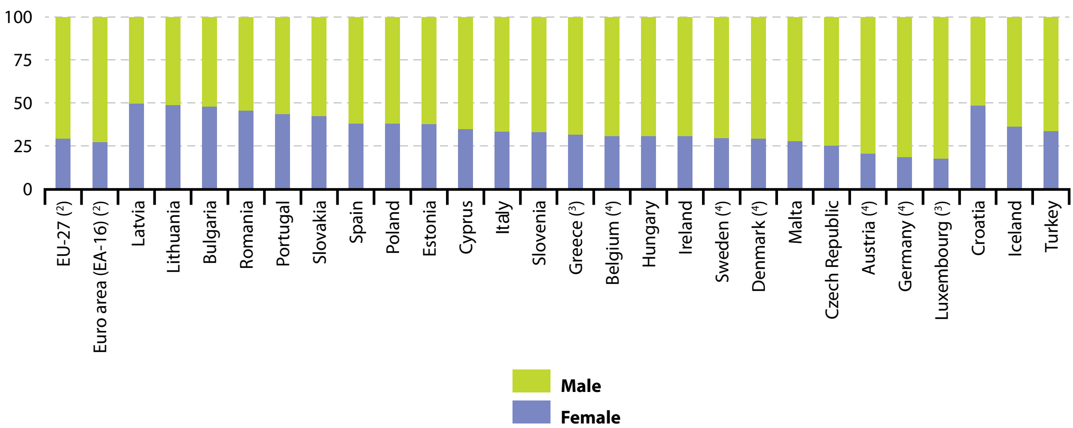
Figure 13.2.1: Proportion of research and development personnel by sector, 2009 (1)
(% of labour force)



(1) Germany, Ireland, Latvia, Lithuania, Luxembourg, Hungary, the Netherlands, Norway, Croatia and Turkey, private non-profit, not available.
(2) Estimates.
(3) Provisional.
(4) Provisional, except Government.
(5) Provisional, except higher education.
(6) Business enterprise, provisional.
(7) 2007, estimates.
(8) Provisional; private non-profit, 2008.

Source: Eurostat (online data code: tsc00002)

Figure 13.2.2: Gender breakdown of researchers in all institutional sectors, 2008 (1)
(% of total researchers, based on FTEs)



(1) France, the Netherlands, Finland and the United Kingdom, not available.
(2) Estimates.
(3) 2005.
(4) 2007.

Source: Eurostat (online data code: tsc00006)

Table 13.2.2: Human resources in science and technology, 2007-2010

	People working in an S&T occupation					People who have a tertiary education and work in an S&T occupation				
	(1 000)	(% of total employment)				(1 000)	(% of total employment)			
	2010	2007	2008	2009	2010	2010	2007	2008	2009	2010
EU-27	66 761	29.9	30.1	30.8	31.0	40 672	17.2	17.6	18.5	18.9
Belgium	1 530	33.1	32.5	33.5	34.2	1 115	23.7	22.9	23.8	24.9
Bulgaria	687	21.9	21.6	22.9	22.5	526	16.3	16.0	17.1	17.2
Czech Republic	1 721	33.3	33.8	35.6	35.3	708	11.5	11.8	13.4	14.5
Denmark	1 112	36.0	37.8	39.4	40.9	678	21.9	22.5	24.1	24.9
Germany	14 210	36.8	36.6	37.0	37.2	7 333	18.1	18.3	19.1	19.2
Estonia	179	27.3	26.7	30.0	31.4	125	18.0	17.9	21.1	21.9
Ireland	495	23.3	23.5	25.9	27.0	404	17.7	18.3	20.6	22.0
Greece	1 055	23.1	23.3	23.4	24.1	840	17.9	18.2	18.3	19.2
Spain	4 906	24.2	25.3	26.2	26.6	3 928	18.7	19.6	21.2	21.3
France	8 495	31.9	32.0	32.7	33.0	5 503	19.6	20.0	20.6	21.4
Italy	6 853	31.9	31.5	30.6	30.0	3 034	12.5	13.1	13.2	13.3
Cyprus	104	27.0	27.2	26.4	27.3	85	21.3	21.8	20.9	22.1
Latvia	284	29.8	31.1	32.4	30.2	185	15.7	17.2	19.5	19.7
Lithuania	433	26.9	29.2	30.3	32.3	336	19.0	20.5	22.1	25.0
Luxembourg	112	39.5	41.5	50.9	50.8	73	26.3	27.9	33.8	32.9
Hungary	1 063	26.6	27.8	28.3	28.1	660	15.5	16.3	17.2	17.5
Malta	45	27.3	28.1	28.7	27.6	23	13.6	14.1	14.3	14.0
Netherlands	3 231	37.6	37.9	38.0	39.3	1 904	22.0	22.5	22.9	23.1
Austria	1 280	29.7	29.9	31.2	31.4	526	11.5	11.8	12.8	12.9
Poland	4 509	26.2	26.3	27.4	28.3	3 028	16.0	16.3	17.8	19.0
Portugal	966	17.6	18.5	19.2	19.8	623	10.9	11.5	12.1	12.8
Romania	1 836	18.6	19.3	19.7	19.9	1 165	10.8	11.7	12.1	12.6
Slovenia	309	31.2	32.0	32.7	32.4	177	17.9	17.9	18.5	18.6
Slovakia	728	29.3	29.0	30.0	31.4	348	12.1	12.2	13.6	15.0
Finland	859	34.5	34.9	35.3	35.2	609	23.1	24.6	25.0	24.9
Sweden	1 878	39.3	39.6	40.6	41.4	1 187	23.9	24.4	25.5	26.1
United Kingdom	7 880	26.9	26.9	27.9	27.4	5 551	18.1	18.1	19.4	19.3
Iceland	64	33.4	36.3	38.4	38.6	37	18.9	20.6	21.8	22.2
Norway	976	36.9	37.4	38.7	39.1	703	25.9	26.3	27.7	28.2
Switzerland (1)	1 736	39.5	40.7	41.1	:	949	20.4	21.7	22.5	:
Croatia	413	24.0	24.9	26.5	27.0	267	14.7	15.3	16.6	17.4
FYR of Macedonia	128	20.7	19.0	19.9	20.1	89	13.1	11.9	13.2	13.9
Turkey	2 945	12.5	13.4	13.4	13.1	2 034	7.7	8.6	9.0	9.0

(1) 2009 instead of 2010 for the number of people.

