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Science, technology and innovation in Europe

2013 edition

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Table of contents

Introduction 7
Abbreviations and symbols 9

Part I — Investing in R&D

Chapter 1 — Government budget appropriations or outlays on R&D (GBAORD) 17
Chapter 2 — R&D expenditure 25

Part II — Monitoring the knowledge workers

Chapter 3 — R&D personnel 39
Chapter 4 — Human resources in science and technology (HRST) 51

Part III — Productivity and competitiveness

Chapter 5 — Innovation 67
Chapter 6 — Patents 87
Chapter 7 — High technology 101

Methodological notes 123

Table des matières

Introduction 7

Abréviations et symboles 9

Partie I — Investir dans la R&D

Chapitre 1 — Crédits budgétaires publics de R&D (CBPRD) 17

Chapitre 2 — Dépenses de R&D 25

Partie II — Suivi des travailleurs du savoir

Chapitre 3 — Personnel de R&D 39

Chapitre 4 — Ressources humaines en sciences et technologie (HRST) 51

Partie III — Productivité et compétitivité

Chapitre 5 — Innovation 67

Chapitre 6 — Brevets 87

Chapitre 7 — Haute technologie 101

Notes méthodologiques 123

Inhaltsverzeichnis

Einleitung 7

Abkürzungen und Symbole 9

Teil I — FuE-Investitionen

Kapitel.1 — Staatliche Aufwendungen für FuE (GBAORD) 17

Kapitel. 2 — FuE-Ausgaben 25

Teil II — Beobachtung der Wissensarbeiter

Kapitel. 3 — FuE-Personal 39

Kapitel. 4 — Humanressourcen im Wissenschafts- und Technologiebereich (HRST) 51

Teil III — Produktivität und Wettbewerbsfähigkeit

Kapitel. 5 — Innovation 67

Kapitel. 6 — Patente 87

Kapitel. 7 — Hochtechnologie 101

Angaben zur Methodik 123

This pocketbook gives an overview of science, technology and innovation (STI) statistics. All the statistical data and indicators are based on sources available at Eurostat. Only the most relevant indicators have been selected so as to give an overall statistical picture of science, technology and innovation in Europe and of where the EU stands in relation to its partners.

Eurostat has been collecting STI data for many years to meet the needs of policymakers and the scientific community. In 2010 the Commission acknowledged that STI statistics are closely linked to the European Union's policy activities. Innovation indicators are thus a key element in monitoring the objectives of the Innovation Union initiative and the European Research Area (ERA) under the various Europe 2020 Strategy priorities.

The Europe 2020 Strategy sets out a vision of Europe's social market economy for the 21st century with the 3 % R&D intensity goal as one of the five headline targets to be achieved by the EU by 2020.

On 17 July 2012, the Commission adopted its Communication on '*A Reinforced European Research Area (ERA) Partnership for Excellence and Growth*'. The ERA is a unified research area open to the world and based on the internal market, in which researchers, scientific knowledge and technology circulate freely. EU Member States, the Commission and research organisations need to implement the measures in the Communication to ensure completion of the ERA by 2014 as called for by the European Council.

This statistical publication is by no means exhaustive: it is a showcase for the main data sets available. All sources that have been used are acknowledged beneath each table or graph.

The focus is on the EU-27 and the candidate countries. However, for purposes of international comparison, other countries are included wherever the relevant data are available.

The pocketbook is divided into three main parts and seven chapters, as follows:

Part 1 ('Investing in R&D') deals with government budget appropriations or outlays on R&D (GBAORD — Chapter 1) and R&D expenditure (Chapter 2).

Part 2 ('Monitoring the knowledge workers') sets out data on R&D personnel (Chapter 3) and human resources in science

and technology (HRST — Chapter 4).

Part 3 ('Productivity and competitiveness') features statistics on innovation (Chapter 5), patents (Chapter 6) and high technology (Chapter 7).

The three main parts are supplemented by methodological notes (including definitions) for the various statistical data sources used.

NB: Tables and figures in this publication refer to the data available in Eurostat's reference database at the time of writing (September to December 2012). However, the reference database is updated regularly as new data are received, so the most recent data may differ from those available at the time of publishing.

A code (such as 'gba_nabsfin07') has been inserted as part of the source wherever Eurostat data is presented in this publication. This code allows the reader to easily access the complete and most recent data on the Eurostat website by means of the search function which can be found in the upper-right corner of the Eurostat homepage (http://ec.europa.eu/eurostat). The PDF version contains hyperlinks to the data set.

Statistical symbols and abbreviations

b	break in series
e	estimate
f	forecast
p	provisional
r	revised value
s	Eurostat estimate
u	unreliable data
:	data not available
:c	confidential data
:u	extremely unreliable data
-	not applicable or real zero
%	percentage
0	less than fifty percent of the unit used
1 000	thousands
2011	calendar year (e.g. from 01.01.2011 to 31.12.2011)
2009/10	academic year (e.g. from 01.09.2009 to 31.8.2010)
2005–2011	period of several calendar years (e.g. from 01.01.2005 to 31.12.2011)

Abbreviations

AGR	Annual growth rate
ABR	Abroad
AAGR	Average annual growth rate
BERD	Business enterprise intramural expenditure on R&D
BES	Business enterprise sector
CC	Candidate countries
CIS 2010	Community Innovation Survey 2010
COMEXT	Eurostat reference database containing external trade statistics
EEA	European Economic Area (EU-27, Iceland, Liechtenstein and Norway)
EFTA	European Free Trade Association

EPO	European Patent Office
ESA	European System of Accounts
EU-LFS	European Union Labour Force Survey
EUR	Euro
Eurostat	Statistical Office of the European Union
EXP	Expenditure
FTE	Full-time equivalent
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOV	Government sector
GUF	General University Funds
HC	Head count
HES	Higher education sector
HRST	Human Resources in Science and Technology
HRSTC	Human Resources in Science and Technology — Core
HRSTE	Human Resources in Science and Technology — Education
HRSTO	Human Resources in Science and Technology — Occupation
HRSTU	Human Resources in Science and Technology — Unemployed
IPC	International Patent Classification
ICT	Information and communications technology
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
JPO	Japanese Patent Office
KIA	Knowledge-Intensive Activities
KIABI	Knowledge-Intensive Activities – Business Industries
KIS	Knowledge-Intensive Services

MS	Member States
MSTI	Main Science and Technology Indicators (OECD)
NABS	Nomenclature for the analysis and comparison of scientific programmes and budgets
NACE	Statistical classification of economic activities in the European Communities
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Cooperation and Development
PCT	Patent Cooperation Treaty
PNP	Private non-profit sector
PPS	Purchasing power standard
PSL	Personnel
R&D	Research and development
S&E	Science and engineering
S&T	Science and technology
SBS	Structural Business Statistics
SES	Structure of Earning Survey
SITC	Standard International Trade Classification
SMEs	Small and medium-size enterprises
STI	Science Technology and Innovation
UNESCO	United Nations Educational Scientific and Cultural Organization
USPTO	United States Patent and Trademark Office
VCI	Venture Capital Investment
WIPO	World Intellectual Property Organisation

Country abbreviations

Aggregates

EU-27 The 27 Member States of the European Union from 1 January 2007 (BE, BG, CZ, DK, DE, EE, IE, EL, ES, FR, IT, CY, LV, LT, LU, HU, MT, NL, AT, PL, PT, RO, SI, SK, FI, SE, UK)

EU-15 The 15 Member States of the European Union prior to accession of ten candidate countries on 1 May 2004 (BE, DK, DE, IE, EL, ES, FR, IT, LU, NL, AT, PT, FI, SE, UK)

EU Member States

BE	Belgium
BG	Bulgaria
CZ	Czech Republic
DK	Denmark
DE	Germany
EE	Estonia
IE	Ireland
EL	Greece
ES	Spain
FR	France
IT	Italy
CY	Cyprus
LV	Latvia
LT	Lithuania
LU	Luxembourg
HU	Hungary
MT	Malta
NL	Netherlands
AT	Austria
PL	Poland
PT	Portugal
RO	Romania
SI	Slovenia
SK	Slovakia
FI	Finland
SE	Sweden
UK	United Kingdom

EFTA countries

IS [1]	Iceland
LI	Liechtenstein
NO	Norway
CH	Switzerland

Candidate countries

HR	Croatia
MK [2]	Former Yugoslav Republic of Macedonia
ME	Montenegro
RS	Serbia
TR	Turkey

Other countries

AU	Australia
CA	Canada
CN	China
IL	Israel
IN	India
JP	Japan
KR	South Korea
RU	Russia
TW	Taiwan
US	United States

[1] Also a candidate country.
[2] Provisional code which does not prejudge in any way the definitive nomenclature for this country, and which will be agreed upon following the conclusion of negotiations currently taking place at the United Nations.

I

Investing in R&D

1 Government budget appropriations or outlays on R&D (GBAORD)

Government budget appropriations or outlays on research and development (GBAORD) are funds allocated to R&D in central government or federal budgets. They represent budgetary provisions, not actual expenditure.

In 2011, GBAORD expressed as a percentage of GDP stood at 0.73 % in the EU-27, representing a slight decrease compared to 2010 (0.76 %). This was below the levels recorded by its major economic partners: Japan (0.78 %) and the United States (1.02 %, 2010 data). Japan recorded an increase in 2011 (0.78 %) compared to 2010 (0.74 %), while the United States experienced a decrease from 1.18 % in 2009 to 1.02 % in 2010. In South Korea, GBAORD as a share of GDP was stable and continued to increase after 2005 reaching 1.09 % in 2010.

In 2011, wide disparities in GBAORD as a share of GDP were observed among the Member States, ranging from 1.09 % in Finland to 0.15 % in Latvia. Finland, Denmark and Portugal were the only Member States where this share exceeded 1 %, as was also the case in the United States and South Korea. A further six Member States recorded GBAORD levels above the EU-27 average (0.73 %): Germany, France, the Netherlands, Sweden, Austria and Estonia.

In 2011, GBAORD in the EU-27 amounted to EUR 92 308 million. The three leading Member States in terms of GBAORD — Germany, France and the United Kingdom — accounted for more than half of this amount.

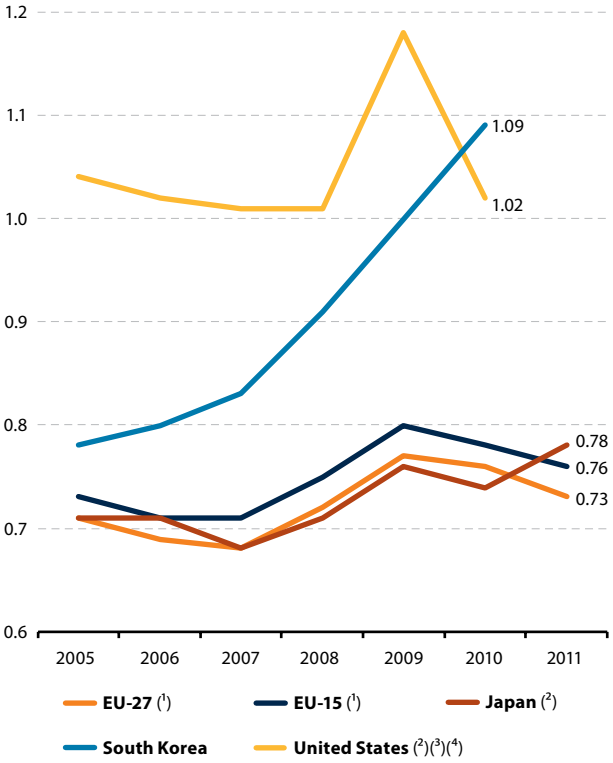
Government budget appropriations or outlays on R&D are distributed by socio-economic objectives, depending on the purpose of the R&D programmes or projects, on the basis of the Nomenclature for the analysis and comparison of scientific programmes and budgets (NABS 2007).

In 2011, the main socio-economic objective within the EU-27 was 'general advancement of knowledge: R&D financed from general university funds (GUF)', which accounted for 33.2 % of total GBAORD, followed by 'general advancement of knowledge: R&D financed from other sources than GUF' (17.0 %), 'industry production and technology' (9.9 %) and 'health' (8.5 %).

In Japan, 'general advancement of knowledge: R&D financed from GUF' was also the prime objective, taking up 36.4 % of total GBAORD, while in the United States more than half of GBAORD (57.3 %, 2010 data) was allocated to 'defence'.

At country level, the two socio-economic objectives linked to the 'general advancement of knowledge' accounted for the largest shares of total GBAORD in 25 Member States. 'Industrial production and technology' was the top socio-economic objective in Belgium, while 'education' came first in Lithuania.

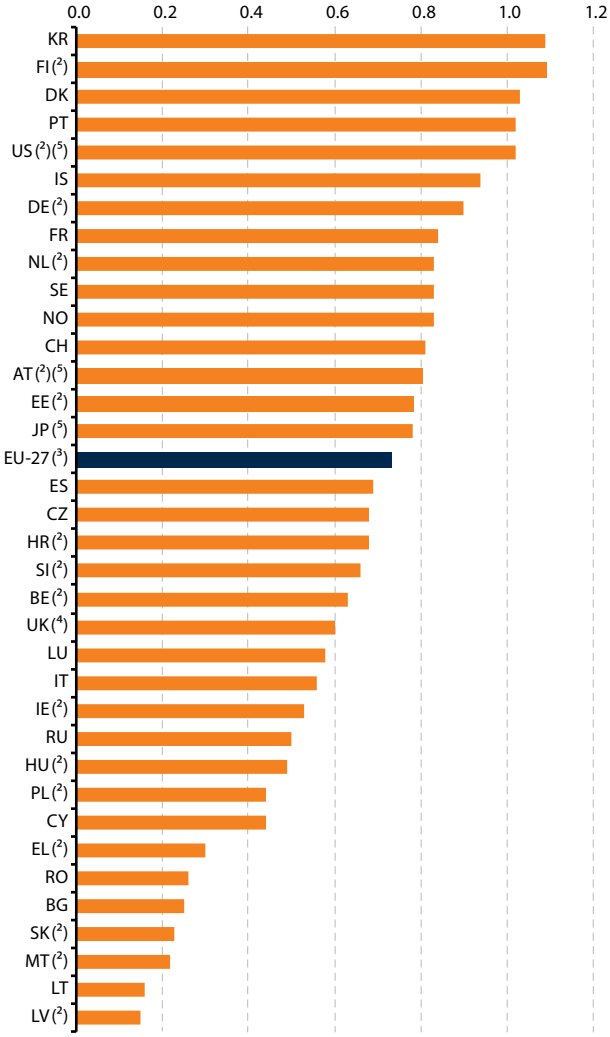
Figure 1.1: Total GBAORD as a percentage of GDP, EU-27, EU-15, Japan, South Korea and the United States, 2005–2011
(% of GDP)



(1) From 2009 to 2011, Eurostat estimate.
(2) Federal or central government only; excluding R&D in the social sciences and humanities.
(3) 2009 and 2010, provisional data; 2009, break in series.
(4) Total excludes data for the R&D content of general payment to the higher education sector for combined education and research (public GUF).

Source: Eurostat (online data code: gba_nabsfin07); for KR, JP and US, OECD-MSTI.

Figure 1.2: Total GBAORD as a percentage of GDP, 2011 (1)
(% of GDP)



(1) KR, US, CH and RU, 2010; EL, 2008.
(2) Provisional data.
(3) Eurostat estimate.
(4) National estimate.
(5) Federal or central government only.

Source: Eurostat (online data code: gba_nabsfin07); for KR, JP and US, OECD-MSTI .

Table 1.3 (Part I): Total GBAORD in million EUR and by socio-economic objectives (NABS 2007) as a percentage of total, 2011 (1)

	Total GBAORD in million EUR		Exploration and exploitation of the earth		Environment		Exploration and exploitation of space		Transport, telecommunication and other frastructures		Energy		Industrial production and technology		Health	
EU-27	92 308	s	1.9	s	2.5	s	5.5	s	3.1	s	4.2	s	9.9	s	8.5	s
BE	2 326	p	0.6	p	2.4	p	8.7	p	1.7	p	1.7	p	35.1	p	1.8	p
BG	96		6.9		3.0		1.6		0.2		0.8		9.7		1.4	
CZ	1 048		1.9		2.0		1.6		3.2		3.3		15.1		6.1	
DK	2 459		0.4		2.1		1.3		0.9		4.7		9.8		10.3	
DE (2)	23 437	p	1.8	ip	2.7	ip	4.8	ip	1.4	ip	4.4	ip	15.9	ip	4.5	ip
EE	124	p	2.3	p	5.8	p	1.8	p	13.1	p	2.1	p	11.4	p	15.2	p
IE	823	p	0.2	p	1.7	p	1.7	p	0.9	p	2.4	p	23.0	p	5.3	p
EL	691	p	3.6	p	2.1	p	2.0	p	2.5	p	2.4	p	9.6	p	5.5	p
ES	7 294		1.8		4.4		4.7		5.4		3.3		8.7		14.2	
FR (2)	16 814		0.8	i	1.5	i	12.9	i	6.0	i	6.2	i	1.7	i	6.8	i
IT	8 891		4.3		3.1		7.4		1.7		6.4		11.9		9.9	
CY	78		0.7		1.1		0.0		1.1		0.0		0.0		2.6	
LV	30	p	2.9	p	8.1	p	0.5	p	7.2	p	8.1	p	10.5	p	6.7	p
LT	50		0.0		0.3		0.0		0.0		1.3		0.0		9.4	
LU	249		0.6		2.4		0.2		3.0		1.6		4.7		14.7	
HU	492	p	1.1	p	2.6	p	0.1	p	7.1	p	1.3	p	8.4	p	8.9	p
MT	15	p	0.0	p	2.1	p	0.0	p	0.1	p	1.4	p	0.7	p	0.3	p
NL	4 972	p	0.6	p	0.6	p	2.9	p	3.1	p	2.2	p	8.0	p	5.2	p
AT (2)	2 408	ip	2.0	ip	2.4	ip	0.6	ip	1.4	ip	1.4	ip	14.0	ip	4.1	ip
PL (3)	1 631	p	2.9	ip	0.5	ip	0.2	ip	2.1	ip	1.9	ip	6.1	ip	6.5	ip
PT	1 751		1.8		2.5		0.4		4.6		1.5		5.1		10.4	
RO	353		3.8		8.8		3.4		5.5		6.0		13.4		9.0	
SI	239	p	1.6	p	3.2	p	0.3	p	4.4	p	3.8	p	23.0	p	6.1	p
SK	162	p	1.6	p	3.1	p	0.4	p	2.2	p	2.4	p	7.2	p	6.5	p
FI	2 065	p	1.2	p	1.6	p	1.6	p	1.7	p	10.9	p	19.6	p	5.8	p
SE (2)	3 209		0.7	i	1.9	i	0.3	i	4.6	i	5.3	i	2.3	i	1.4	i
UK	10 561	e	3.1	e	3.0	e	1.7	e	1.8	e	0.7	e	1.3	e	20.5	e
IS	94		1.7		3.2		:		2.5		0.5		2.5		7.6	
NO	2 897		1.5		2.7		2.6		1.8		3.1		8.7		14.9	
CH (2)	3 362	i	0.1	i	0.3	i	3.4	i	0.3	i	0.6	i	0.5	i	0.4	i
HR	306	p	1.1	p	0.6	p	0.0	p	2.3	p	0.3	p	1.1	p	1.6	p
JP (2)	32 880	i	1.4	i	1.1	i	6.6	i	2.8	i	13.3	i	6.7	i	4.4	i
KR (2)(3)	8 464		1.7	e	2.2	e	2.0	e	0.6	e	5.4	e	29.5	e	7.9	e
RU (3)	4 963		:		0.1		21.4		0.6		2.0		8.0		2.6	
US (2)	111 977	ip	1.0	ip	0.4	ip	6.0	ip	1.1	ip	1.6	ip	0.4	ip	22.6	ip

(1) CH and US, 2010; RU, 2009; EL, 2008.