Source: Eurostat (online data code: hrst_st_nocc)

Table 13.2.3: Science and technology graduates, 2004 and 2009
(tertiary graduates in science and technology per 1 000 persons aged 20-29 years)

	Total		Male		Female	
	2004	2009	2004	2009	2004	2009
EU-27	*12.5*	14.3	*16.9*	19.2	*7.9*	9.4
Belgium	11.2	12.0	16.6	17.5	5.7	6.6
Bulgaria	8.5	10.1	9.6	12.4	7.2	7.8
Czech Republic	7.4	15.3	10.2	20.5	4.4	9.8
Denmark	13.8	15.2	18.6	19.1	9.0	11.2
Germany	9.0	13.5	13.4	18.3	4.3	8.6
Estonia	8.9	10.8	10.5	12.8	7.4	8.7
Ireland	23.1	17.2	31.6	24.1	14.5	10.5
Greece (1)	8.0	11.2	9.2	12.5	6.8	9.8
Spain	12.5	12.5	16.9	17.0	7.7	7.8
France (2)	22.8	20.2	32.7	28.9	12.9	11.5
Italy (1)	10.8	11.3	13.4	13.6	8.1	9.0
Cyprus	4.2	4.6	5.2	5.9	3.2	3.4
Latvia	9.4	9.8	12.5	13.1	6.3	6.3
Lithuania	17.5	18.5	22.3	25.2	12.6	11.4
Luxembourg	:	:	:	:	:	:
Hungary	5.1	7.5	7.1	10.4	2.9	4.4
Malta (2)	3.4	7.0	4.6	9.4	2.1	4.5
Netherlands	7.9	8.9	12.6	14.2	3.1	3.6
Austria	8.7	14.0	13.4	21.1	4.0	6.8
Poland	9.4	14.3	12.4	17.4	6.4	11.0
Portugal	11.0	14.6	12.8	18.3	9.1	10.8
Romania	9.8	20.0	11.8	24.9	7.7	14.9
Slovenia	9.3	11.3	13.6	16.2	4.8	6.0
Slovakia	9.2	17.5	11.7	22.2	6.6	12.5
Finland	17.9	19.0	24.6	26.3	10.9	11.3
Sweden	15.9	13.0	20.6	17.1	11.0	8.7
United Kingdom	18.1	17.5	24.8	23.7	11.4	11.0
Iceland	10.8	10.3	13.2	12.6	8.3	7.8
Liechtenstein	0.9	7.0	0.9	10.1	0.9	3.7
Norway	9.0	9.0	13.4	12.4	4.4	5.5
Switzerland	14.6	18.1	24.6	28.9	4.7	7.1
Croatia	5.4	12.8	7.1	16.5	3.6	8.9
FYR of Macedonia	3.7	7.0	4.0	8.0	3.5	6.0
Turkey	5.6	8.0	7.6	11.0	3.5	4.9
Japan	13.4	14.2	22.4	23.7	4.0	4.1
United States	10.2	10.3	13.8	13.9	6.4	6.5

(1) 2008 instead of 2009.
(2) 2005 instead of 2004.

Source: Eurostat (online data code: tsiir050)

Table 13.2.4: PhD students (ISCED level 6), 2009

	Number (1 000)			Share (% of total PhD students)					
	Total PhD students	Male	Female	Social science, business & law	Teacher training & educ.; humanities & arts	Science, maths & comput.; engin., manuf. & construc.	Agriculture & veterinary	Health & welfare; services	Others (1)
EU-27 (2)	*525.8*	*274.4*	*251.4*	*21.8*	*21.0*	*36.4*	*2.9*	*14.5*	*2.0*
Belgium	12.5	7.0	5.5	21.2	12.4	43.2	7.0	16.1	0.1
Bulgaria	3.9	1.9	2.0	23.2	21.2	36.3	3.1	16.2	0.0
Czech Republic	24.9	14.7	10.2	17.5	16.9	48.3	4.2	13.1	0.0
Denmark	7.1	3.8	3.3	13.6	13.1	40.0	6.5	26.8	0.0
Germany	:	:	:	:	:	:	:	:	:
Estonia	2.5	1.1	1.4	20.5	22.8	43.5	4.8	8.4	0.0
Ireland	7.3	3.8	3.5	14.8	20.2	43.7	2.5	13.0	5.8
Greece (3)	21.6	12.1	9.5	22.6	20.4	33.1	2.6	21.3	0.0
Spain	77.2	37.1	40.1	21.7	22.3	24.4	1.9	19.5	10.2
France	71.7	38.2	33.5	27.0	24.1	46.1	0.1	2.7	0.0
Italy (4)	39.4	18.6	20.8	19.7	14.9	42.5	6.1	16.4	0.5
Cyprus	0.4	0.2	0.2	17.2	31.6	48.3	0.9	2.0	0.0
Latvia	2.0	0.8	1.2	33.7	22.0	32.6	2.1	9.5	0.0
Lithuania	2.9	1.2	1.7	31.6	:	40.3	4.6	:	0.0
Luxembourg	0.0	0.0	0.0	–	–	–	–	–	–
Hungary	6.9	3.5	3.4	21.6	26.7	31.6	5.1	15.0	0.0
Malta	0.1	0.1	0.0	21.6	33.8	29.7	0.0	14.9	0.0
Netherlands	7.7	4.4	3.4	:	:	:	:	:	100.0
Austria	18.5	10.1	8.4	34.2	21.2	31.2	3.2	7.9	2.3
Poland	32.5	15.6	16.9	24.9	23.9	35.8	1.9	13.5	0.0
Portugal	15.3	6.8	8.5	20.1	33.3	30.8	5.4	10.4	0.0
Romania	27.9	14.3	13.6	14.3	:	39.7	7.2	21.0	:
Slovenia	2.0	1.0	1.0	17.6	14.1	36.6	3.7	27.9	0.0
Slovakia	10.4	5.5	4.9	20.1	18.2	37.0	3.3	21.4	0.0
Finland	20.8	9.8	11.0	22.3	24.0	39.7	2.0	11.9	0.0
Sweden	19.9	10.0	9.9	11.8	11.1	41.7	2.1	33.3	0.0
United Kingdom	81.7	43.7	38.0	21.7	21.3	39.7	1.0	16.3	0.0
Iceland	0.3	0.1	0.2	18.4	24.1	34.8	1.1	21.6	0.0
Liechtenstein	0.0	0.0	0.0	33.3	3.3	0.0	0.0	63.3	0.0
Norway	6.9	3.5	3.4	19.2	11.5	39.7	1.8	26.6	1.3
Switzerland	19.1	10.9	8.2	25.7	16.3	39.1	2.3	16.2	0.4
Croatia	3.1	1.5	1.6	17.1	25.2	37.3	6.5	13.9	0.0
FYR of Macedonia	0.2	0.1	0.1	28.4	24.5	17.0	2.6	27.5	0.0
Turkey	35.9	19.9	16.0	23.6	23.5	33.3	7.6	11.9	0.0
Japan	74.4	51.2	23.2	12.8	13.9	31.6	5.5	33.0	3.1
United States	457.4	228.9	228.5	20.7	25.1	38.1	0.7	15.3	0.0

(1) Unknown or not specified.
(2) 2007.
(3) 2008.
(4) Analaysis by field of education, 2007.

Source: Eurostat (online data code: educ_enrl5)

13.3 Innovation

Europe has a long-standing tradition of producing inventions. However, commentators often focus on an entrepreneurial gap in order to explain why some ideas for new products or services do not become a success in the marketplace, or why other ideas relating to new processes do not get implemented, thereby surrendering the opportunity to make efficiency gains in production or within organisations. This subchapter looks at the state of innovation in the European Union (EU) by presenting data on where innovation takes place and how many enterprises are involved.

Main statistical findings

Extent of innovation

Among the EU Member States the highest propensity to innovate in 2008 (see Figure 13.3.1) was recorded in Germany (79.9 % of all enterprises), followed by Luxembourg (64.7 %) – these were the only Member States where more than 60 % of enterprises were innovative – the EU-27 average (excluding Greece) was 51.6 %. The lowest propensities to innovate were recorded in Latvia (24.3 %), Poland (27.9 %) and Hungary (28.9 %) – the only Member States where the proportion of innovative enterprises was below 30 %. Estonia, Cyprus and the Czech Republic were the only Member States that joined the EU in 2004 to report a propensity to innovate above the EU average. Note that large enterprises tend to innovate more than small and medium-sized enterprises (SMEs) and as such these figures for the Member States may, at least to some degree, reflect the enterprise structure of each domestic economy.

New or significantly improved products contributed a relatively small proportion of total turnover among innovative enterprises in 2008, with 15 of the 25 Member States for which data are available reporting single-digit shares (see Figure 13.3.2). These products did however account for a higher proportion of sales in Malta (24.7 %), Bulgaria (17.0 %), Hungary (16.6 %), the Czech Republic (16.1 %) and Slovakia (14.9 %).

Large enterprises (with 250 or more employees) were more likely to have brought product innovations to market in 2008 than either medium-sized enterprises (50 to 249 employees) or small enterprises (10 to 49 employees); this pattern held for all of the Member States for which data are available – as shown in Table 13.3.1. Lithuania was the only Member State where the proportion of small enterprises with product innovations was above the overall proportion for all enterprises.

A similar size class breakdown for process innovations that are developed within the enterprise also showed that large innovative enterprises were generally more likely to introduce such innovations: the main exception to this was Cyprus where process innovations were much less likely to have been introduced in large enterprises than in small or medium-sized enterprises, while this was also true to a lesser extent in Bulgaria and Lithuania; in Romania, Poland, Portugal and Finland small enterprises were more likely than large enterprises to have introduced process innovations, while in Italy and Slovenia medium-sized enterprises were the most likely to have introduced process innovations.

Innovations with environmental benefits

The environmental benefits of an innovation can occur during the production of a good or service, or during the after sales use of a good or service by the end-user. Table 13.3.2 shows the proportion of innovative enterprises having introduced environmental benefits with a distinction between benefits from the production or from the use of the innovative product: six different benefits related to production are presented as well as three benefits related to use. Among the benefits from production, the most common benefits were generally a reduction in energy use or increased recycling. The main exceptions were: Estonia and Lithuania, where the most common benefit was reduced material use; Latvia, Austria and Poland (and Croatia), where the most common benefit was reduced pollution; and the Netherlands, where the most common benefit was the use of less polluting or hazardous materials.

Among the benefits from after sales use, the most common benefit was reduced energy; reduced pollution was a more common benefit in Cyprus, Latvia and Poland (as well as Croatia), whereas improved end of product life recycling was the most common benefit in Ireland and Portugal.

Table 13.3.3 focuses on innovations with reduced energy use and presents an analysis by innovator size class. In every Member State for which data are available, large enterprises were more likely than either small or medium-sized enterprises to have introduced innovations with reduced energy use during production. A similar situation can be seen for innovations which lead to reduced energy use by end-users, although there were exceptions; in Latvia such innovations were more common among small enterprises and in Lithuania they were more common among medium-sized enterprises.

The motivation for environmental innovations is presented in Table 13.3.4. The most common reason for introducing environmental innovations appears to be either because of existing environmental regulations or taxes on pollution or because of voluntary codes or agreements for environmental good practice. Current or expected market demand from customers was, however, the most common motivation in the Netherlands and Finland. Expected future environmental regulations or taxes were also often cited as a motivation, for example, in Malta. In every Member State, the availability of government financial incentives for environmental innovation was the least common motivation of the five reasons that were surveyed.

Data sources and availability

The Community innovation survey (CIS) collects information about product and process innovation, as well as organisational and marketing innovations. The legal basis for the collection of these statistics is Regulation 1450/2004 of 13 August 2004 implementing Decision 1608/2003/EC concerning the production and development of Community statistics on innovation.

Innovations are based on the results of new technological developments, new combinations of existing technology, or the use of other knowledge acquired (by the enterprise). For the purpose of the Community innovation survey an innovation is defined as a new or significantly improved product (good or service) introduced to the market, or the introduction within an enterprise of a new or significantly improved process, as well as organisational and marketing innovations, including new logistics or distribution methods. Such innovations may be developed by the innovating enterprise or by another enterprise. However, purely selling innovations wholly produced and developed by other enterprises is not included as an innovation activity, nor is introducing products with purely aesthetic changes. Innovations should therefore be new to the enterprise concerned: for product innovations they do not necessarily have to be new to the market, and for process innovations the enterprise does not necessarily have to be the first one to have introduced the process.

Enterprises with innovation activity include all types of innovator, namely product and process innovators, as well as enterprises with only on-going and/or abandoned innovation activities. Enterprises may cooperate with other parties (for example suppliers, competitors, customers, educational/research establishments) when engaging in an innovative activity. The proportion of enterprises with innovation activity is also referred to as the propensity to innovate.