(2) Flag 'i': DE: unrevised breakdown not adding to the revised total; FR: 'Political and social systems, structures and processes' includes 'Education' and 'Culture, recreation, religion and mass media', the sum of the breakdown does not add to the total; AT, CH, JP and US: federal or central government only; SE: the sum of the breakdown does not add to the total; JP: Defence is underestimated or based on underestimated data; KR: 'General advancement of knowledge: R&D financed from other sources than GUF' includes 'General advancement of knowledge: R&D financed from GUF'.

(3) The sum of the breakdown does not add to the total.

Source: Eurostat (online data code: gba_nabsfin07); for KR, JP and US, OECD-MSTI .

Table 1.3 (Part II): Total GBAORD in million EUR and by socio-economic objectives (NABS 2007) as a percentage of total, 2011 (1)

	Total GBAORD in million EUR		Agriculture		Education		Culture, recreation, religion and mass media		Political and social systems, structures and processes		General advancement of knowledge: R&D financed from GUF		General advancement of knowledge: R&D financed from other sources than GUF		Defence	
EU-27	92308	s	3.5	s	1.2	s	1.1	s	3.3	s	33.2	s	17.0	s	5.2	s
BE	2326	p	1.5	p	0.3	p	2.0	p	3.5	p	16.8	p	23.8	p	0.2	p
BG	96		15.3		11.9		1.3		0.5		10.4		34.7		2.3	
CZ	1048		4.0		0.3		0.5		0.9		30.4		29.1		1.7	
DK	2459		3.3		2.7		1.4		2.6		42.9		17.5		0.3	
DE (2)	23437	p	2.9	ip	1.0	ip	1.4	ip	1.5	ip	37.9	ip	16.5	ip	4.0	ip
EE	124	p	9.8	p	4.0	p	7.6	p	4.0	p	0.0	p	22.6	p	0.3	p
IE	823	p	11.5	p	2.0	p	0.0	p	1.5	p	19.2	p	30.6	p	0.0	
EL	691	p	6.6	p	0.8	p	0.4	p	2.7	p	49.9	p	11.4	p	0.5	p
ES	7294		7.6		1.1		0.9		1.6		26.5		18.1		1.7	
FR (2)	16814		2.2	i	:	i	:	i	5.0	i	22.7	i	16.6	i	6.8	i
IT	8891		3.3		4.4		1.1		9.3		34.2		2.2		0.7	
CY	78		12.2		3.4		0.6		0.0		33.6		44.7		0.0	
LV	30	p	9.1	p	3.3	p	1.0	p	0.5	p	:		41.6	p	0.5	p
LT	50		0.0		88.1		0.0		0.8		0.0		0.0		0.1	
LU	249		0.2		2.9		0.5		6.5		22.9		39.9		0.0	
HU	492	p	6.1	p	1.1	p	0.2	p	0.9	p	23.8	p	38.3	p	0.0	p
MT	15	p	4.0	p	0.1	p	0.2	p	0.0	p	91.0	p	0.0	p	0.0	p
NL	4972	p	3.1	p	0.2	p	0.4	p	2.4	p	53.5	p	16.1	p	1.6	p
AT (2)	2408	ip	1.6	ip	1.1	ip	0.4	ip	1.1	ip	57.1	ip	12.7	ip	0.0	ip
PL (3)	1631	p	2.9	ip	1.6	ip	0.9	ip	0.6	ip	11.1	ip	20.8	ip	12.8	ip
PT	1751		3.8		3.1		2.4		1.8		41.8		20.5		0.2	
RO	353		11.0		5.9		4.4		8.0		:		18.7		2.0	
SI	239	p	4.7	p	0.4	p	7.7	p	0.7	p	0.8	p	42.0	p	1.4	p
SK	162	p	7.2	p	1.8	p	4.7	p	1.8	p	24.2	p	33.6	p	3.3	p
FI	2065	p	4.6	p	0.1	p	0.7	p	5.0	p	26.9	p	17.8	p	2.6	p
SE (2)	3209		1.6	i	0.2	i	0.2	i	2.6	i	49.1	i	20.4	i	7.8	i
UK	10561	e	3.3	e	0.5	e	1.9	e	1.7	e	24.6	e	19.4	e	16.8	e
IS	94		18.5		:		:		13.6		0.0		49.8		:	
NO	2897		7.0		0.9		0.8		5.8		33.3		12.5		4.3	
CH (2)	3362	i	1.7	i	0.2	i	0.2	i	1.3	i	59.9	i	30.3	i	0.5	i
HR	306	p	0.9	p	0.3	p	1.1	p	1.5	p	54.6	p	34.5	p	0.1	p
JP (2)	32880	i	3.1	i	0.2	i	0.1	bi	0.4	i	36.4	bi	21.0	i	2.7	i
KR (2)(3)	8464		6.3	e	:		:		:		:	i	25.9	ei	16.3	e
RU (3)	4963		2.1		3.0		0.2		0.1		:		:		:	
US (2)	111977	ip	1.8	ip	0.3	ip	0.0	ip	0.5	ip	0.0	i	7.0	ip	57.3	ip

(1) CH and US, 2010; RU, 2009; EL, 2008.

(2) Flag'i': DE: unrevised breakdown not adding to the revised total; FR: 'Political and social systems, structures and processes' includes 'Education' and 'Culture, recreation, religion and mass media', the sum of the breakdown does not add to the total; AT, CH, JP and US: federal or central government only; SE: the sum of the breakdown does not add to the total; JP: Defence is underestimated or based on underestimated data; KR: 'General advancement of knowledge: R&D financed from other sources than GUF' includes 'General advancement of knowledge: R&D financed from GUF'.

(3) The sum of the breakdown does not add to the total.

Source: Eurostat (online data code: gba_nabsfin07); for KR, JP and US, OECD-MSTI .

2

R&D expenditure

One of the five headline targets of Europe 2020 Strategy is to achieve an R&D intensity (R&D expenditure as a percentage of GDP) of 3 % in the EU. In 2011, R&D intensity in the EU-27 stood at 2.03 %. Despite an increase on the 2010 figure (2.01 %), it was below the figures recorded in Japan (2009: 3.36 %), South Korea (2010: 4 %) and the United States (2009: 2.87 %), but higher than in China (2009: 1.7 %).

Among the EU Member States, only Finland (3.78 %), Sweden (3.37 %) and Denmark (3.09 %) exceeded the EU goal of devoting 3 % of GDP to R&D, also outperforming the United States. Another seven Member States, namely Germany (2.84 %), Austria (2.75 %), Slovenia (2.47 %), Estonia (2.38 %), France (2.25 %), the Netherlands and Belgium (both 2.04 %) were above the EU-27 average although below the target figure of 3 %.

Between 2005 and 2011, R&D expenditure in the EU-27 increased by an average of 3 % per year, reaching EUR 257 billion in 2011. Germany, France and the United Kingdom together accounted for more than half of all R&D expenditure in the EU-27.

The business enterprise sector (BES) was the largest of the four main institutional sectors of R&D performance in 2011, accounting for 62.3 % of EU-27 R&D expenditure. The higher education sector (HES) and government sector (GOV) followed with shares of 24.0 % and 12.7 % respectively.

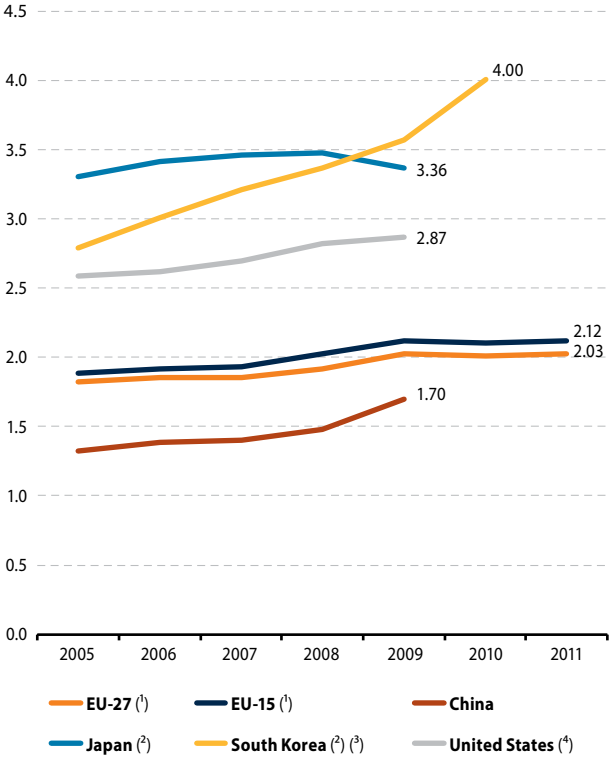
In 2010, the government sector financed 34.6 % of total R&D expenditure in the EU-27, while business enterprise financed 53.9 %. The third important source of funds (almost 9 %) was the category of 'abroad'. More than 49 % of R&D expenditure in Cyprus, Poland, Romania and Slovakia was funded by the government sector. On the other hand, the business enterprise sector was heavily involved in financing R&D activities in R&D-intensive Member States such as Germany, Finland, Sweden and Denmark.

In many of the countries under review, the 'manufacturing' sector accounted for the greatest share of business enterprise R&D expenditure. This was notably the case in Germany, Slovenia, Finland and Sweden, where 75 % or more of R&D expenditure by the BES was devoted to manufacturing. However, eight other Member States (Bulgaria, Estonia, Ireland, Cyprus, Latvia, Lithuania, Portugal and the United Kingdom) saw more than half of their expenditure go on the services of the business economy.

The breakdown of business enterprise R&D expenditure (BERD) by size class reveals that enterprises with more than 250 employees generally invest the most in R&D. In Germany, Luxembourg, Finland and Sweden, such large enterprises accounted for more than 80 % of BERD. On the other hand, in Bulgaria, Estonia, Spain, Cyprus, Latvia, Malta and Romania, large enterprises accounted for less than 50 % of BERD.

The R&D expenditure per inhabitant of the leading regions in three EU Member States was more than EUR 2 000, over four times higher than the EU-27 average (EUR 492). Hovedstaden recorded the highest regional R&D expenditure per inhabitant in Denmark (EUR 2 597), followed by Province Brabant Wallon in Belgium (EUR 2 454) and Stuttgart in Germany (EUR 2 134). Regions from six other EU countries and Norway completed the list of the top 30 regions with the highest R&D expenditure per inhabitant: Finland, Austria, France, the United Kingdom, Luxembourg and Sweden.

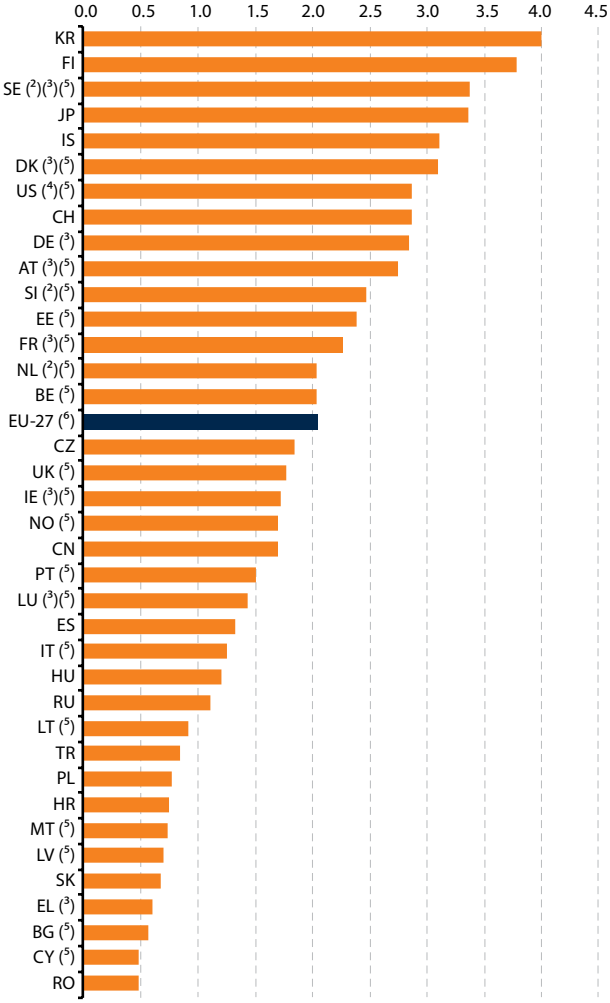
Figure 2.1: R&D intensity (R&D expenditure as % of GDP), EU-27, EU-15, China, Japan, South Korea and the United States, 2005–2011
(% of GDP)



(1) From 2008 to 2011, Eurostat estimate.
(2) JP (2008) and KR (2007), break in series.
(3) 2005–2006, excluding R&D in the social sciences and humanities.
(4) Excludes most or all capital expenditure.

Source: Eurostat (online data code: rd_e_gerdtot); for CN, JP, KR and US, OECD-MSTI.

Figure 2.2: R&D intensity (R&D expenditure as % of GDP), 2011 ([1])
(% of GDP)



([1]) KR, RU and TR, 2010; JP, IS, US and CN, 2009; CH, 2008; EL, 2007.
([2]) Break in series.
([3]) National estimate.
([4]) Excludes most or all capital expenditure.
([5]) Provisional data.
([6]) Eurostat estimate.

Source: Eurostat (online data code: rd_e_gerdtot); for CN, JP, KR and US, OECD-MSTI.

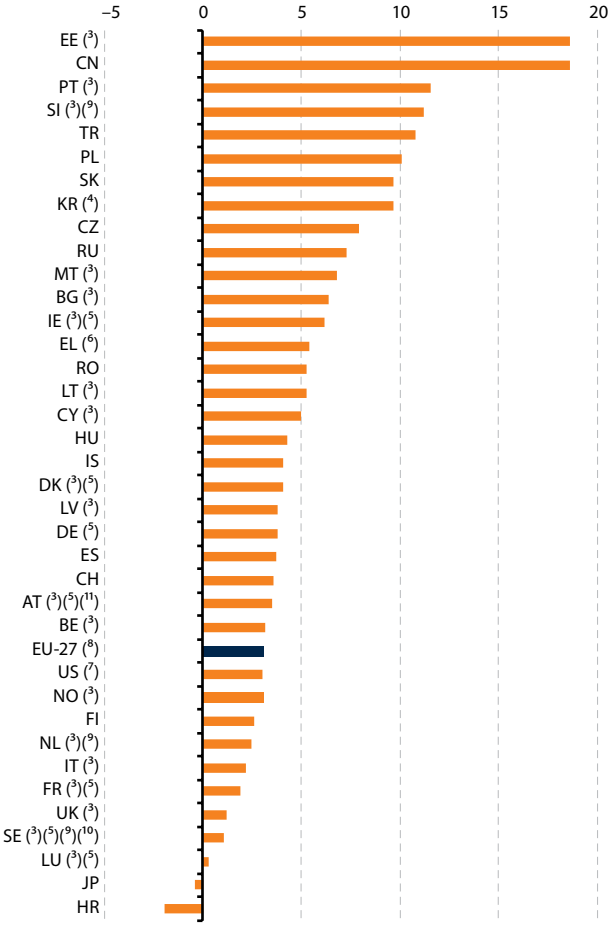
Table 2.3: R&D expenditure in million EUR by sector of performance, 2011 (1)
(million EUR)

	All sectors		Business enterprise sector		Government sector		Higher education sector		Private non-profit sector	
EU-27	256 587	s	159 976	s	32 528	s	61 555	s	2 528	s
BE	7 556	p	5 073	p	682	p	1 727	p	74	p
BG	220	p	117	p	79	p	23	p	2	p
CZ	2 875		1 735		504		622		14	
DK	7 437	ep	5 025	ep	161	ep	2 220	ep	32	ep
DE	73 692	e	49 342	p	10 900	e	13 450	e	:	
EE	379	p	237	p	31		107		4	
IE	2 741	ep	1 855	p	132	p	754	ep	:	
EL	1 342	e	384		281	e	661	e	17	e
ES	14 184		7 396		2 762		4 002		24	
FR	44 922	ep	28 497	ep	6 341	ep	9 528	ep	556	ep
IT	19 756	p	10 700	p	2 713	p	5 642	p	701	p
CY	86	p	14	p	15	p	46	p	12	p
LV	141	p	39	p	33	p	69	p	:	
LT	282	p	74	p	55	p	153	p	:	
LU	608	ep	416	p	117	ep	75	ep	:	
HU (2)	1 205		752	i	190	i	243	i	:	
MT	47	p	32	p	2	p	14	p	0	
NL (2)	12 292	bp	6 416	bp	1 333	ip	4 543	p	:	i
AT	8 263	ep	5 626	ep	441	ep	2 156	ep	40	ep
PL	2 836		855		979		996		7	
PT	2 557	p	1 174	p	192	p	979	p	212	p
RO	657		237		268		150		2	
SI	894	bp	660	bp	128	bp	105	bp	1	bp
SK (2)	468		174		130	i	164		1	
FI	7 164		5 047		634		1 432		51	
SE	13 078	bep	9 062	ep	567	p	3 407	ep	42	bp
UK	30 993	p	19 051	p	2 876	p	8 326	p	740	p
IS	269		142		54		67		6	
NO	5 928	p	2 997	p	962	p	1 968	bp	:	
CH (2)	10 268		7 547		76	i	2 482		164	
HR	336		150		92		93		1	
TR	4 642		1 975		531		2 136		:	
CN	60 897		44 592		11 391		4 914		:	
JP	121 357		91 943		11 183		16 274		1 957	
KR	28 629		21 415		3 628		3 098		488	
RU	14 931		9 101		4 455		1 349		26	
US (2)	287 909	i	202 461	i	33 781	i	38 989	i	12 678	ip

(1) TR and KR, 2010; IS, CN, JP and US, 2009; CH, 2008; EL, 2007.
(2) Flag 'i':
HU: The sum of the breakdown does not add to the total;
NL: GOV sector includes PNP sector;
SK: Defence excluded (all or mostly);
CH: GOV sector includes federal or central government only;
US: GOV sector includes federal or central government only; excludes most or all capital expenditure.