An environmental innovation is an innovation that creates environmental benefits compared with alternatives. The environmental benefits can be the primary objective or motivation of the innovation or the result of other innovation objectives.

The European innovation scoreboard formerly used for assessing innovation performance in the Member States has been reworked to improve international comparability and to include a number of research-oriented indicators in line with the purpose of monitoring the implementation of the innovation union.

Context

While Europe has a tradition of producing initial ideas (inventions), it is regarded by some as not being so good at bringing them to market; as such, EU policy in this field increasingly aims to provide more focus to industry-driven, applied research and development (R & D).

Education is another area seen as key to developing an innovation-oriented society, through the acquisition of entrepreneurial, managerial, scientific, mathematical and foreign-language skills, as well as digital literacy. Policymakers express concern at the numbers of science and technology graduates who directly apply their education once they move into the labour market, while a lack of job mobility between universities and business may potentially hinder the transfer of ideas, thereby reducing the EU's innovation performance (see R & D personnel).

In October 2006, the European Parliament and the Council adopted a Decision 1639/2006/EC establishing a competitiveness and innovation framework programme (CIP) for the period 2007-2013. With SMEs as its main target, the competitiveness and innovation framework programme aims to support innovation activities (including eco-innovation), provide better access to finance and deliver business support services in the regions. It encourages the take-up and use of information and communication technologies and aims to help to develop the information society. Furthermore, it also promotes the increased use of renewable energies and energy efficiency. Horizon 2020 is planned as the framework programme for research and innovation after 2013 – see the introduction for science and technology for more information.

The European Institute of Innovation and Technology was established in March 2008 to increase sustainable growth and competitiveness by reinforcing the innovation capacity and, most importantly, the innovation impact of the EU. Its aim is to bring together higher education, research and innovation through the creation of 'knowledge and innovation communities'.

In September 2009, the European Commission adopted a Communication ((2009) 442) 'reviewing Community innovation policy in a changing world'. In October 2010, as one of the seven flagship initiatives of the Europe 2020 strategy for smart, sustainable and inclusive growth, the European Commission adopted a Communication ((2010) 546) on an innovation union. This sets outs a comprehensive innovation strategy for Europe, focusing on major areas of concern for citizens such as climate change, energy efficiency and healthy living. It pursues a broad concept of innovation, not only technological, but also in business models, design, branding and services that add value for users. It includes public sector and social innovation as well as commercial innovation. It aims to involve all actors and all regions in the innovation cycle. The policies in the innovation union aim to do three things:

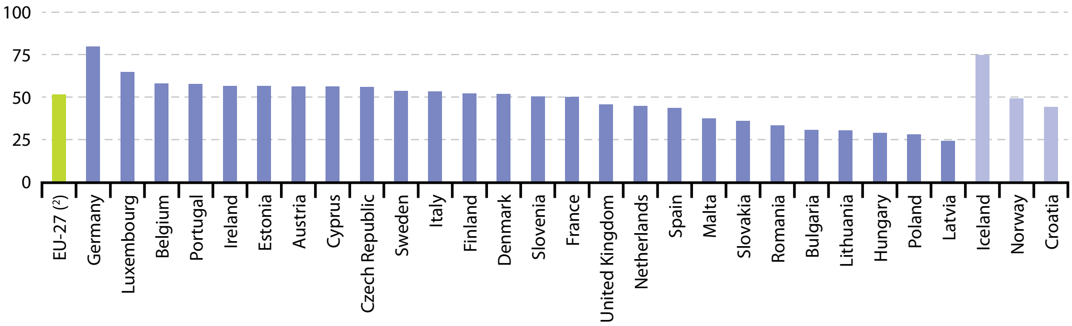
- make Europe into a world-class science performer;
- revolutionise the way public and private sectors work together, notably through innovation partnerships;
- remove bottlenecks like expensive patenting, market fragmentation, slow standard setting and skills shortages that currently prevent ideas getting quickly to market.

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. The first EIP announced in February 2011 is a partnership for active and healthy ageing and has three main objectives, namely to:

- enable EU citizens to lead healthy, active and independent lives while ageing;
- improve the sustainability and efficiency of social and healthcare systems;
- boost the competitiveness and markets for innovative products and services that respond to the ageing challenge.

The partnership for active and healthy ageing is focused on prevention and health promotion, integrated care, and independent living for older persons. Its overarching target is to increase the average number of healthy life years within the EU-27 population by two years by 2020.

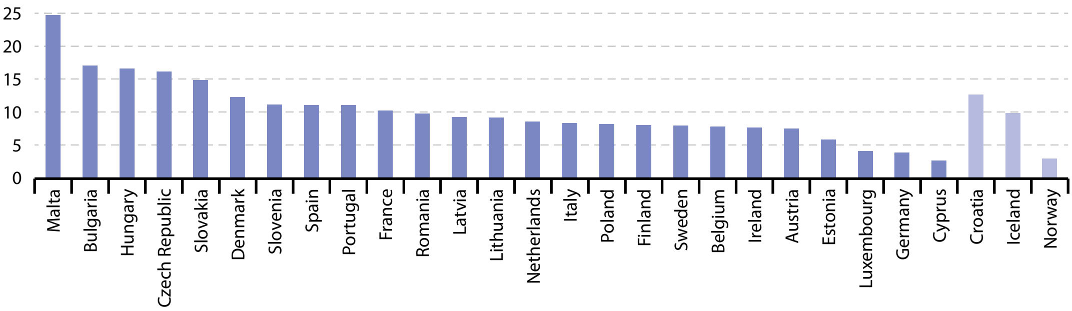
Figure 13.3.1: Proportion of innovative enterprises, 2008 ([1])
(% of all enterprises)



([1]) Greece, not available.
([2]) Excluding Greece.

Source: Eurostat (online data code: inn_cis6_type)

Figure 13.3.2: Turnover from new or significantly improved products new to the market, 2008 ([1])
(% of total turnover of innovative enterprises)



([1]) Greece and the United Kingdom, not available.

Source: Eurostat (online data code: inn_cis6_prod)

Table 13.3.1: Proportion of innovative enterprises which introduced products new to the market or own-developed process innovations, 2008
(% of enterprises within size class or total)

	Process innovations: developed by the enterprise or group				Product innovations: new to market			
	Total	With 10 to 49 employees	With 50 to 249 employees	With > 250 employees	Total	With 10 to 49 employees	With 50 to 249 employees	With > 250 employees
Belgium	42.2	42.7	39.3	47.5	47.5	47.1	45.5	59.3
Bulgaria	41.3	40.7	43.8	38.1	25.9	23.3	30.8	30.8
Czech Republic	39.0	40.1	35.4	41.2	39.1	34.0	47.0	54.1
Denmark	:	:	:	:	44.4	44.1	42.3	54.1
Germany	30.1	27.1	35.6	42.0	26.0	23.2	29.5	43.7
Estonia	40.5	37.9	44.3	56.0	25.8	24.2	28.0	36.1
Ireland	:	:	:	:	:	:	:	:
Greece	:	:	:	:	:	:	:	:
Spain	50.7	50.6	49.4	57.4	21.5	18.0	28.1	43.6
France	50.8	50.8	49.1	55.0	43.2	39.9	46.3	60.0
Italy	44.9	44.0	48.7	47.9	47.7	45.5	55.5	61.4
Cyprus	50.9	53.5	47.3	22.7	26.8	24.0	33.6	40.9
Latvia	33.9	31.3	36.1	50.6	23.4	22.7	21.5	35.6
Lithuania	51.8	55.0	47.3	46.4	37.2	40.2	28.8	47.1
Luxembourg	51.7	48.0	53.2	69.7	40.6	35.3	47.6	55.8
Hungary	24.8	25.0	21.0	32.6	33.1	31.2	32.0	45.2
Malta	47.7	46.9	46.9	55.0	39.1	38.3	32.7	60.0
Netherlands	23.4	22.0	25.7	29.4	49.2	48.1	51.3	53.6
Austria	37.6	34.9	41.7	45.8	49.5	46.3	52.1	66.4
Poland	43.7	45.8	40.7	42.7	41.5	40.1	41.6	47.5
Portugal	52.0	52.4	50.7	52.2	35.6	33.1	41.7	53.7
Romania	66.0	67.0	64.4	63.7	24.8	23.0	26.8	31.4
Slovenia	37.2	36.2	38.8	38.7	51.3	51.3	48.1	59.5
Slovakia	34.2	34.6	31.3	39.7	35.7	34.2	33.4	48.0
Finland	39.2	40.4	35.1	40.0	37.3	35.5	35.9	57.7
Sweden	33.5	33.1	33.0	39.5	50.4	48.3	53.6	62.8
United Kingdom	:	:	:	:	:	:	:	:
Norway	27.4	28.0	25.1	29.0	34.5	36.8	28.5	34.6
Croatia	37.4	36.9	39.3	36.0	37.4	36.7	38.5	39.1

Source: Eurostat (online data code: inn_cis6_prod)

Table 13.3.2: Innovations with environmental benefits — proportion of innovative enterprises introducing innovations with specified benefits, 2008
(% of innovative enterprises)

	Environmental benefits from the production of goods or services within the enterprise						Environmental benefits from the after sales use of a good or service by the end-user		
	Reduced material use per unit of output	Reduced energy use per unit of output	Reduced CO_2 'footprint' (total CO_2 production)	Replaced materials with less polluting or hazardous substitutes	Reduced air, water, soil or noise pollution	Recycled waste, water, or materials	Reduced energy use	Reduced air, water, soil or noise pollution	Improved recycling of product after use
Belgium	22.8	30.3	26.6	25.7	28.8	35.7	27.0	20.8	24.0
Bulgaria	11.6	13.6	6.0	10.0	10.5	8.6	8.8	8.1	6.1
Czech Republic	28.6	33.1	17.1	20.1	27.0	41.3	30.7	27.5	29.7
Denmark	:	:	:	:	:	:	:	:	:
Germany	38.8	46.4	38.5	25.5	41.7	41.2	44.0	35.5	30.8
Estonia	27.4	11.7	13.4	22.3	10.0	10.6	15.0	10.2	10.4
Ireland	28.2	33.5	33.1	30.9	27.1	54.3	33.1	23.8	37.1
Greece	:	:	:	:	:	:	:	:	:
Spain	:	:	:	:	:	:	:	:	:
France	27.6	28.2	21.0	26.5	24.7	38.8	23.9	17.6	17.7
Italy	13.0	16.5	13.4	15.3	23.8	25.8	23.5	23.5	23.3
Cyprus	10.8	13.6	8.6	8.2	13.5	13.2	5.4	6.1	5.6
Latvia	19.9	23.5	11.5	19.7	27.9	14.3	21.7	27.9	12.6
Lithuania	29.3	29.3	20.7	25.6	21.3	18.2	22.9	20.0	18.7
Luxembourg	20.8	24.8	27.1	26.6	22.6	41.4	30.1	18.3	29.2
Hungary	31.8	36.3	17.3	29.4	27.6	26.1	19.1	16.9	13.4
Malta	23.0	27.0	13.7	19.8	12.5	27.8	19.8	6.9	16.9
Netherlands	17.1	21.1	15.9	22.3	19.3	21.5	19.8	15.9	13.8
Austria	26.9	30.7	25.1	27.4	30.9	23.6	28.9	23.1	17.2
Poland	23.5	25.3	16.1	24.9	28.2	23.7	24.8	25.3	17.0
Portugal	37.8	41.5	31.5	41.3	46.2	58.5	39.1	38.8	41.8
Romania	31.3	32.8	22.7	21.1	31.5	32.3	30.3	29.6	20.1
Slovenia	:	:	:	:	:	:	:	:	:
Slovakia	20.2	23.7	9.2	19.5	21.9	29.3	26.2	21.0	19.0
Finland	32.0	32.9	25.9	24.0	22.8	32.2	33.0	20.3	22.2
Sweden	24.0	28.6	23.7	24.2	23.0	21.8	28.1	23.6	18.5
United Kingdom	:	:	:	:	:	:	:	:	:
Croatia	28.8	32.7	18.1	30.4	39.2	36.1	32.6	36.1	31.2

Source: Eurostat (online data code: inn_cis6_eco)

Table 13.3.3: Proportion of innovative enterprises introducing innovations with reduced energy use, 2008
(% of innovative enterprises)