Source: Eurostat (online data code: rd_e_gerdtot); for CN, JP, KR and US, OECD-MSTI.

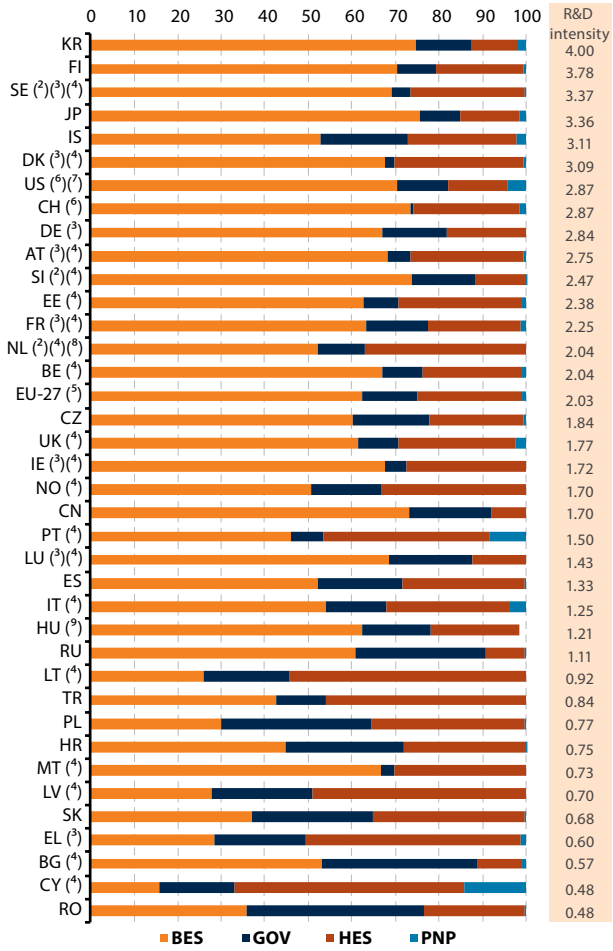
Figure 2.4: Average annual growth rate (AAGR) of R&D expenditure, 2005–2011 (1) (2)
(%)



(1) Calculated on R&D expenditure in PPS at 2000 constant prices.
(2) TR, 2005–2010; CN, KR, RU, IS, US and JP, 2005–2009; CH, 2004–2008; EL, 2003–2007.
(3) 2011, provisional data.
(4) 2005, excluding R&D in the social sciences and humanities.
(5) 2011, national estimate.
(6) 2007, national estimate.
(7) Excludes most or all capital expenditure.
(8) Eurostat estimate.
(9) 2011, break in series.
(10) 2005, break in series.
(11) 2005, national estimate.

Source: Eurostat (online data code: rd_e_gerdtot); for CN, JP, KR and US, OECD-MSTI.

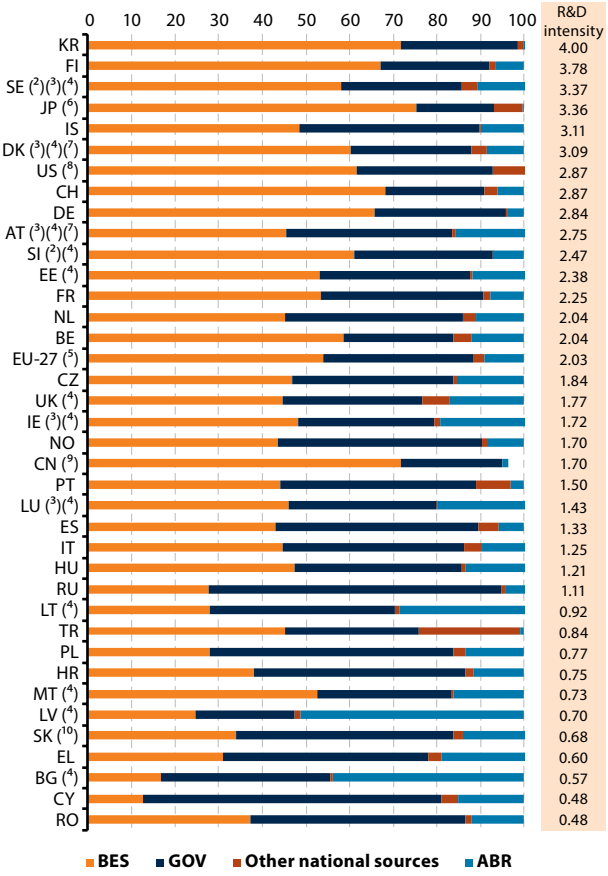
Figure 2.5: R&D expenditure by sector of performance as a percentage of total, ranked by R&D intensity, 2011 (1)
(%)



(1) KR and TR, 2010; JP, IS, US and CN, 2009; CH, 2008; EL, 2007.
(2) Break in series.
(3) National estimate.
(4) Provisional data.
(5) Eurostat estimate.
(6) GOV sector includes federal or central government only.
(7) Excludes most or all capital expenditure.
(8) GOV sector includes PNP sector.
(9) Incomplete breakdown of R&D expenditure by sector of performance.

Source: Eurostat (online data code: rd_e_gerdtot); for CN, JP, KR and US, OECD-MSTI.

Figure 2.6: R&D expenditure by source of funds as a percentage of total, ranked by R&D intensity, 2011 (1)
(%)

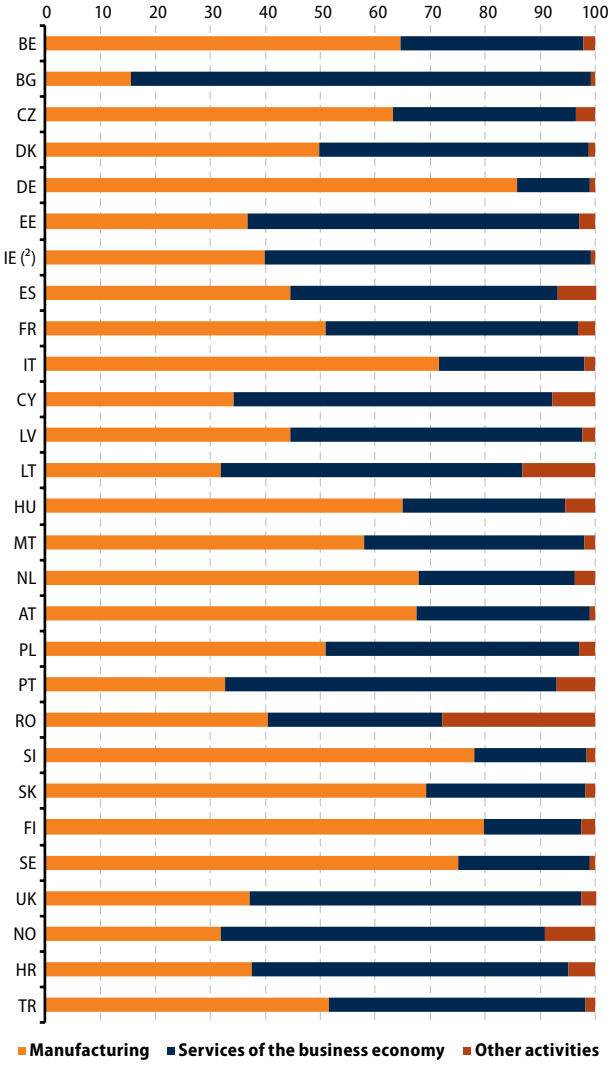


(1) Exceptions to the reference year for R&D expenditure: KR, DE, FR, EU-27, PT, ES, IT, TR and CY, 2010; JP, IS, US, NL, BE, NO and CN, 2009; CH, 2008; EL, 2005. Exceptions to the reference year for R&D intensity: KR and TR, 2010; JP, IS, US and CN, 2009; CH, 2008; EL, 2007.
(2) Break in series.
(3) National estimate.
(4) Provisional data.
(5) Eurostat estimate.
(6) GOV and other national sources: national results adjusted by the Secretariat to meet Frascati Manual norms.
(7) GOV sector includes HES sector.
(8) Excludes most or all capital expenditure; GOV sector includes federal or central government only.
(9) The sum of the breakdown does not add to the total.
(10) GOV: underestimated or based on underestimated data.

Source: Eurostat (online data codes: rd_e_gerdtot and rd_e_fundgerd); for CN, KR, JP and US, OECD-MSTI.

Figure 2.7: Business enterprise R&D expenditure by sector of activity (NACE Rev.2) as a percentage of total, 2010 (1)

(%)



(1) BE, AT and SE, 2009; EL, not available; LU, confidential data.
(2) National estimate.

Source: Eurostat (online data code: rd_e_berdindr2).

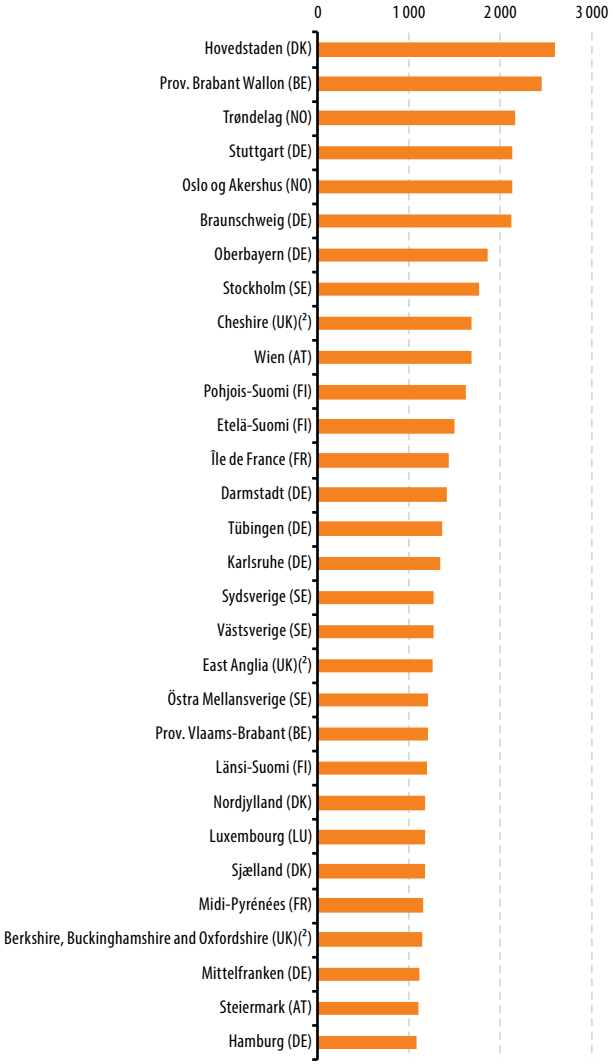
Table 2.8: Business enterprise R&D expenditure (BERD) in million EUR and by size class as a percentage of total, 2010 (1)

	Total in million EUR	Less than 10 employees	Between 10 and 49 employees	Between 50 and 249 employees	More than 250 employees
EU-27	152 478	:	:	:	:
BE	4575	2.3	9.6	22.3	65.8
BG	108	: c	9.4	: c	12.2
CZ	1 448	2.2	9.1	26.8	62.0
DK	4 931	3.8	10.2	13.6	72.4
DE	45 275	0.6	3.0	7.5	89.0
EE	117	10.1	21.1	38.0	30.8
IE	1 834 e	:	:	:	:
EL	384	6.1	11.9	2.6	79.4
ES	7 506	4.9	18.2	27.1	49.8
FR	27 403	2.6	7.4	12.1	77.9
IT	10 579	1.4	7.6	13.5	77.6
CY	15	38.9	22.3	4.9	33.8
LV	40	9.1	16.1	32.6	42.1
LT	65	6.9	18.5	21.9	52.7
LU	471	0.0	7.0	9.6	83.4
HU	674	12.8	13.2	16.9	57.1
MT	26	6.2	27.2	33.9	32.7
NL	5 218	0.0	10.4	21.3	68.3
AT	5 093	2.8	8.2	17.7	71.3
PL (3)	694	4.2	8.0	18.2	70.8
PT	1 266	2.7	10.5	20.1	66.7
RO	220	4.2	19.6	29.6	46.6
SI	506	5.7	11.3	22.2	60.8
SK	175	7.6	5.5	27.7	59.2
FI	4 854	2.9	6.7	9.6	80.8
SE	7 405	0.0	6.5	12.1	81.5
UK	18 731	1.6	4.3	14.7	79.4
NO	2 737	0.0	21.1	31.1	47.8
CH	7 547	2.9	7.7	18.4	71.0
HR	148	0.4	5.1	36.7	57.8
JP (2)	91 943	:	:	6.3 i	93.5 i
KR	21 415	1.1	10.2	11.8	76.9
US (2)	202 461 i	: i	7.6 i	9.2 i	83.2 i

(1) BE, DK, DE, LU, AT, SE, JP and US, 2009; CH, 2008; EL, 2007.
(2) Flag 'i':
JP: Underestimated or based on underestimated data;
US: Excludes most or all capital expenditure; data for 'between 10 and 49 employees' includes data for 'less than 10 employees'.
(3) The sum of the breakdown does not add to the total.

Source: Eurostat (online data code: rd_e_berdsize); for JP, KR and US, OECD-MSTI.

Figure 2.9: Top 30 regions at NUTS 2 level in terms of R&D expenditure per inhabitant, 2010 (1)
(EUR per inhabitant)



(1) DK, BE, DE, SE, UK, AT and FR, 2009.
(2) National estimate.

Source: Eurostat (online data code: rd_e_gerdreg).

II

Monitoring the knowledge workers

3

R&D personnel

In 2009, 1.68 % of total EU-27 employment (in head count — HC) was related to R&D activities, which was lower than in Japan and South Korea (1.84 % and 1.99 % respectively). In 2010, at national level, the highest shares of R&D personnel in total employment were observed in Iceland (3.3 %, 2009 data), Finland (3.27 %) and Denmark (3.12 %).

In 2011, the EU-27 counted 2.6 million people, expressed in full-time equivalents (FTEs), working in R&D. In the EU as a whole, the business enterprise sector was the largest sector, employing more than half of R&D personnel (1.4 million FTEs). However, this pattern differed at national level for certain countries. In Bulgaria, most of the R&D personnel were employed in the government sector, while the higher education sector accounted for the highest shares of R&D personnel in Estonia, Greece (2007), Cyprus, Latvia, Lithuania, Poland, Portugal, Slovakia, Croatia and the United Kingdom.

Between 2005 and 2011, the total number of R&D personnel measured in FTEs grew by 2.9 % per year on average in the EU-27, although this rate varied substantially between countries. Among the EU Member States, the highest increase, of more than 5 %, was recorded by Portugal (12.8 %), the Czech Republic (11.3 %), Slovenia (9.2 %), Malta (9.0 %) and Hungary (6.5 %). Four EU Member States reported a decrease in R&D personnel — Romania (– 1.8 %), Finland (– 0.9 %), Sweden (– 0.7 %) and Latvia (– 0.2 %).

The breakdown of researchers by institutional sector across the EU-27 reveals that 44.9 % of researches (in FTEs) were employed in the business enterprise sector in 2010, 41.6 % in the higher education sector and 12.5 % in the government sector.

R&D activity remained largely a male field of work; women working in R&D (35.4 %) and female researchers (32.9 %) in HC comprised a minority in the EU-27 in 2009. In 2010, Lithuania (53.5 %), Bulgaria (51.8 %), Latvia and Croatia (both 50.1 %) were the only countries where women accounted for more than half of R&D personnel. As regards researchers, only Lithuania and Latvia reached a gender balance, with 51.3 % and 50.8 % of female researchers respectively.

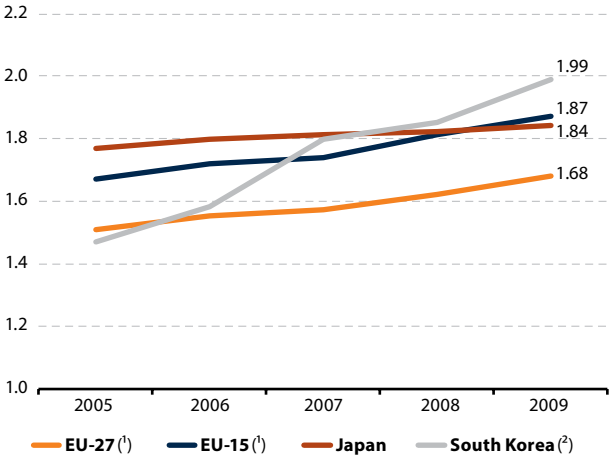
In the business enterprise sector (BES), manufacturing accounted for the highest shares of researchers in most European countries. However, in Estonia, Ireland, Portugal

and Norway more than 60 % of BES researchers (in FTEs) were employed in business economy services in 2010.

North Eastern Scotland (UK) was the leading European region in terms of the share of R&D personnel in total employment, reaching 6.0 % in 2009. It was followed by two capital regions, namely Hovedstaden (DK) with 5.2 % and Wien (AT) with 4.7 %. With the exception of the region of Trøndelag (NO), the share of R&D personnel in total employment was below 4.5 % in all other European regions.

The largest discrepancy between the highest and lowest ranking regions within a given country was in the United Kingdom (5.8 percentage points); by contrast, the smallest gap was recorded in Ireland (0.5 percentage points).

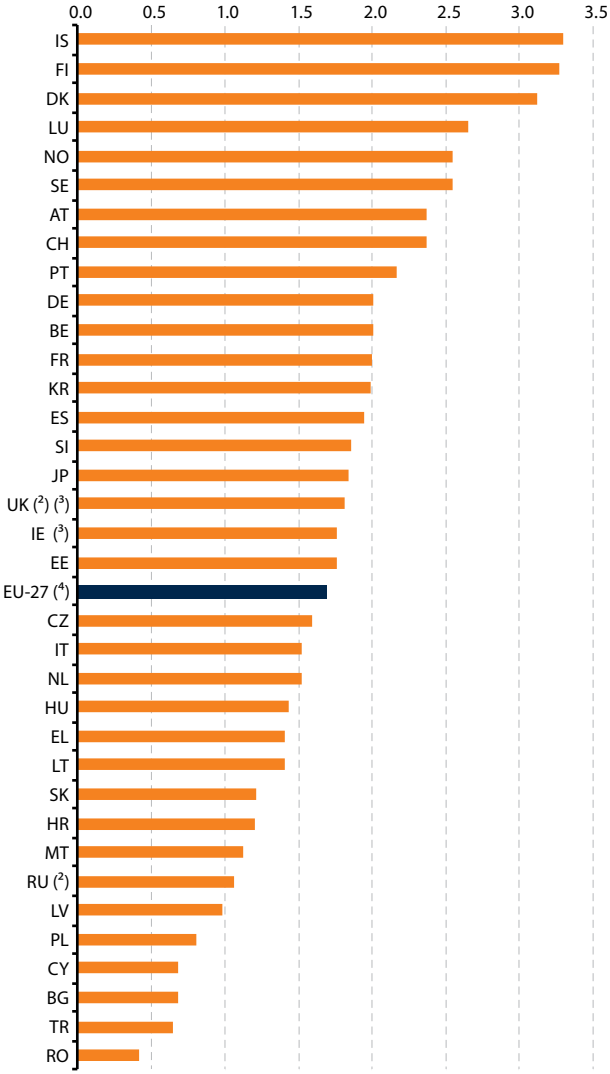
Figure 3.1: R&D personnel (HC) as a percentage of persons employed, EU-27, EU-15, Japan and South Korea, 2005–2009
(% of persons employed)



(1) Eurostat estimate.
(2) 2005–2006, excluding R&D in the social sciences and humanities; 2007, break in series.

Source: Eurostat (online data code: rd_p_perslf); for JP and KR, OECD-MSTI.

Figure 3.2: R&D personnel (HC) as a percentage of persons employed, 2010 (1)
(% of persons employed)



(1) IS, LU, SE, AT, DE, BE, KR, JP and EU-27, 2009; CH, 2008; EL, 2005.
(2) Underestimated or based on underestimated data.
(3) National estimate.
(4) Eurostat estimate.

Source: Eurostat (online data code: rd_p_perslf); for JP and KR, OECD-MSTI.

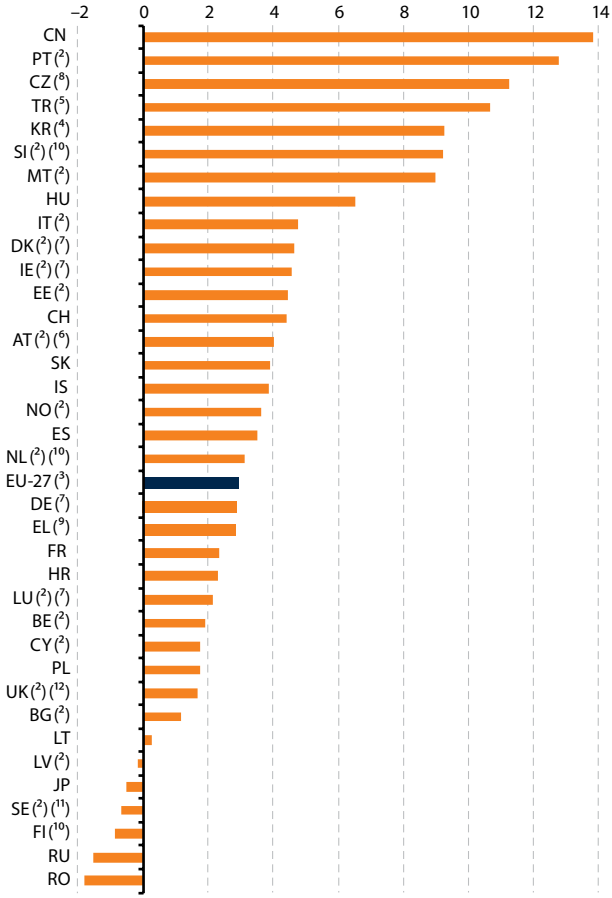
Table 3.3: R&D personnel (FTE) by sector of performance, 2011 (1)
(FTE)

	All sectors	Business enterprise sector	Government sector	Higher education sector	Private non-profit sector
EU-27	2 600 114 s	1 351 418 s	357 616 s	862 605 s	28 475 s
BE	59 991 p	31 668 p	4 799 p	22 940 p	584 p
BG	16 986 p	2 439 p	9 238 p	5 216 p	93 p
CZ	82 283	38 415	14 335	29 149	384
DK	57 170 ep	37 242 ep	1 482 ep	18 151 ep	296 ep
DE	562 600 e	345 000 p	93 500 e	124 100 e	:
EE	5 666 p	2 063 p	776	2 735	92
IE	21 817 ep	14 051 p	1 041 p	6 725 ep	:
EL	35 531 e	11 562	4 584 e	19 172 e	213 e
ES	215 079	89 841	43 913	80 900	425
FR	392 875	230 735	50 092 b	106 389	5 659
IT	231 914 p	116 726 p	34 977 p	73 723	6 488 p
CY	1 285 p	275 p	250 p	605 p	155 p
LV	5 432 p	870 p	1 169 p	3 393 p	:
LT	11 173	2 085	2 229	6 859	:
LU	4 988 ep	3 388 p	1 006 ep	594 ep	:
HU	33 960	17 220	8 480	8 260	:
MT	1 382 p	1 000 p	64 p	319 p	0
NL (2)	112 546 bp	65 396 bp	11 550 ip	35 600 p	: i
AT	60 378 ep	40 977 ep	2 867 ep	16 110 ep	425 ep
PL	85 219	19 530	21 407	44 154	128
PT	52 944 p	14 114 p	3 285 p	29 997 p	5 548 p
RO	29 749	10 002	10 675	8 879	193
SI	15 269 bp	9 622 bp	2 628 bp	3 003 bp	16 bp
SK (2)	18 112	3 251	4 103 i	10 712	46
FI	54 526 b	31 180	6 881	15 847 b	619
SE (2)	74 678 beip	54 769 ep	3 386 bip	16 263 ep	260 bp
UK	358 583 p	158 321 p	19 163 p	174 245 p	6 854 p
IS	3 753	1 577	816	1 250	110
NO	37 120 p	17 978 p	6 480 p	12 662 bp	:
CH (2)	62 066	39 832	809 i	21 425	:
HR	10 622	2 532	3 607	4 466	18
TR	81 792	37 522	11 357	32 913	:
CN	2 291 252	1 647 454	368 607	275 191	:
JP	878 418	616 965	63 045	184 951	13 457
KR	335 228	230 221	26 939	73 511	4 557
RU	839 183	439 683	276 341	121 151	2 007

(1) FR, TR and KR, 2010; IS, CN and JP, 2009; CH, 2008; EL, 2007.
(2) Flag 'i':
NL: GOV sector includes PNP sector.
SK: Defence excluded (all or mostly).
SE: Underestimated or based on underestimated data.
CH: Federal or central govenment only.

Source: Eurostat (online data code: rd_p_persocc); for CN, JP and KR, OECD-MSTI.

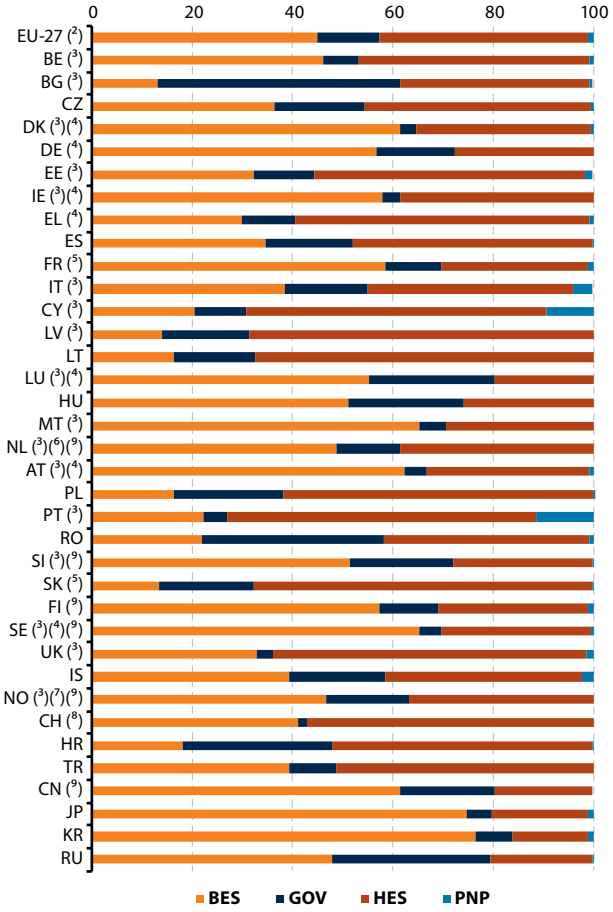
Figure 3.4: Average annual growth rate (AAGR) of R&D personnel (FTE), 2005–2011 ([1])
(%)



([1]) TR, KR and FR, 2005–2010; CN, IS and JP, 2005–2009; CH, 2004–2008; EL, 2005–2007.
([2]) 2011, provisionnal data.
([3]) Eurostat estimate.
([4]) 2005, excluding R&D in the social sciences and humanities.
([5]) 2005, underestimated or based on underestimated data.
([6]) 2005 and 2011, national estimate.
([7]) 2011, national estimate.
([8]) 2005, break in series.
([9]) 2007, national estimate.
([10]) 2011, break in series.
([11]) 2011, undestimated or based on underestimated data; 2005 and 2011 break in series.
([12]) 2005, underestimated or based on underestimated data and break in series.

Source: Eurostat (online data code: rd_p_persocc); for CN, JP and KR, OECD-MSTI.

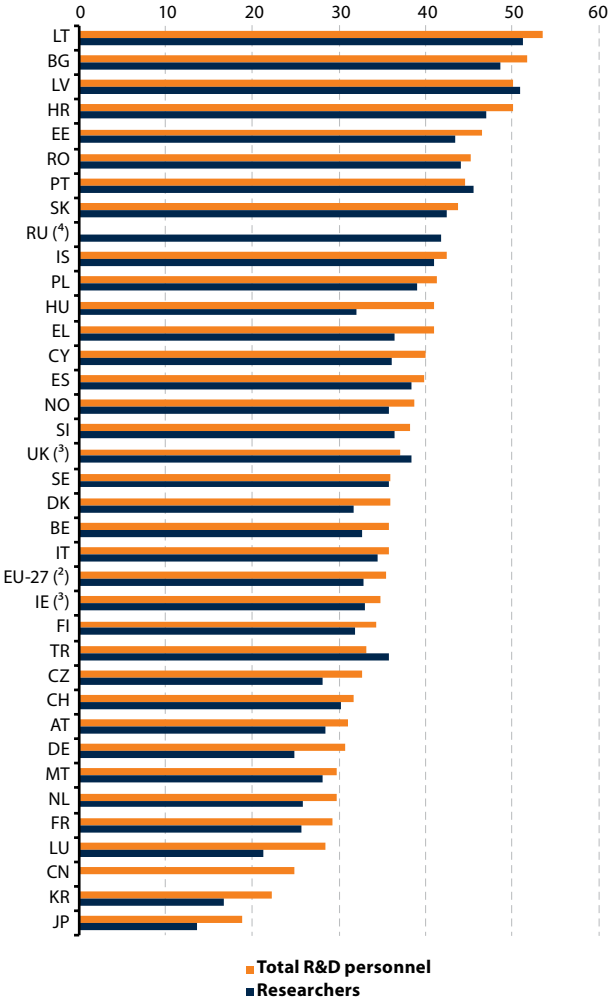
Figure 3.5: Researchers (FTE) by sector of performance as a percentage of total, 2011 ([1])
(%)



([1]) EU-27, DE, FR, TR and KR, 2010; IS, CN and JP, 2009; CH, 2008; EL, 2007.
([2]) Eurostat estimate.
([3]) Provisional data; EE, provisional data for BES only; IT, provional data for BES, GOV and PNP.
([4]) National estimate; DE, national estimate only for BES; IE, national estimate only for HES ; EL, national estimate only for GOV, HES and PNP ; LU, national estimate only for GOV and HES.
([5]) GOV: defence excluded (all or mostly).
([6]) GOV sector includes PNP sector.
([7]) BES: university graduates instead of researchers.
([8]) GOV: federal or central government only.
([9]) Break in series; NL, break in series only for BES; FI and NO, break in series only for HES; SE, break in series only for GOV and PNP.

Source: Eurostat (online data code: rd_p_persocc); for CN, JP and KR, OECD-MSTI.

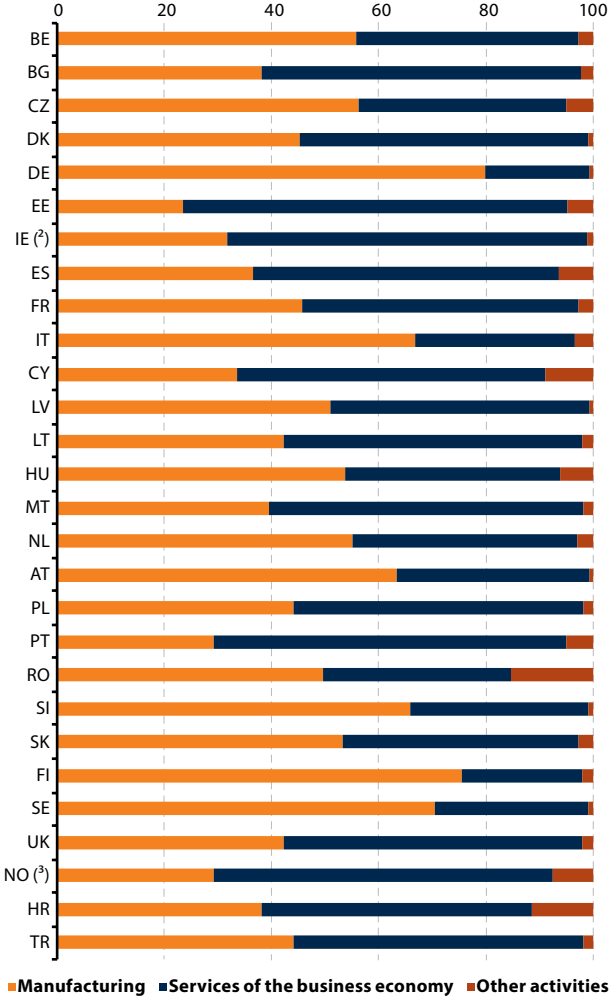
Figure 3.6: Percentage of women in total R&D personnel and among researchers (HC), 2010 (1)
(%)



(1) IS, SE, DK, BE, EU-27, AT, NL, LU, CN and JP, 2009; CH, 2008; EL, 2005.
(2) Eurostat estimate.
(3) National estimate.
(4) Underestimated or based on underestimated data.

Source: Eurostat (online data code: rd_p_persocc); for CN, JP and KR, OECD-MSTI.

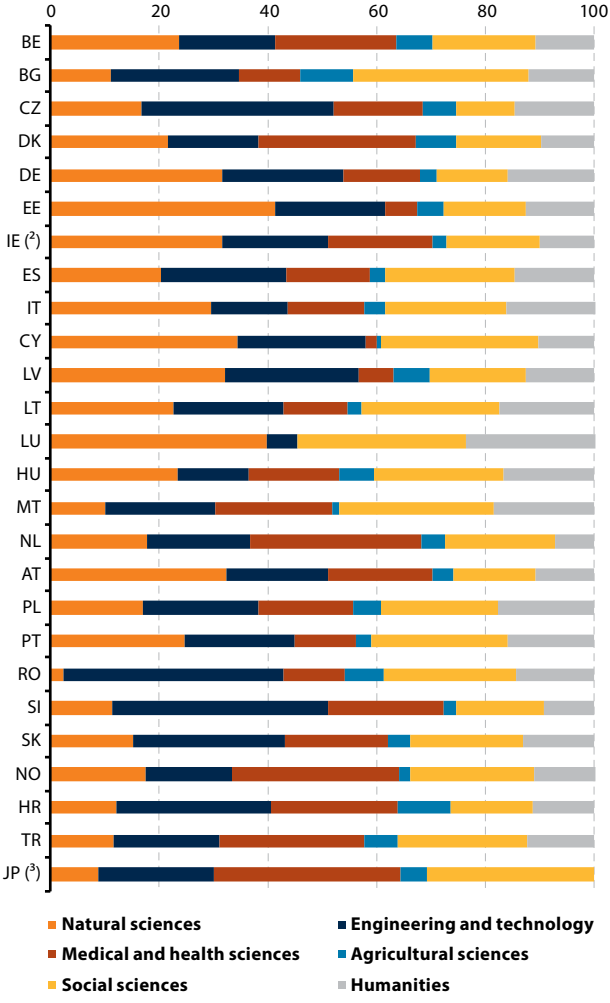
Figure 3.7: Business enterprise sector researchers (FTE) by sector of activity (NACE Rev.2) as a percentage of total, 2010 ([1]) (%)



([1]) BE, DE, AT and SE, 2009; EL, breakdown not available; LU, confidential data.
([2]) National estimate.
([3]) University graduates instead of researchers.

Source: Eurostat (online data code: rd_p_bempoccr2).

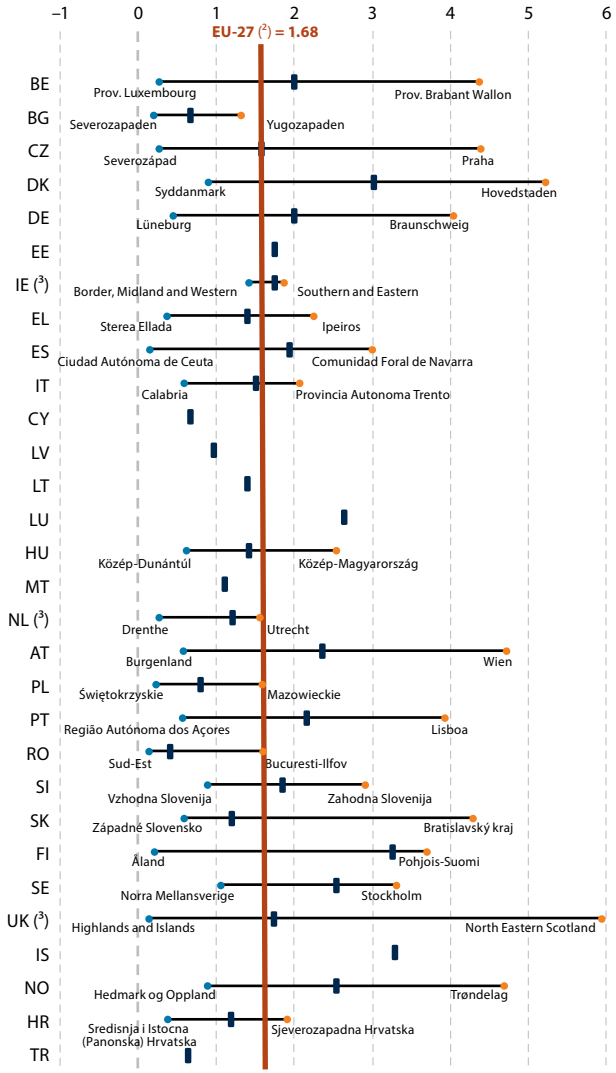
Figure 3.8: Researchers (FTE) in higher education sector by field of science as a percentage of total, 2010 (1)
(%)



(1) BE, LU, NL, AT, and JP 2009; EL, FR, FI, SE and UK, breakdown not available.
(2) National estimate.
(3) Social sciences includes Humanities.