	Reduced energy use per unit of output				End-user benefits, reduced energy use			
	Total	With 10 to 49 employees	With 50 to 249 employees	With > 250 employees	Total	With 10 to 49 employees	With 50 to 249 employees	With > 250 employees
Belgium	30.3	26.3	37.9	56.5	27.0	25.0	31.5	37.8
Bulgaria	13.6	11.4	15.5	24.4	8.8	8.3	8.2	15.0
Czech Republic	33.1	28.4	40.8	53.1	30.7	29.3	33.2	36.9
Denmark	:	:	:	:	:	:	:	:
Germany	46.4	42.9	54.5	60.4	44.0	41.4	49.3	55.9
Estonia	11.7	10.3	14.5	18.4	15.0	12.7	18.8	30.4
Ireland	33.5	28.0	44.7	64.4	33.1	31.8	35.1	43.1
Greece	:	:	:	:	:	:	:	:
Spain	:	:	:	:	:	:	:	:
France	28.2	23.8	35.0	50.5	23.9	21.6	27.0	38.5
Italy	16.5	14.8	22.6	34.8	23.5	21.5	30.8	43.3
Cyprus	13.6	11.5	19.3	28.0	5.4	4.8	7.3	8.0
Latvia	23.5	26.8	13.7	29.7	21.7	26.1	11.4	18.8
Lithuania	29.3	22.7	37.0	51.9	22.9	19.4	28.8	27.9
Luxembourg	24.8	17.5	33.8	54.6	30.1	28.5	28.3	48.3
Hungary	36.3	33.1	36.9	55.7	19.1	19.3	16.5	23.8
Malta	27.0	25.3	25.9	45.0	19.8	17.7	20.7	35.0
Netherlands	21.1	17.6	26.3	41.9	19.8	17.9	23.2	30.2
Austria	30.7	26.8	34.9	53.8	28.9	26.0	32.9	44.2
Poland	25.3	21.5	28.0	40.5	24.8	24.1	24.1	31.4
Portugal	41.5	40.2	43.8	55.9	39.1	40.2	34.7	40.6
Romania	32.8	29.2	37.1	50.6	30.3	28.8	32.3	37.2
Slovenia	:	:	:	:	:	:	:	:
Slovakia	23.7	18.3	31.4	45.5	26.2	24.9	27.7	32.9
Finland	32.9	28.4	38.9	56.5	33.0	29.7	35.7	55.6
Sweden	28.6	25.1	33.4	53.5	28.1	27.3	25.6	46.5
United Kingdom	:	:	:	:	:	:	:	:
Croatia	32.7	29.8	35.7	50.0	32.6	32.2	31.7	40.2

Source: Eurostat (online data code: inn_cis6_eco)

Table 13.3.4: Motivation to introduce environmental innovations — proportion of innovative enterprises reporting specified motivations, 2008
(% of innovative enterprises)

	Existing environmental regulations or taxes on pollution	Environmental regulations or taxes expected to be introduced in the future	Govern-ment grants, subsidies or other financial incentives for environmental innovation	Current or expected market demand from customers for environmental innovations	Voluntary codes or agreements for environmental good practice within sector
Belgium	20.1	16.3	7.8	13.6	26.1
Bulgaria	8.6	5.4	2.4	4.0	5.2
Czech Republic	40.6	26.8	9.5	13.6	24.3
Denmark	:	:	:	:	:
Germany	20.8	19.0	7.7	18.3	18.8
Estonia	24.1	19.3	4.4	17.2	26.3
Ireland	27.2	19.9	9.1	25.3	28.5
Greece	:	:	:	:	:
Spain	:	:	:	:	:
France	24.0	15.0	6.4	17.6	23.9
Italy	22.9	16.3	12.8	13.0	14.8
Cyprus	7.2	5.3	3.1	3.9	13.1
Latvia	19.1	11.3	8.3	13.6	34.0
Lithuania	39.3	31.8	12.5	26.8	24.5
Luxembourg	10.1	11.4	4.4	15.0	43.2
Hungary	41.3	34.5	4.1	31.9	32.8
Malta	23.8	23.8	8.1	11.3	13.3
Netherlands	10.5	9.2	6.7	13.8	12.7
Austria	:	:	:	:	:
Poland	24.1	16.1	4.9	12.7	13.3
Portugal	31.6	18.3	7.0	21.9	42.0
Romania	37.6	20.4	9.3	17.6	17.7
Slovenia	:	:	:	:	:
Slovakia	37.0	27.3	4.7	11.7	18.9
Finland	15.8	17.8	6.2	30.3	29.1
Sweden	8.4	12.3	2.7	14.7	15.1
United Kingdom	:	:	:	:	:
Croatia	35.7	28.0	8.4	19.6	30.3

Source: Eurostat (online data coed: inn_cis6_ecomot)

13.4 Patents

This subchapter provides information on patent applications in the European Union (EU). Intellectual property rights, in particular patents, provide a link between innovation, inventions and the marketplace. Applying for a patent makes an invention public, but at the same time gives it protection. A count of patents is one measure of a country's inventive activity and also shows its capacity to exploit knowledge and translate it into potential economic gains. In this context, indicators based on patent statistics are widely used to assess the inventive and innovative performance of a country.

Main statistical findings

With the exception of the years 2000 to 2002, the number of EU-27 patent applications filed with the European Patent Office (EPO) increased at a relatively fast pace from 1998 to the latest period for which data are available (2008), with annual growth averaging 7.3 % per annum between 1998 and 2000, and 2.6 % between 2002 and 2008. Over the whole of the period under consideration (1998-2008), the number of EU-27 patent applications filed with the EPO increased from 44 796 to 59 468.

Among the EU Member States, Germany had by far the highest number of patent applications to the EPO, some 24 557 in 2008 (41.3 % of the EU-27 total). In relative terms, Sweden reported the highest number of patent applications per million inhabitants (318.9), followed by Germany (298.7) and Finland (250.3). Between 2003 and 2008 the number of patent applications filed with the EPO increased in all Member States except Lithuania and the United Kingdom where small decreases were recorded; in contrast, relatively large decreases in patent applications to the EPO were recorded for Japan and the United States.

EU-27 high-technology patent applications to the EPO represented an increasing share of total patent applications up until 2001 when they accounted for 23.6 % of all applications. Their relative importance declined after this, as did their absolute number – from 12 078 high-technology patent applications in 2001, there was a relatively steady reduction through to 2007 (despite growth in 2004). This was followed by a collapse in the number of high-technology applications in 2008, with the total falling to 5 375 (provisional data). Behind Romania (which had a very small number of total patent applications) the highest shares of high-technology patent applications in total patent applications in 2008 were recorded for Finland, Belgium and France, while high-technology patent applications accounted for a low share of total applications in Luxembourg, Estonia, Austria and Italy.