Source: Eurostat (online data code: rd_p_perssci); for JP, OECD-MSTI.

Figure 3.9: Regional disparities (NUTS 2 level) in R&D personnel (HC) as a percentage of persons employed, 2010 ([1]) (%)



([1]) EU-27, BE, DK, DE, LU, NL, AT, SE, UK and IS, 2009; EL, 2005; FR, regional data not available.
([2]) Eurostat estimate.
([3]) National estimate.

Source: Eurostat (online data code: rd_p_persreg).

Human resources in science and technology (HRST)

4

Investment in research, development, education and skills constitutes a key policy area for the EU as these are elements essential to economic growth and to the development of a knowledge-based economy, leading to a growing interest in the role and measurement of skills. In this context, there is an increased need to measure and analyse the most highly skilled parts of the labour force, both within the EU and internationally. Statistics on human resources in science and technology (HRST) are used to monitor the supply and demand of highly qualified persons by measuring stocks and flows. In 2010, close to one third (32.0 %) of the EU population aged 20–29 years was in tertiary education. Although this percentage varied across countries, it was higher than 20 % in all EU Member States except Malta and Luxembourg. Greece had the highest proportion of tertiary education students among the population aged 20–29 years (49.3 %), followed very closely by Finland (47.8 %), Slovenia (41.1 %) and Lithuania (41.0 %).

At EU level, about one quarter of students in tertiary education chose science and engineering (S&E) as their main field of study, representing 7.8 % of the population aged 20–29 years.

In the EU-27, the share of women in higher education reached 55.4 % in 2010, yet women accounted for only 30.2 % of tertiary education students in science and engineering. The number of tertiary education students grew on average by 4 % per year between 2005 and 2010, closely matched by the increase number of students in the S&E fields (3.6 %).

In terms of HRST stocks, the EU had a total of more than 98 million highly qualified knowledge workers in 2011. Of these, 73 million were considered as HRST by virtue of education (HRSTE), 67 million as HRST by virtue of occupation (HRSTO) and 42 million as HRST by virtue of both education and occupation (HRSTC). In the EU-27, the proportion of women exceeded 50 % in all categories of HRST.

The HRST population increased at an average rate of 2.7 % per year between 2006 and 2011 in the EU-27. This was even higher than the increase in the total labour force over the same period. The HRST population grew faster than the total labour force in all EU-27 Member States.

In 2011, HRST accounted for 35.8 % of the total population aged 25–64 years in the EU-27. At country level the proportions did not exceed 50 %, the highest values being recorded in

Switzerland (50.0 %), Norway (48.8 %), Sweden (48.3 %), Luxembourg (48.2 %) and Iceland (47.2 %).

In 2011 in the EU-27, within the population of HRSTC, the biggest age group recorded was 45–64 which accounted for 39 %, while the other age groups — 25–34 and 35–44 years — accounted for about 30 % each of HRSTC. However, in some countries such as Turkey and Poland, the highest proportion of HRSTC were aged 25–34 years (above 40 %), whereas in Croatia and Germany, HRSTC aged 45–64 accounted for more than 50 % of the total.

Unemployment rates were generally significantly higher for non-HRST than HRST. Although unemployment levels in both categories remained comparable in the EU-27 between 2001 and 2011, there were significant variations across countries. Bulgaria is one example of a country where the unemployment rate dropped between those years for both HRST and non-HRST. The same downward trend was noted for Germany, Finland and Croatia. By contrast, the opposite trend was observed in Ireland, Spain, Greece, Hungary, Portugal and Luxembourg where unemployment rates increased significantly for both categories.

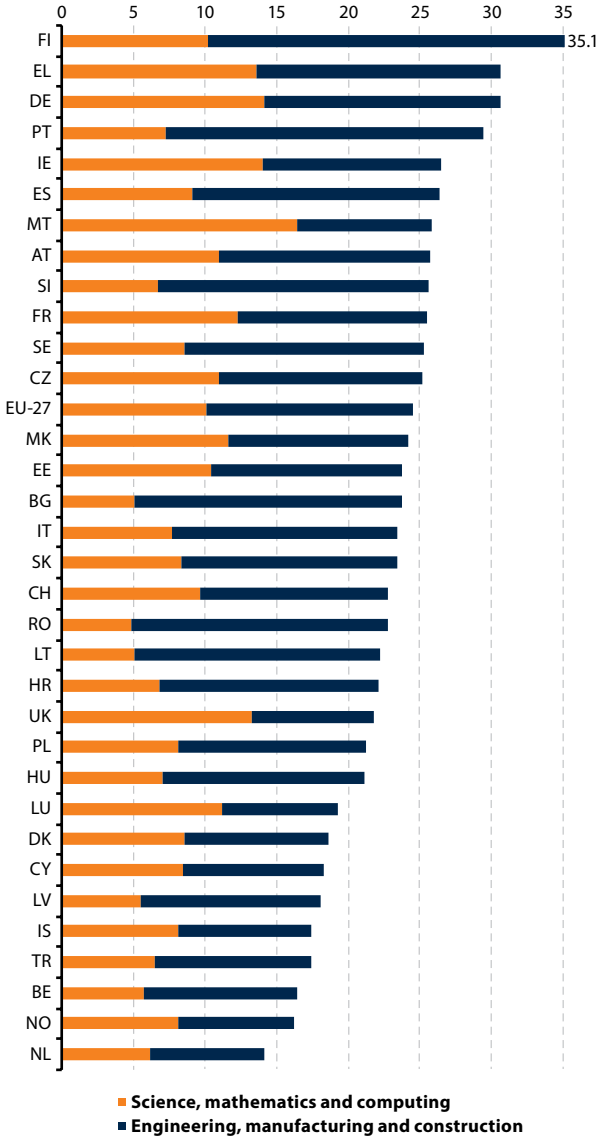
In 2011, Praha (CZ) was the leading region as regards the proportion of HRSTO in the labour force (49.3 %). As a rule, capital regions were well represented among the 30 leading regions in terms of HRSTO as a share of labour force. Countries that had several regions in the top 30 were Germany (7 regions), Switzerland (4), the Netherlands (3), France (2), the United Kingdom (2), Belgium (2) and Sweden (2). All other countries were represented by only one region.

Table 4.1: Students participating in tertiary education, 2010

	All fields		Science, mathematics and computing		Engineering, manufacturing and construction	
	1 000	As a % of population aged 20–29	1 000	As a % of population aged 20–29	1 000	As a % of population aged 20–29
EU-27	19 847	32.0	1 996	3.2	2 864	4.6
BE	445	32.8	26	1.9	47	3.5
BG	287	33.1	15	1.7	54	6.2
CZ	437	30.1	48	3.3	62	4.3
DK	241	37.7	21	3.3	24	3.8
DE	2 556	26.4	362	3.7	420	4.3
EE	69	33.5	7	3.5	9	4.5
IE	194	29.3	27	4.1	24	3.7
EL	642	49.3	86	6.6	115	8.8
ES	1 879	33.8	171	3.1	326	5.9
FR	2 245	29.4	276	3.6	296	3.9
IT	1 980	30.0	152	2.3	310	4.7
CY	32	27.4	3	2.3	3	2.7
LV	113	31.7	6	1.8	14	4.0
LT	201	41.0	10	2.1	34	7.0
LU	5	8.5	1	1.0	0	0.7
HU	389	29.9	28	2.1	55	4.2
MT	11	18.0	2	2.9	1	1.7
NL	651	32.7	40	2.0	52	2.6
AT	350	33.1	38	3.6	51	4.9
PL	2 149	36.9	173	3.0	283	4.9
PT	384	28.7	28	2.1	85	6.3
RO	1 000	29.9	49	1.5	179	5.3
SI	115	41.1	8	2.8	22	7.8
SK	235	26.8	20	2.2	35	4.0
FI	304	47.8	31	4.9	76	11.9
SE	455	38.3	39	3.3	76	6.4
UK	2 479	29.6	330	4.0	210	2.5
IS	18	40.6	1	3.3	2	3.8
LI	1	:	-	:	0	:
NO	225	35.6	18	2.9	18	2.8
CH	249	25.4	24	2.5	33	3.3
HR	141	27.7	10	1.9	22	4.2
MK	62	18.8	7	2.2	8	2.4
TR	3 529	30.6	229	2.0	384	3.3

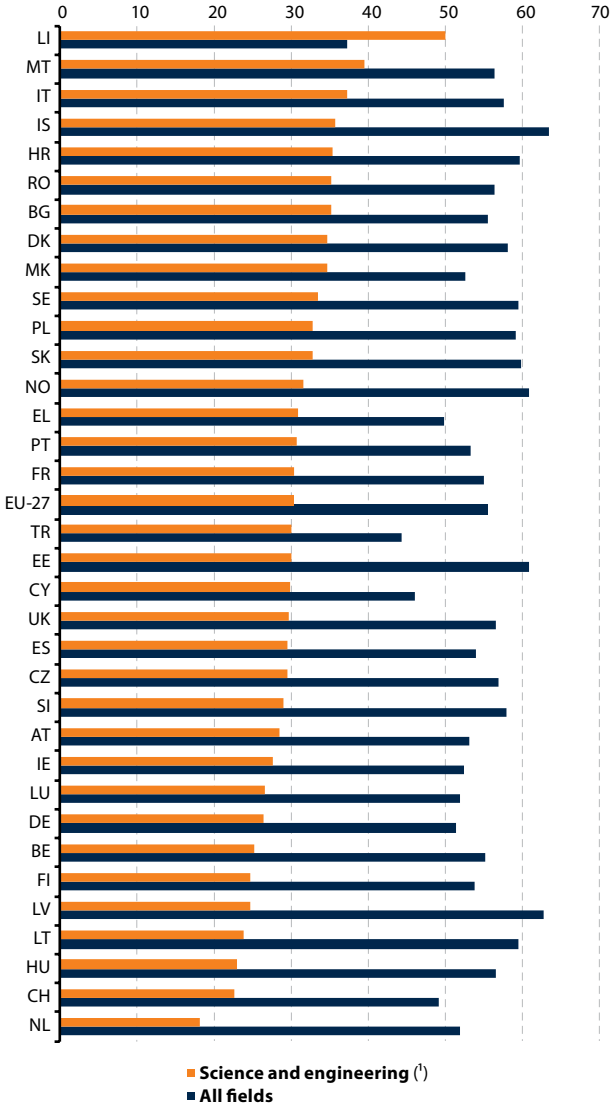
Source: Eurostat (online data code: hrst_fl_tepart).

Figure 4.2: Students in science and engineering as a percentage of tertiary students, 2010
(%)



Source: Eurostat (online data code: hrst_fl_tepart).

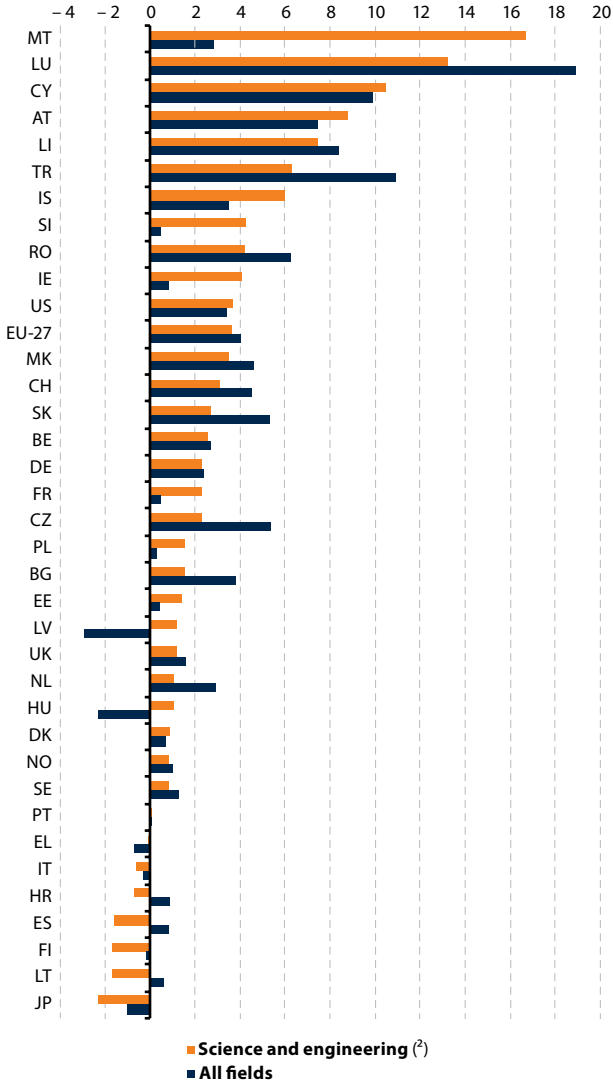
Figure 4.3: Share of female students in tertiary education, 2010
(%)



(1) Science and engineering corresponds to following fields of study: science, mathematics, computing and engineering, manufacturing and construction.

Source: Eurostat (online data code: hrst_fl_tepart).

Figure 4.4: Average annual growth rates (AAGR) of students participating in tertiary education, 2005–10 (1)
(%)



(1) LU and FR, between 2006 and 2010; EU-27: 2005, estimate.
(2) Science and engineering corresponds to following fields of study: science, mathematics, computing and engineering, manufacturing and construction.

Source: Eurostat (online data code: hrst_fl_tepart).

Table 4.5: Stocks of HRST and HRSTC aged 25–64 years old, total and percentage of women, 2011 ([1])

	HRST		HRSTC	
	Total in 1 000	% of women	Total in 1 000	% of women
EU-27	98 020	50.8	42 249	51.7
BE	2 444	50.0	1 134	53.2
BG	1 118	59.9	509	67.6
CZ	1 887	49.8	702	48.3
DK	1 329	52.3	670	55.8
DE	17 677	48.7	8 468	44.4
EE	318	62.3	126	69.8
IE	1 025	53.6	429	55.0
EL	1 754	49.7	818	50.9
ES	9 432	49.5	3 854	51.2
FR	13 330	49.7	5 410	52.8
IT	8 749	50.2	2 985	51.3
CY	188	51.1	83	53.0
LV	413	63.7	179	69.8
LT	676	61.1	345	69.9
LU	138	47.1	76	44.7
HU	1 574	57.4	688	56.3
MT	56	41.1	22	45.5
NL	4 061	47.2	1 802	48.1
AT	1 585	45.1	520	48.7
PL	6 481	58.8	2 992	61.0
PT	1 395	52.7	677	59.4
RO	2 418	53.8	1 208	53.2
SI	414	56.3	182	62.1
SK	927	57.1	349	55.9
FI	1 350	54.1	655	56.8
SE	2 350	52.9	1 156	59.2
UK	14 931	49.7	6 211	50.4
IS	76	59.2	36	61.1
NO	1 285	51.1	629	52.1
CH	2 203	44.7	911	40.7
HR	530	51.5	240	57.1
MK	245	49.0	99	52.5
TR	5 061	36.7	1 877	40.1

([1]) TR, 2010.

Source: Eurostat (online data code: hrst_st_ncat).

Table 4.6: Stocks of HRSTE and HRSTO aged 25–64 years old, total and percentage of women, 2011 (1)

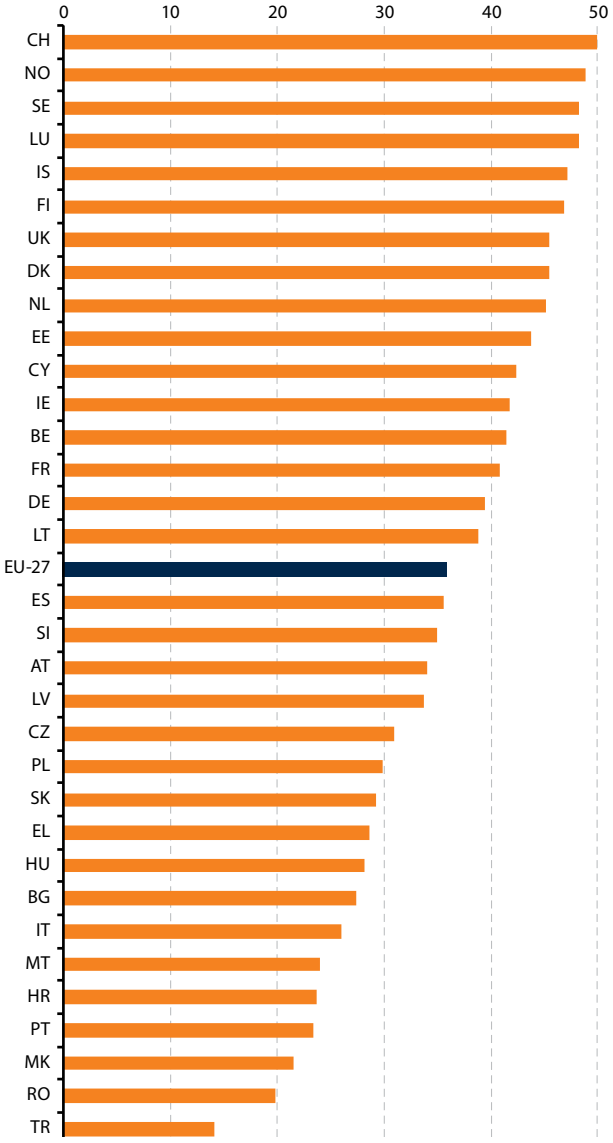
	HRSTE		HRSTO	
	Total in 1 000	% of women	Total in 1 000	% of women
EU-27	73 265	52.1	67 004	50.0
BE	2 041	53.0	1 536	48.4
BG	960	61.9	667	63.0
CZ	1 122	50.1	1 467	48.9
DK	953	55.5	1 046	51.7
DE	12 348	45.0	13 798	49.3
EE	267	64.0	177	64.4
IE	904	54.9	550	52.5
EL	1 558	50.3	1 013	50.0
ES	8 543	51.5	4 743	47.4
FR	9 761	54.0	8 980	46.9
IT	5 019	55.5	6 715	46.7
CY	166	53.0	105	49.5
LV	340	65.0	252	66.3
LT	592	61.5	429	67.8
LU	104	46.2	110	46.4
HU	1 178	56.8	1 084	57.4
MT	36	47.2	42	38.1
NL	2 886	47.6	2 977	47.3
AT	901	44.6	1 204	46.9
PL	5 149	59.1	4 324	59.9
PT	1 027	58.5	1 044	51.3
RO	1 801	51.2	1 824	55.9
SI	298	58.7	298	57.4
SK	595	55.1	681	58.1
FI	1 132	56.8	873	52.7
SE	1 708	57.4	1 798	52.7
UK	11 876	51.2	9 266	48.3
IS	55	58.2	58	58.6
NO	998	54.3	917	48.3
CH	1 541	40.9	1 574	46.1
HR	403	54.1	367	52.6
MK	200	49.5	143	50.3
TR	4 289	39.7	2 649	34.3

(1) TR, 2010.

Source: Eurostat (online data code: hrst_st_ncat).

Figure 4.7: Share of HRST aged 25–64 years old in total population, 2011 (1)

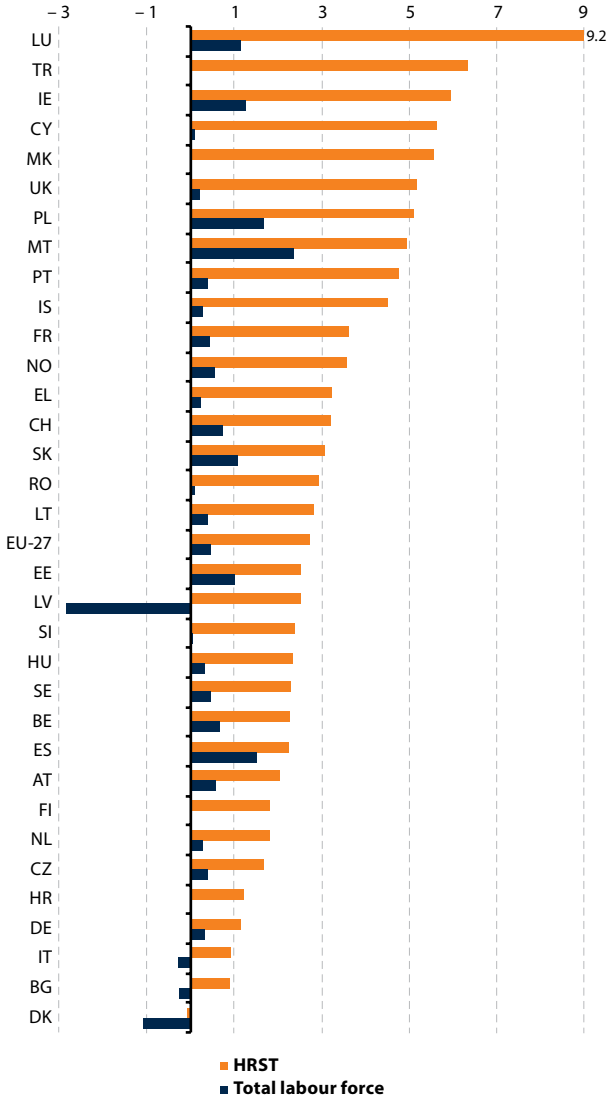
(%)



(1) TR, 2010.

Source: Eurostat (online data code: hrst_st_ncat).

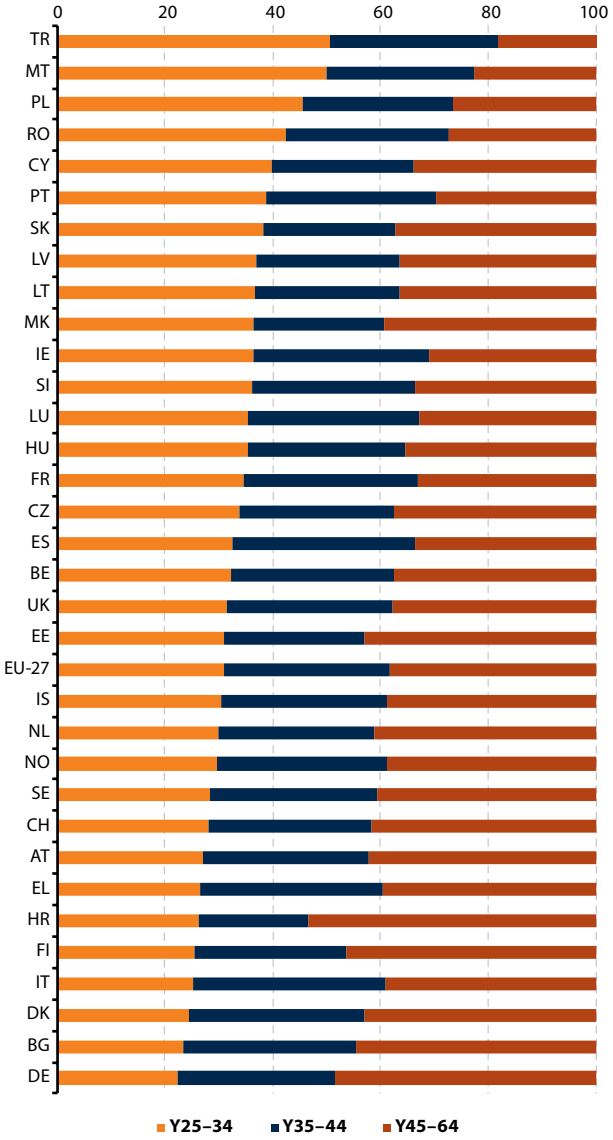
Figure 4.8: Average annual growth rate (AAGR) of HRST and of total labour force, 2006–11 (1) (2)
(%)



(1) 2011, break in series due to implementation of ISCO-08.
(2) TR, between 2006 and 2010.

Source: Eurostat (online data codes: hrst_st_ncat and lfsa_agan).

Figure 4.9: Distribution of HRSTC by age group, 2011 (1) (%)



(1) TR, 2010.

Source: Eurostat (online data code: hrst_st_ncat).

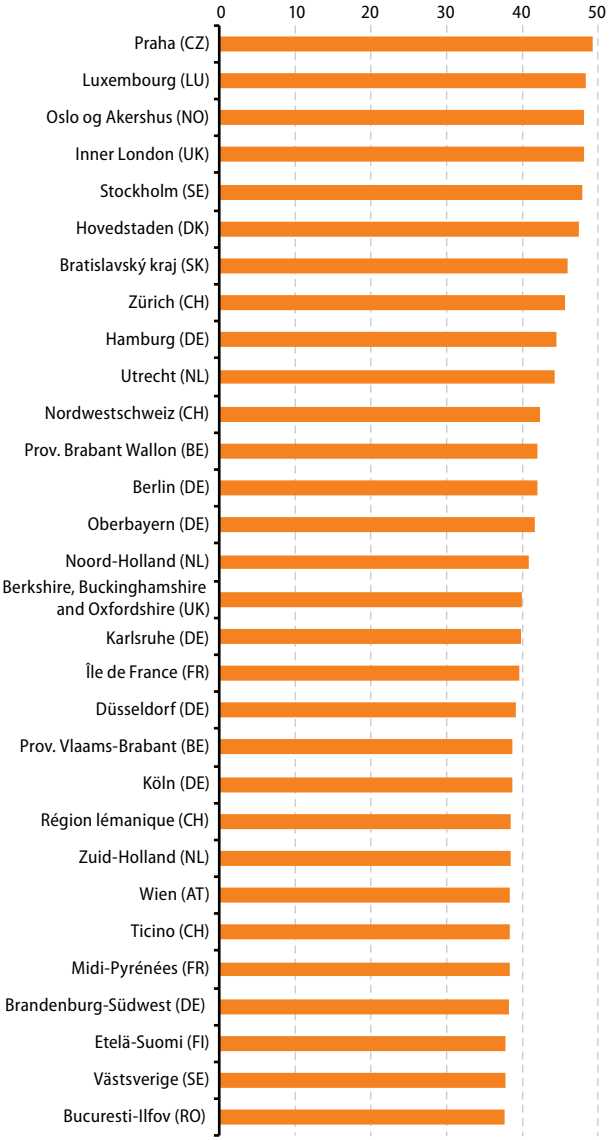
Table 4.10: Percentage of unemployment among HRST and NON-HRST
(%)

	2001 (1)				2011 (2)			
	HRST		NON-HRST		HRST		NON-HRST	
EU-27	2.8		11.4		4.0		13.4	
BE	2.8		9.3		3.1		10.9	
BG	6.9	b	25.5	b	4.2		14.4	
CZ	1.0	b	11.1	b	1.6		9.5	
DK	2.4		5.3		3.5		10.6	
DE	2.4		11.2		1.4		9.2	
EE	6.6		15.8		6.4		17.4	
IE	1.3		4.9		6.6		21.2	
EL	6.3		11.7		12.2		20.3	
ES	6.7	b	12.1	b	11.6		28.0	
FR	3.5		11.4		4.0		14.0	
IT	2.4		12.4		2.8		11.2	
CY	2.3		5.0		6.2		9.1	
LV	3.6		17.1		5.3		21.2	
LT	5.8		22.0		5.4		22.8	
LU	0.9	u	2.3	u	2.8		8.0	
HU	0.7	b	7.6	b	3.1		14.9	
MT	:	u	:	u	:	u	9.2	
NL	0.9		2.8		2.0		6.5	
AT	1.0		5.3		1.2		6.0	
PL	3.1		23.0		4.0		12.7	
PT	1.6	u	4.3	u	6.6		15.1	
RO	2.2		7.6		3.7		8.5	
SI	1.2	u	7.5	u	3.4		11.4	
SK	2.1		25.6		3.5		18.5	
FI	3.1		15.9		3.1		12.0	
SE	1.4	b	6.7	b	2.9		11.7	
UK	1.7		6.3		3.4		12.3	
IS	:	u	:	u	3.0		10.4	
NO	1.8		4.8		1.0		5.1	
CH	0.8		3.8		1.8		6.5	
HR	6.5		17.9		6.3	u	16.4	
MK	15.8	b	41.3	b	18.5		35.9	
TR	5.9	b	8.9	b	9.4		8.7	

(1) HR, 2002; MK and TR, 2006.
(2) 2011, break in series due to implementation of ISCO-08.

Source: Eurostat (online data code: hrst_st_nunesex).

Figure 4.11: Top 30 regions ranked according to the proportion of HRSTO in the labour force (NUTS level 2), 2011 (%)



Source: Eurostat (online data code: hrst_st_rcat).

III

Productivity and competitiveness

5 Innovation

Community Innovation Survey

The Community Innovation Survey (CIS) is designed to monitor the progress of innovation activity in Europe. It allows a better understanding of the innovation process and analyses the links between innovation and economic fields as competitiveness, employment, economic growth. The survey is conducted every two years. Seven waves of CIS have been launched so far. The latest wave, CIS 2010, was conducted in 31 countries — the EU-27 Member states (except Greece), Iceland, Norway, Croatia, Serbia and Turkey — and is mainly based on a reference period from 2008 to 2010. Its results are available on Eurostat's database (Eurobase).

Some results of CIS 2010

In the EU-27 Member States (excluding Greece) 52.9 % of enterprises from industry and services reported innovation activity between 2008 and 2010. Among all the participating countries, the highest proportions of enterprises with innovation activity were found in Germany (79.3 %), Luxembourg (68.1 %), Iceland (63.8 %), Belgium (60.9 %) and Portugal (60.3 %). The lowest rates were observed in Bulgaria (27.1 %), Poland (28.1 %), Latvia (29.9 %), Romania (30.8 %) and Hungary (31.1 %).

In 2010, 39.7 % of enterprises in the EU-27 (excluding Greece and the United Kingdom) were considered active in terms of product and process innovation, the same percentage as in 2008.

In most countries, the proportion of innovative enterprises was generally higher in industry (excluding construction) than in services. The opposite was observed in Iceland, Luxembourg, Portugal, Lithuania, Hungary and Romania.

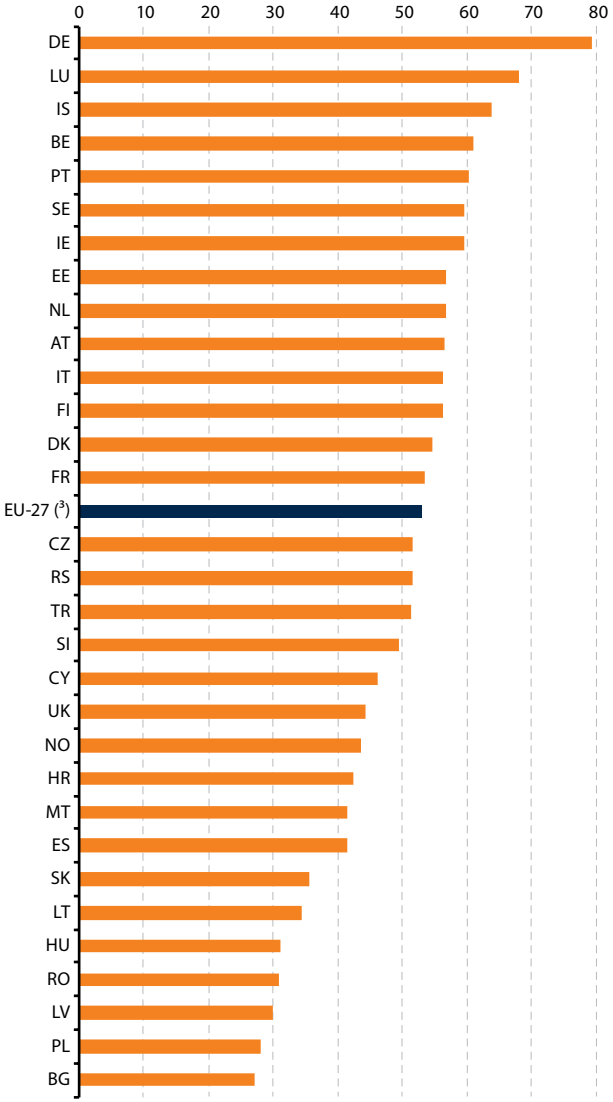
Product and/or process innovative enterprises in the EU-27 were more often engaged in in-house R&D than in external R&D. The highest proportions of enterprises engaged in internal R&D activities in the EU-27 were recorded in Finland (79.2 %), Slovenia (74.2 %), France (66.8 %) and Sweden (59.7 %), while the highest proportions of enterprises engaged in external R&D activities in the EU-27 were observed in Finland (54.9 %), Lithuania (40.7 %), Cyprus (39.8 %) and Slovenia (37.5 %).

Between 2008 and 2010, one in four product and/or process innovative enterprises (26.5 %) in the EU-27 cooperated with

other enterprises, universities or public research institutes, while the remaining 73.5 % relied on internal resources alone. The highest proportions of innovation cooperation were found in Cyprus (62.3 %), Austria (51.0 %), Slovenia (44.7 %) and Lithuania (43.3 %), and the lowest in Italy (12.1 %), Malta (18.5 %), Portugal (19.5 %) and Spain (22.3 %). In the EU-27, 11.4 % of product and/or process innovative enterprises teamed up with a partner in the EU-27, EFTA or the candidate countries, 3.1 % with a partner in the United States and 2.0 % with a partner in China or India. Innovation cooperation with a European partner was highest in Cyprus (37.8 %), Slovenia (34.8 %), Austria (30.1 %), Estonia and Slovakia (both 30.0 %), and lowest in Italy (4.0 %), Spain (5.3 %), Germany (8.2 %), Portugal (8.7 %) and Bulgaria (12.8 %). Finland (12.2 %), Sweden (10.6 %) and Slovenia (7.6 %) recorded the highest shares of cooperation with US partners. Finland (8.9 %), Sweden (6.8 %), Luxembourg and Slovenia (both 6.0 %) also reported the highest shares of cooperation with partners in China or India.

In this publication the majority of tables and figures present the data as a percentage of product and/or process innovative enterprises (including on-going, suspended or abandoned activities), without regard to organisational or marketing innovation. However, in the other tables and figures, the indicators are mainly based on all enterprises or on innovative enterprises, i.e. enterprises with any form of innovation activity (product, process, on-going, suspended or abandoned, organisational and marketing innovation).

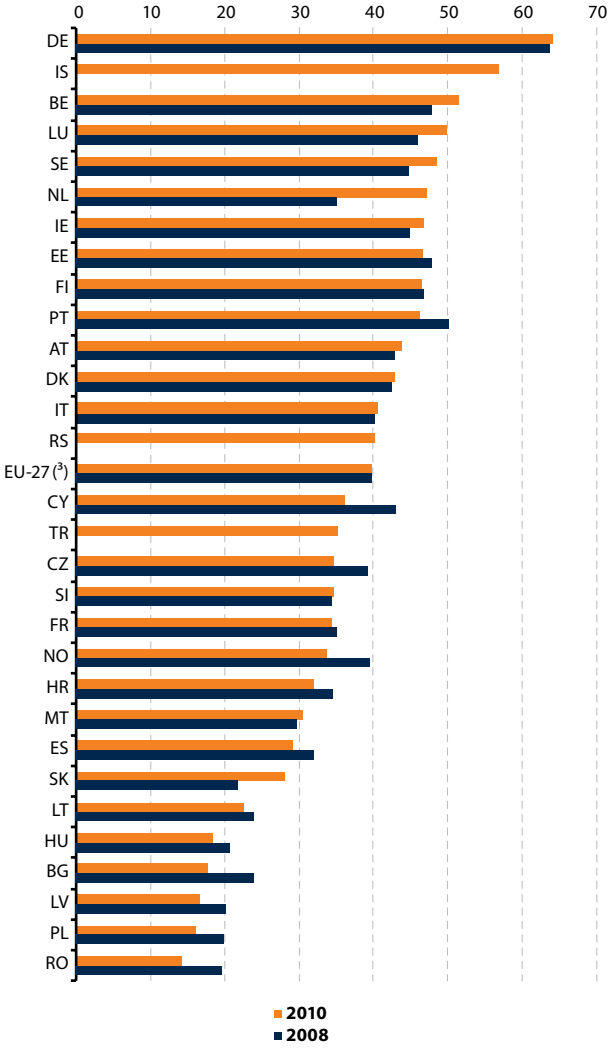
Figure 5.1: Innovative enterprises, 2008–2010 (1) (2)
(% of the total of enterprises)



(1) Innovative enterprises i.e. enterprises that implemented any type of innovation (including enterprises with abandoned, suspended or ongoing innovation activities).
(2) EL, data not available.
(3) EU-27 excluding EL.

Source: Eurostat (online data code: inn_cis7_type).