Finland and Sweden registered the highest number of high-technology patent applications per million inhabitants in 2008, the figures for both countries being over 35, while Germany, the Netherlands, Denmark, Belgium, France and Austria were the only other Member States to record double-digit ratios.

The considerable reduction in high-technology patent applications filed with the EPO may reflect the length of patent procedures. Given the increasing speed of technological change and the rapid pace at which imitators are able to bring new technologies to market, it may be that enterprises increasingly choose to invest in continued innovation alongside patent protection.

Just under two fifths (38.2 %) of EU-27 patent applications to the EPO in 2008 were from a single inventor, while the remainder were co-patents (see Figure 13.4.2). By far the most common type of co-patent involved multiple inventors/applicants from a single country – in fact, such co-patents made up an overall majority (54.0 %) of all patent applications. Patent applications involving inventors from more than one country made up the remaining 7.8 % of patent applications to the EPO.

Citations in a patent application may be references to other patents or to other relevant reference material, such as scientific journals. Figure 13.4.3 shows that EU patent citations were more likely to refer to EU patent publications than to non-EU patent publications; this is an established pattern that could be observed each year between 1997 and 2007.

Data sources and availability

Since 2007 Eurostat's production of European Patent Office (EPO) data has been based almost exclusively on the EPO's worldwide statistical patent database (PATSTAT). The EPO grants European patents for the contracting states to the European Patent Convention (EPC), of which there are currently 38 – the EU Member States, the EFTA Member States, several other candidate countries (Croatia, the former Yugoslav Republic of Macedonia and Turkey), as well as Albania, Monaco, San Marino and Serbia.

European patent applications refer to applications filed directly under the EPC or to applications filed under the Patent Cooperation Treaty (PCT) and designated to the EPO (Euro-PCT). Patent applications are counted according to the year in which they are filed and are assigned to a country according to the inventor's place of residence, using fractional counting if there are multiple inventors.

In contrast, the United States Patent and Trademark Office (USPTO) data refer to patents granted; data are recorded by year of publication as opposed to the year of filing. This methodological difference implies that any comparison between EPO and USPTO patent data should be interpreted with caution.

High-technology patents are counted following criteria established by the trilateral statistical report (drafted by the EPO, USPTO and the Japan Patent Office (JPO)), where the following technical fields are defined as high-technology groups in accordance with the international patent classification (IPC): computer and automated business equipment; micro-organism and genetic engineering; aviation; communication technology; semiconductors; and lasers.

Context

Intellectual property law establishes protection over intangibles – for example, when a manufactured product is sold, the product itself becomes the property of the purchaser, however, intellectual property rights allow intangible elements to remain in the ownership of the creator; these intangibles include (among others) the idea itself, or the name or sign/logo used to distinguish the product from others.

Patents and trademarks are common ways to protect industrial property. Patents are a limited term exclusive right granted to an inventor, maintained through the payment of fees. While patents are generally used to protect research and development (R & D) results, they are also a source of technical information, which can potentially prevent re-inventing and re-developing ideas. A count of patents shows a country's capacity to exploit knowledge and translate it into potential economic gains; in this context, patent statistics are widely used to assess the inventive and innovative performance of countries. Most studies show that innovative enterprises tend to make more use of intellectual property protection than enterprises that do not innovate. Enterprise size and the economic sector in which an enterprise operates are also likely to play an important role in determining whether an enterprise chooses to protect its intellectual property; for this reason the structure of an economy plays a part in the level of patent applications.

The use of patents is relatively restricted within the EU – this may be due to a range of influences: their relative cost; the overlap between national and European procedures; or the need for translation into foreign languages. Furthermore, the increasing number and complexity of patent applications worldwide has resulted in a backlog of pending applications, while the constant expansion of the human knowledge base makes it increasingly difficult for patent offices to keep abreast of technological developments.

The European Council held in Lisbon in March 2000 called for the creation of a Community patent system to address shortcomings in the legal protection of inventions, while providing an incentive for investments in R & D. In July of the same year the European Commission made a first proposal for the creation of a Community patent: this was discussed at various levels and despite a number of proposals and amendments for a Council Regulation during 2003 and 2004 no legal basis was forthcoming. In

April 2007 the European Commission released a Communication (COM(2007) 165) titled 'Enhancing the patent system in Europe', stating that European patent systems were more expensive, uncertain and unattractive than those in non-member countries.

In July 2008 the European Commission adopted a Communication (COM(2008) 465) titled 'An industrial property rights strategy for Europe' foreseeing the development of legislation, arguing that the harmonisation of patent law should make it easier for European enterprises to patent their inventions both within and outside the EU.

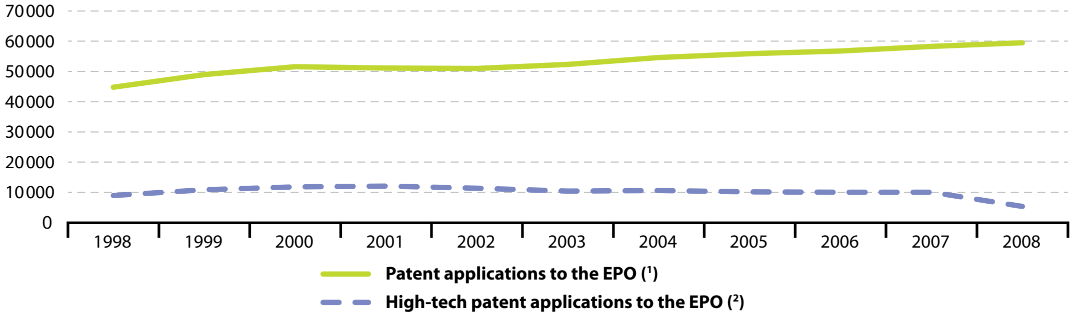
On 4 December 2009, the European Council unanimously adopted conclusions on an enhanced patent system in the EU. The package agreed covers two main areas: firstly, agreement on the approach to be adopted in order to move towards an EU patent regulation; secondly, an agreement on establishing a new patent court in the EU. It is anticipated that these measures will together make it less costly for businesses to protect innovative technology and make litigation more accessible and predictable. However, the creation of the EU patent depends on a solution being found for translation arrangements which were the subject of European Commission proposal (COM(2010) 350) for a 'Council Regulation on the translation arrangements for the European Union patent' in July 2010. In December 2010 it became clear that there was not unanimous agreement on this proposal: in February 2011 the European Parliament gave its consent for the use of the enhanced cooperation procedure to make progress on this issue and this was authorised by the Council in March 2011.

Table 13.4.1: Patent applications to the EPO and patents granted by the USPTO, 2000-2008

	Patent applications to the EPO			High technology patent applications to the EPO			Patents granted by the US Patent & Trademark Office		
	(number of patent applications)		(per million inhab.)	(number of patent applications)		(per million inhab.)	(number of patents granted)		(per million inhab.)
	2003	2008	2008	2003	2008	2008	2000	2005	2005
EU-27	52 318	59 468	119.5	10 446	5 375	10.8	32 009	18 153	37.0
Belgium	1 340	1 519	142.4	278	205	19.2	772	484	46.4
Bulgaria	22	32	4.2	3	2	0.3	4	77	9.9
Czech Republic	112	200	19.3	12	15	1.5	41	57	5.6
Denmark	1 071	1 275	232.9	260	106	19.3	597	349	64.5
Germany	21 994	24 557	298.7	3 537	1 934	23.5	13 127	7 766	94.1
Estonia	11	35	25.9	7	1	0.7	3	8	6.0
Ireland	223	324	73.7	51	37	8.3	192	179	43.5
Greece	85	127	11.3	22	10	0.9	21	33	2.9
Spain	948	1 545	34.1	135	126	2.8	396	229	5.3
France	7 902	8 557	133.7	1 908	1 145	17.9	4 441	2 759	44.0
Italy	4 378	5 349	89.7	489	250	4.2	2 086	1 152	19.7
Cyprus	6	10	13.2	3	1	1.3	5	3	3.8
Latvia	8	24	10.4	1	3	1.3	10	3	1.4
Lithuania	17	10	3.0	2	1	0.4	6	29	8.5
Luxembourg	88	115	238.1	6	2	4.2	51	43	94.0
Hungary	132	195	19.4	26	21	2.1	75	60	5.9
Malta	6	10	23.9	:	1	2.4	3	1	2.5
Netherlands	3 459	3 711	226.2	1 012	342	20.9	1 777	1 227	75.3
Austria	1 358	1 932	232.2	224	99	11.9	709	426	52.0
Poland	111	226	5.9	14	17	0.5	33	49	1.3
Portugal	65	144	13.6	10	16	1.5	16	20	1.9
Romania	16	36	1.7	3	10	0.5	6	17	0.8
Slovenia	73	119	59.1	6	8	4.0	32	10	5.2
Slovakia	31	50	9.2	4	5	0.9	9	8	1.4
Finland	1 278	1 327	250.3	578	199	37.5	1 060	636	121.5
Sweden	2 029	2 928	318.9	456	337	36.7	1 783	540	59.9
United Kingdom	5 555	5 511	90.1	1 399	482	7.9	4 754	2 195	36.5
Iceland	31	28	88.8	13	2	7.7	27	18	62.2
Liechtenstein	22	34	963.9	2	3	75.5	14	16	470.3
Norway	342	563	118.8	69	19	4.1	328	194	42.0
Switzerland	2 762	3 351	441.3	355	205	27.1	1 680	896	120.8
Croatia	42	32	7.2	1	3	0.6	18	10	2.2
FYR of Macedonia	:	:	:	:	1	0.2	:	:	:
Turkey	85	270	3.8	10	14	0.2	16	12	0.2
Japan	21 600	20 239	158.5	7 623	3 317	26.0	110 199	83 784	253.3
United States	32 601	31 602	103.8	11 150	2 967	9.7	43 396	32 358	283.0

Source: Eurostat (online data codes: tsc00009, tsiir060, pat_ep_ntec, tsc00010, pat_us_ntot and tsiir070)

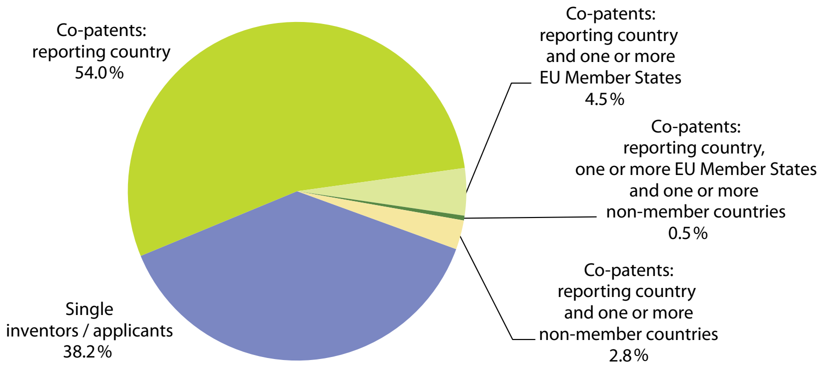
Figure 13.4.1: Patent applications to the EPO, EU-27, 1998-2008
(number of patent applications)



(1) 2007 and 2008, estimates.
(2) 2008, provisional.

Source: Eurostat (online data codes: pat_ep_ntot and pat_ep_ntec)

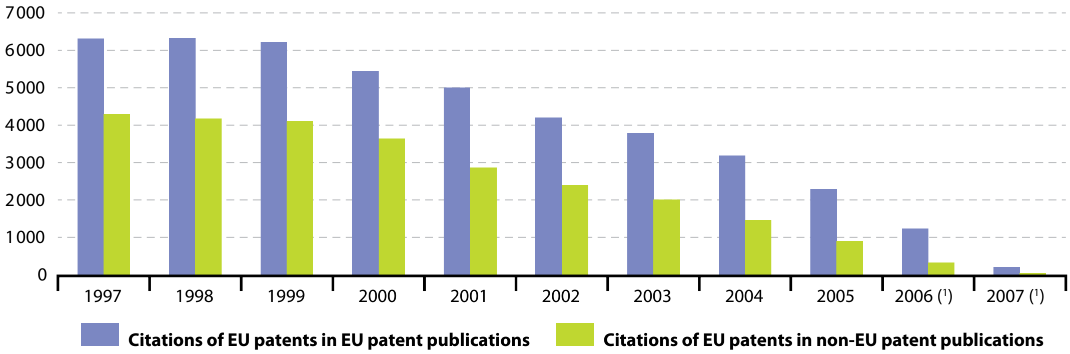
Figure 13.4.2: Co-patenting at the EPO according to inventors' country of residence, 2008 (1)
(% of total)



(1) Provisional.

Source: Eurostat (online data code: pat_ep_cpi)

Figure 13.4.3: EU patent citations (EPO), 1997-2007
(number)



(1) Provisional.

Source: Eurostat (online data code: pat_ep_cti)