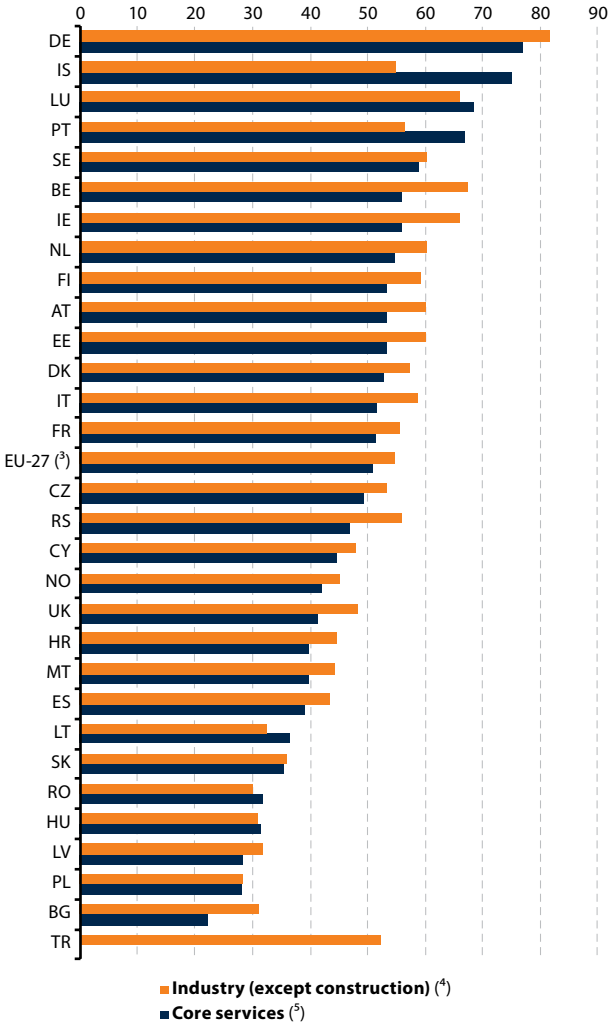
Figure 5.2: Product and/or process innovative enterprises in CIS 2008 and CIS 2010 (1) (2)
(% of the total of enterprises)



(1) Product and/or process innovative enterprises i.e enterprises that implemented product and/or process innovation including enterprises with ongoing, suspended or abandoned activities, regardless organisational or marketing innovation.
(2) EL and UK, data not available.
(3) CIS 2008: EU-27 excluding EL and UK.
CIS 2010: EU-27 excluding EL and UK.

Source: Eurostat (online data codes: inn_cis6_type and inn_cis7_type).

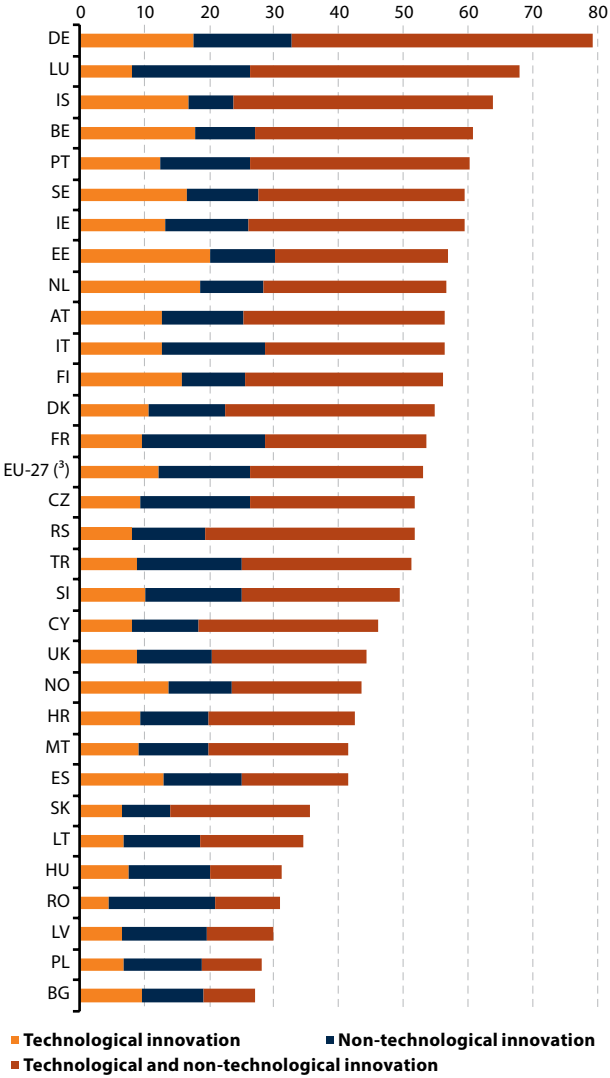
Figure 5.3: Innovative enterprises by main NACE group, 2008–2010 ([1]) ([2])
(% of the total of enterprises)



([1]) Innovative enterprises i.e. enterprises that implemented any type of innovation (including enterprises with abandoned, suspended or ongoing innovation activities).
([2]) EL and SI, data not available.
([3]) EU-27 excluding EL and SI.
([4]) Innovation core industry activities include NACE Rev.2 codes B, C, D and E.
([5]) Innovation core services activities include NACE Rev. 2 codes: G46, H, J58, J61, J62, J63, K and M71.

Source: Eurostat (online data code: inn_cis7_type).

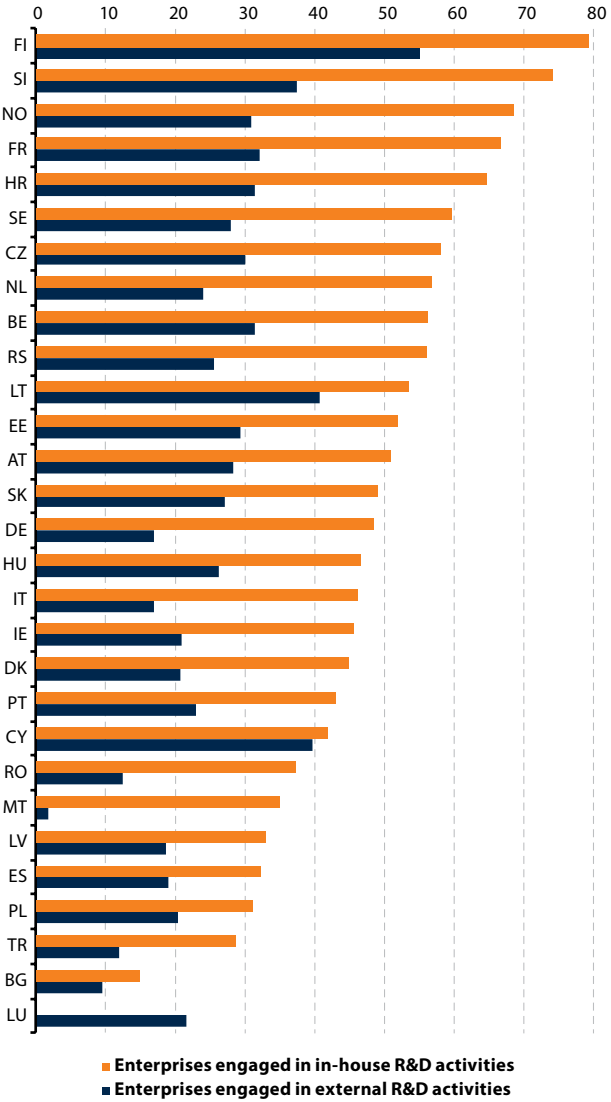
Figure 5.4: Innovative enterprises by type of innovation, 2008–2010 (1) (2)
(% of the total of enterprises)



(1) Innovative enterprises i.e. enterprises that implemented any type of innovation (including enterprises with abandoned, suspended or ongoing innovation activities).
(2) EL, data not available.
(3) EU-27 excluding EL.

Source: Eurostat (online data code: inn_cis7_type).

Figure 5.5: Product and/or process innovative enterprises doing in-house and external R&D, 2008–2010 (1)
(% of the total of product and/or process innovative enterprises)



(1) Product and/or process innovative enterprises i.e enterprises that implemented product and/or process innovation including enterprises with ongoing, suspended or abandoned activities, regardless organisational or marketing innovation.

Source: Eurostat (online data code: inn_cis7_exp).

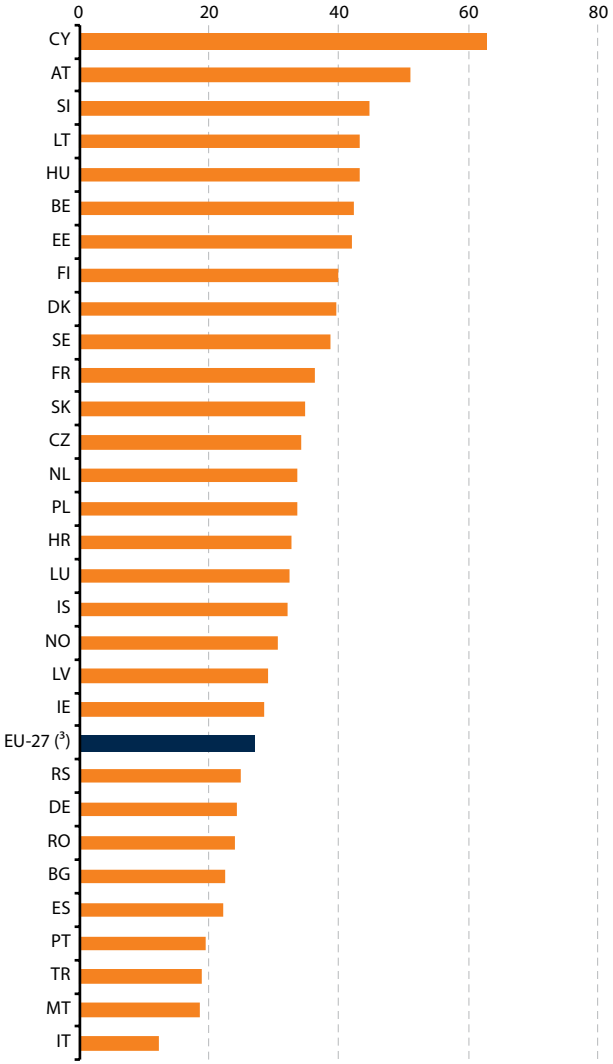
Table 5.6: Expenditures in product and/or process innovative enterprises in 2010, by type of expenditure (1)

	Total innovation expenditure (million EUR)	of which			
		Acquisition of machinery, equipment and software (%)	Acquisition of external knowledge (%)	Purchase of external R&D (%)	For in-house R&D (%)
BE	8 635	23.4	4.2	19.7	52.7
BG	201	84.0	2.3	2.6	11.2
CZ	3 243	50.9	4.1	20.7	24.4
DK	6 493	5.5	3.6	28.1	62.9
DE	92 230 e	:	:	:	:
EE	353	55.3	3.1	8.2	33.4
IE	2 545	23.7	8.1	18.9	49.2
EL	:	:	:	:	:
ES	11 987	29.8	5.5	20.7	44.0
FR	37 900	20.8	2.7	16.6	59.9
IT	23 386	40.1	4.6	10.9	44.4
CY	277	91.6	3.8	2.3	2.4
LV	130	77.4	2.6	8.1	11.9
LT	478	80.5	1.2	7.8	10.5
LU	598	35.9	7.1	7.8	49.2
HU	1 581	38.2	2.6	32.5	26.7
MT	93	72.4	3.4	0.1	24.1
NL	10 460	34.3	3.1	15.8	46.8
AT	6 335	18.6	1.8	10.3	69.3
PL	6 436	74.9	6.8	5.6	12.8
PT	2 279	40.5	2.8	9.8	46.9
RO	896	69.1	1.4	11.1	18.3
SI	625	35.6	3.4	8.5	52.3
SK	833	71.7	3.6	7.7	17.0
FI	7 251	15.1	2.2	18.3	64.4
SE	12 516	15.1	6.7	21.8	56.3
UK	:	:	:	:	:
NO	3 008	12.2	2.9	18.8	66.2
HR	888	32.4	1.7	3.4	62.5
RS	21	72.5	4.8	4.1	14.2
TR	5 923	56.0	5.3	3.7	35.0

(1) Product and/or process innovative enterprises i.e enterprises that implemented product and/or process innovation including enterprises with ongoing, suspended or abandoned activities, regardless organisational or marketing innovation.

Source: Eurostat (online data code: inn_cis7_exp).

Figure 5.7: Product and/or process innovative enterprises engaged in any type of co-operation, 2008–2010 (1) (2)
(% of the total of product and/or process innovative enterprises)



(1) Product and/or process innovative enterprises i.e enterprises that implemented product and/or process innovation including enterprises with ongoing, suspended or abandoned activities, regardless organisational or marketing innovation.
(2) EL and UK, data not available.
(3) EU-27 excluding EL and UK.

Source: Eurostat (online data code: inn_cis7_coop).

Table 5.8: Product and/or process innovative enterprises engaged in co-operation arrangements on innovation, 2008–2010 (1)

(% of the total of product and/or process innovative enterprises)

	Enterprises engaged in any type of innovation co-operation by partners localisation:				
	National (2)	in other countries in Europe (3)	in the US (3)	in other countries (3)	in China or India (3)
EU-27	24.4	11.4	3.1	2.5	2.0
BE	36.9	23.4	7.1	3.9	3.2
BG	18.3	12.8	3.0	3.2	1.8
CZ	30.6	20.9	3.8	3.9	2.8
DK	:	:	:	:	:
DE	23.5	8.2	2.2	1.5	1.5
EE	31.8	30.0	3.0	3.6	1.8
IE	22.7	17.6	6.9	3.7	3.0
EL	:	:	:	:	:
ES	21.3	5.3	1.1	1.0	0.5
FR	34.1	16.2	6.4	5.0	3.7
IT	11.4	4.0	1.0	1.1	0.8
CY	3.7	37.8	7.3	13.3	5.5
LV	25.8	20.6	5.1	8.1	4.4
LT	33.9	25.6	3.9	11.4	3.9
LU	21.9	27.2	7.0	5.8	6.0
HU	39.6	17.0	2.2	2.1	1.9
MT	10.4	13.1	4.5	2.7	2.7
NL	31.1	13.2	3.2	2.8	2.5
AT	43.7	30.1	5.5	3.9	2.9
PL	30.1	15.6	3.0	2.8	1.9
PT	18.7	8.7	1.8	2.3	0.8
RO	20.7	:	:	0.0	:
SI	44.7	34.8	7.6	8.5	6.0
SK	28.2	30.0	4.8	5.0	3.4
FI	39.7	27.5	12.2	7.6	8.9
SE	36.9	22.2	10.6	6.6	6.8
UK	:	:	:	:	:
IS	30.5	13.1	4.2	5.9	:
NO	27.7	16.4	5.9	3.3	3.4
HR	29.6	19.9	3.9	5.7	2.8
RS	23.8	14.4	3.1	3.5	2.9
TR	17.5	5.5	2.1	2.3	1.9

(1) Product and/or process innovative enterprises i.e enterprises that implemented product and/or process innovation including enterprises with ongoing, suspended or abandoned activities, regardless organisational or marketing innovation.
(2) EU-27 excluding DK, EL and UK.
(3) EU-27 excluding DK, EL, RO and UK.

Source: Eurostat (online data code: inn_cis7_coop).

Table 5.9: Highly important innovation objectives in product and/or process innovative enterprises, 2008–2010 (1)
(% of the total of product and / or process innovative enterprises)

	Increasing range of goods or services	Replacing outdated products or processes	Enter new markets	Improving quality of goods or services	Improving flexibility for producing goods or services	Increase capacity for producing goods or services	Improve health and safety	Reduce labour costs per unit output	Reducing material and energy costs per unit output	Reducing environmental impacts
BE	49.7	38.7	41.2	47.0	27.6	27.0	14.7	20.1	14.7	16.2
BG	40.9	29.9	39.8	45.9	28.7	27.1	28.9	25.9	21.2	20.7
CZ	49.2	31.9	33.0	44.7	27.7	24.2	16.1	25.0	19.0	15.1
DK	:	:	:	:	:	:	:	:	:	:
DE	:	:	:	:	:	:	:	:	:	:
EE	40.3	38.0	36.5	46.5	28.0	32.5	17.3	25.3	18.9	12.9
IE	47.9	30.3	55.3	52.6	33.8	30.2	30.1	40.2	34.9	23.2
EL	:	:	:	:	:	:	:	:	:	:
ES	35.0	28.2	35.6	43.2	33.6	36.1	20.9	24.8	18.1	19.2
FR	58.8	35.9	61.3	48.1	24.1	26.7	21.3	24.5	18.5	21.3
IT	43.4	26.4	33.4	51.3	24.6	24.3	27.3	15.3	14.4	16.8
CY	68.8	76.1	64.2	84.1	75.3	72.4	50.4	46.8	36.3	36.8
LV	49.6	44.5	53.6	57.5	29.7	31.8	27.8	31.7	31.5	26.6
LT	42.8	44.1	41.3	54.7	37.7	37.6	31.1	32.4	27.5	26.2
LU	74.8	33.4	53.1	69.8	38.2	33.7	24.5	25.5	16.7	23.7
HU	61.4	47.8	66.4	68.2	46.0	35.6	33.0	25.0	34.5	34.9
MT	41.0	19.8	33.8	44.6	27.9	21.6	23.9	24.3	20.3	17.6
NL	:	:	:	:	:	:	:	:	:	:
AT	50.3	41.1	49.1	58.0	33.3	28.8	21.1	19.4	21.0	19.9
PL	49.4	39.5	43.0	49.6	24.8	31.8	25.4	21.8	21.3	21.5
PT	39.8	30.0	42.1	50.8	32.0	34.2	34.0	35.4	27.2	26.0
RO	57.9	40.9	46.7	67.3	38.1	41.1	37.6	27.9	30.4	29.8
SI	72.8	46.3	55.2	66.3	38.1	35.1	33.9	43.6	37.2	32.9
SK	54.8	40.6	41.6	60.3	46.4	30.8	31.9	24.0	29.3	24.4
FI	:	:	:	:	:	:	:	:	:	:
SE	40.2	28.5	34.3	38.9	20.8	21.2	16.5	21.2	18.0	18.2
UK	:	:	:	:	:	:	:	:	:	:
NO	59.9	48.3	70.3	72.7	36.4	36.7	49.1	48.9	34.3	38.2
HR	48.1	38.2	40.9	58.7	39.9	31.5	25.4	30.4	23.5	26.3
RS	34.9	26.7	22.7	40.3	25.7	27.0	21.7	20.8	16.7	19.6
TR	62.7	39.1	64.2	74.0	41.8	59.4	45.9	51.5	49.3	37.7

(1) Product and/or process innovative enterprises i.e enterprises that implemented product and/or process innovation including enterprises with ongoing, suspended or abandoned activities, regardless organisational or marketing innovation.

Source: Eurostat (online data code: inn_cis7_obj).

Table 5.10: Product and/or process innovative enterprises that received public financial support for innovation activities, 2008–2010 (1)
(% of the total of product and/or process innovative enterprises)

	Enterprises that received any public funding	Public funding received from			
		Local or regional authorities	Central government (2)	European Union	7th Framework Programme
BE	22.6	15.2	9.4	5.9	2.3
BG	16.1	0.5	7.9	9.9	0.9
CZ	24.0	2.9	12.7	16.4	5.9
DK	:	:	:	:	:
DE	21.6	8.5	14.2	4.0	3.2
EE	24.5	1.7	17.6	11.3	2.1
IE	:	:	:	:	:
EL	:	:	:	:	:
ES	26.9	16.9	14.2	2.6	1.3
FR	46.1	13.3	41.5	9.1	2.1
IT	29.2	20.3	9.7	2.9	0.5
CY	42.0	2.6	37.8	9.8	2.3
LV	14.3	0.9	4.0	13.8	4.8
LT	35.8	2.8	6.3	34.0	3.7
LU	16.8	0.0	15.9	3.3	2.0
HU	34.4	1.0	19.5	20.6	2.1
MT	19.4	:	16.7	8.1	0.5
NL	34.1	13.0	32.6	3.9	1.0
AT	:	:	:	:	:
PL	19.6	3.5	5.6	15.6	3.1
PT	24.1	2.5	19.2	6.8	1.7
RO	9.3	2.2	6.1	4.0	1.4
SI	31.3	3.5	25.2	15.3	4.2
SK	15.5	0.4	4.3	12.7	1.9
FI	35.2	6.5	30.6	5.8	1.7
SE	:	:	:	:	:
UK	:	:	:	:	:
HR	29.0	5.5	25.4	2.1	0.1
RS	27.3	7.1	22.1	3.2	0.4
TR	28.1	3.1	26.3	0.9	0.4

(1) Product and/or process innovative enterprises i.e enterprises that implemented product and/or process innovation including enterprises with ongoing, suspended or abandoned activities, regardless organisational or marketing innovation.
(2) Including central government agencies or ministries.

Source: Eurostat (online data code: inn_cis7_pub).

Table 5.11 (Part I): Creativity and skills employed in-house in innovative enterprises, 2008–2010 ([1])
(% of the total of innovative enterprises)

	Design of objects or services	Engineering / applied sciences	Graphic arts / layout / advertising	Multimedia	Market research	Mathematics / statistics / database management	Software development	Web design skills
BE	21.5	21.9	17.3	15.7	17.6	22.9	22.1	19.1
BG	10.6	18.5	7.6	5.7	21.1	12.8	8.4	8.0
CZ	19.6	19.2	25.8	14.2	35.7	23.3	15.8	21.6
DK	:	:	:	:	:	:	:	:
DE	:	:	:	:	:	:	:	:
EE	17.6	31.1	8.9	5.9	21.3	36.4	11.2	13.0
IE	25.4	22.2	18.0	13.8	20.5	20.8	17.4	16.1
EL	:	:	:	:	:	:	:	:
ES	:	:	:	:	:	:	:	:
FR	22.9	20.5	17.8	14.0	18.4	19.5	16.7	15.0
IT	18.4	13.6	9.8	10.2	19.5	18.2	11.6	9.7
CY	29.6	33.2	15.2	7.7	35.6	42.8	18.1	13.2
LV	:	:	:	:	:	:	:	:
LT	24.9	21.0	17.8	13.5	30.4	28.6	13.6	19.2
LU	:	:	:	:	:	:	:	:
HU	12.7	23.9	15.3	8.9	26.1	29.8	13.7	15.6
MT	20.2	19.5	11.6	9.6	19.2	19.5	13.3	11.3
NL	26.9	18.6	22.2	15.5	12.7	20.9	17.1	16.5
AT	:	:	:	:	:	:	:	:
PL	22.0	14.9	24.4	14.7	25.7	22.3	17.1	21.5
PT	34.5	9.2	11.5	9.3	6.1	19.2	19.0	15.2
RO	29.0	27.9	23.1	13.9	42.2	22.8	16.9	15.8
SI	11.8	30.8	9.4	7.6	19.4	19.5	16.6	12.3
SK	15.6	14.8	14.6	11.3	33.7	25.8	8.2	15.6
FI	:	:	:	:	:	:	:	:
SE	25.3	20.0	19.6	14.6	18.2	22.0	16.8	20.4
UK	:	:	:	:	:	:	:	:
NO	34.5	34.7	34.2	21.9	21.1	28.7	30.9	31.4
HR	20.5	24.2	13.4	11.3	28.1	28.5	13.9	13.7
RS	29.3	18.9	17.8	11.3	37.4	26.2	19.6	18.4
TR	35.0	38.9	21.2	16.3	55.3	25.6	15.4	17.9

([1]) Innovative enterprises i.e. enterprises that implemented any type of innovation (including enterprises with abandoned, suspended or ongoing innovation activities).

Source: Eurostat (online data code: inn_cis7_csk).

Table 5.11 (Part II): Creativity and skills employed in-house in non-innovative enterprises, 2008–2010 ([1])
(% of the total of non-innovative enterprises)

	Design of objects or services	Engineering / applied sciences	Graphic arts / layout / advertising	Multimedia	Market research	Mathematics / statistics / database management	Software development	Web design skills
BE	6.1	6.3	7.3	5.8	5.8	4.8	8.6	8.9
BG	3.2	5.5	2.6	1.6	5.5	3.2	2.4	2.2
CZ	4.7	5.6	9.9	5.2	13.7	8.1	4.4	10.1
DK	:	:	:	:	:	:	:	:
DE	:	:	:	:	:	:	:	:
EE	8.4	21.2	7.2	3.2	12.1	22.3	5.6	7.8
IE	8.8	6.4	9.5	5.2	7.4	5.0	4.7	9.0
EL	:	:	:	:	:	:	:	:
ES	:	:	:	:	:	:	:	:
FR	6.5	4.4	6.9	4.7	6.3	4.6	4.5	5.7
IT	8.2	3.8	5.3	3.9	7.9	6.3	4.4	3.7
CY	15.9	20.6	12.4	3.2	22.3	25.6	10.7	10.6
LV	:	:	:	:	:	:	:	:
LT	10.9	6.1	6.4	5.7	12.8	11.6	5.5	9.2
LU	:	:	:	:	:	:	:	:
HU	3.5	8.1	4.6	2.8	10.3	9.9	2.5	4.6
MT	3.5	2.6	2.6	0.9	2.8	3.5	1.2	2.8
NL	9.9	2.8	11.4	5.4	4.7	7.6	3.5	8.2
AT	:	:	:	:	:	:	:	:
PL	9.1	5.5	10.0	5.6	10.1	7.7	5.7	8.8
PT	5.6	3.1	3.8	2.5	2.6	2.6	1.8	2.4
RO	10.7	13.3	9.4	5.8	23.0	11.3	9.1	6.5
SI	5.3	11.4	3.5	3.0	6.1	8.2	5.2	4.4
SK	6.0	6.8	7.8	5.0	22.5	13.3	3.6	5.8
FI	:	:	:	:	:	:	:	:
SE	10.1	6.5	11.1	5.8	7.4	8.9	7.0	12.2
UK	:	:	:	:	:	:	:	:
NO	8.4	5.1	12.2	5.5	4.0	5.6	5.7	10.2
HR	5.0	7.3	3.9	2.8	9.8	8.3	3.5	3.0
RS	0.2	0.0	0.1	:	0.5	0.4	0.2	0.0
TR	13.0	17.6	7.5	5.1	23.1	8.2	5.4	7.1

([1]) Non-innovative enterprises i.e. enterprises that didn't implement any innovation.

Source: Eurostat (online data code: inn_cis7_csk).

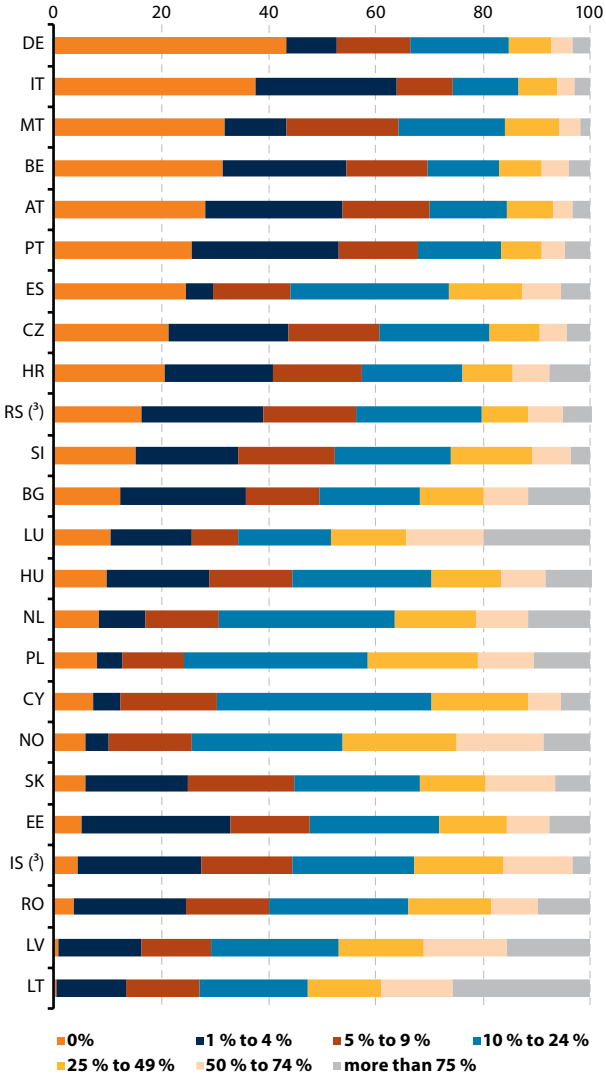
Table 5.12: Successful methods stimulating new ideas or creativity in innovative enterprises, 2008–2010 (1)
(% of the total of innovative enterprises)

	Brainstorming sessions	Financial incentives for employees to develop new ideas	Job rotation of staff	Multidisciplinary or cross-functional work teams	Non-financial incentives for employees	Training employees
BE	42.0	8.7	16.2	31.9	10.1	18.9
BG	16.3	17.3	11.0	14.6	10.2	19.4
CZ	31.2	31.0	4.7	18.3	20.7	23.2
DK	:	:	:	:	:	:
DE	:	:	:	:	:	:
EE	37.6	14.6	17.4	32.0	16.0	11.9
IE	51.7	10.4	23.6	38.0	13.2	21.0
EL	:	:	:	:	:	:
ES	:	:	:	:	:	:
FR	32.9	8.8	14.5	41.4	12.9	16.5
IT	6.9	4.1	6.9	7.9	4.6	8.1
CY	76.9	22.5	50.3	52.6	21.2	51.8
LV	:	:	:	:	:	:
LT	25.2	24.5	10.8	26.9	23.8	26.9
LU	72.2	22.2	35.4	68.4	32.4	46.1
HU	29.5	16.2	11.7	22.3	17.1	21.8
MT	44.0	12.9	20.9	26.8	12.6	19.2
NL	37.6	5.5	10.6	20.7	8.7	13.2
AT	:	:	:	:	:	:
PL	31.8	26.6	15.1	18.4	15.2	21.2
PT	18.8	8.0	18.8	20.8	9.7	23.2
RO	18.1	31.9	17.4	19.7	22.3	24.8
SI	39.4	27.2	27.8	40.3	22.0	24.8
SK	30.0	26.4	13.4	27.4	24.3	22.6
FI	39.2	10.4	21.2	17.7	10.6	16.5
SE	2.2	2.3	1.1	0.8	1.0	0.7
UK	:	:	:	:	:	:
NO	12.1	7.4	8.5	9.9	10.8	10.1
HR	21.5	21.4	25.4	17.5	20.8	24.4
RS	14.8	28.0	26.9	20.1	24.4	32.4
TR	20.1	16.1	17.6	26.4	19.1	20.5

(1) Innovative enterprises i.e. enterprises that implemented any type of innovation (including enterprises with abandoned, suspended or ongoing innovation activities).

Source: Eurostat (online data code: inn_cis7_sucmet).

Figure 5.13: Innovative enterprises by shares of employees with a university degree in 2010 (1) (2)
(% of the total of innovative enterprises)



(1) Innovative enterprises i.e. enterprises that implemented any type of innovation (including enterprises with abandoned, suspended or ongoing innovation activities).
(2) DK, EL and UK, data not available.
(3) Estimates.

Source: Eurostat (online data code: inn_cis7_bas).

Table 5.14: Implementation type of a new marketing method (marketing innovation) in product and/or process innovative enterprises, 2008–2010 (1)
(% of the total of product and/or process innovative enterprises)

	Introduction of significant changes to the aesthetic design or packaging	Introduction of new media or techniques for product promotion	Introduction of new methods for product placement	Introduction of new methods of pricing goods or services
BE	51.9	63.9	31.7	28.9
BG	54.4	60.9	43.5	61.8
CZ	49.9	68.9	34.2	39.4
DK	:	:	:	:
DE	51.4	53.5	53.0	38.9
EE	53.1	43.6	52.3	35.5
IE	52.9	67.9	46.4	47.8
EL	:	:	:	:
ES	52.2	58.4	45.8	43.0
FR	69.3	61.8	34.8	42.4
IT	57.4	60.6	35.7	42.6
CY	56.4	81.3	70.8	59.4
LV	52.3	64.3	48.7	63.9
LT	45.4	35.9	43.7	70.1
LU	55.3	60.9	47.0	61.6
HU	50.4	56.9	47.5	53.2
MT	56.9	61.8	50.0	34.3
NL	29.5	65.3	46.6	33.2
AT	56.6	59.4	40.8	34.0
PL	47.4	57.0	39.6	55.0
PT	54.2	62.0	33.3	51.4
RO	60.8	59.4	49.2	64.7
SI	53.3	63.1	52.3	58.2
SK	52.3	53.9	44.8	39.0
FI	39.1	63.8	33.6	47.2
SE	48.6	64.7	47.7	43.3
UK	:	:	:	:
IS	50.0	50.4	49.2	33.3
NO	64.4	52.3	37.9	36.2
HR	49.3	55.3	45.5	53.6
RS	55.9	54.5	32.0	71.9
TR	65.7	65.4	46.2	64.0

(1) Product and/or process innovative enterprises i.e enterprises that implemented product and/or process innovation including enterprises with ongoing, suspended or abandoned activities, regardless organisational or marketing innovation.

Source: Eurostat (online data code: inn_cis7_sucmet).

Table 5.15: Product and/or process innovative enterprises with knowledge factors highly hampering innovation activities, 2008–2010 (1)
(% of the total product and/or process innovative enterprises)

	Lack of qualified personnel	Lack of information on technology	Lack of information on markets	Difficulty in finding cooperation partners for innovation
BE	13.6	3.8	4.2	5.3
BG	16.6	7.7	9.7	19.8
CZ	10.8	2.1	2.5	3.5
DK	:	:	:	:
DE	:	:	:	:
EE	14.0	4.1	3.7	4.7
IE	8.2	2.7	5.1	5.8
EL	:	:	:	:
ES	10.6	7.9	8.8	12.2
FR	14.1	4.6	6.1	8.8
IT	8.6	3.4	4.2	11.6
CY	9.7	7.9	5.2	8.9
LV	11.5	4.2	6.0	10.2
LT	12.2	5.4	5.7	8.7
LU	12.5	1.3	2.5	10.7
HU	10.6	3.5	4.7	5.6
MT	6.8	3.2	7.2	7.7
NL	:	:	:	:
AT	:	:	:	:
PL	8.0	6.2	5.7	8.7
PT	12.9	6.8	7.4	13.8
RO	9.3	3.8	5.1	7.6
SI	5.8	1.5	2.1	2.8
SK	10.0	4.2	4.8	4.6
FI	10.0	2.8	4.5	3.4
SE	11.5	1.7	2.7	2.6
UK	:	:	:	:
IS	7.4	1.5	1.3	4.2
NO	12.2	3.6	4.3	5.3
HR	14.0	4.7	5.4	9.8
RS	8.3	5.0	5.6	15.4

(1) Product and/or process innovative enterprises i.e enterprises that implemented product and/or process innovation including enterprises with ongoing, suspended or abandoned activities, regardless organisational or marketing innovation.

Source: Eurostat (online data code: inn_cis7_ham).

6

Patents

In 2010, Germany submitted the largest number of patent applications to the EPO among the EU-27 countries (21 880), followed by France (8 751), the United Kingdom (4 795) and Italy (4 443). In terms of patent applications per million inhabitants, Sweden was top (308), followed by Germany (267) and Denmark (244).

At world level, the highest numbers of patent applications were recorded in the US (24 744), in Japan (16 777) and in Korea (3 501).

At EU level, the number of patent applications to the EPO decreased by an average of 0.7 % per year between 2005 and 2010. Over the same period, patenting activity rose in a majority of EU Member States (the Czech Republic, Denmark, Estonia, Ireland, Spain, France, Latvia, Lithuania, Hungary, Austria, Poland, Romania, Slovenia, Slovakia and Sweden).

In 2009, the highest proportion of the EU-27 patent applications to the EPO were related to IPC section B 'Performing operations: transporting'. Most countries were highly specialised, with 20 % or more of all their applications relating to just one section of the IPC. Denmark, Ireland, Spain, Cyprus, Hungary, Malta and Slovenia specialised in patenting linked to 'Human necessities' (IPC section A). 'Performing operations: transporting' (section B) was the most prominent section for patenting in the Czech Republic, Germany, Greece, Italy, Austria, Portugal and Slovakia, whereas 20 % or more of patent applications from Lithuania, Latvia and Belgium were related to 'Chemistry: metallurgy' (section C). By contrast, a smaller proportion of patent applications was related to 'Textiles: paper' (section D), 'Fixed constructions' (section E) and 'Mechanical engineering' (section F). The biggest share of patent applications to the EPO in Estonia concerned 'Physics' (section G). EPO applications relating to 'Electricity' (section H) predominated in Bulgaria, France, the Netherlands, Poland, Romania, Finland and Sweden.

The majority of patent applications were submitted by the business enterprise sector, which accounted for half or even three quarters of all patent applications in all of the countries under review (except for Latvia, Greece, Russia and Bulgaria, where numbers remained well below 50 %).

ICT patent applications to the EPO as a percentage of the total varied significantly. Shares of over 50 % were noted for Croatia (55.1 %) and Romania (52.7 %).

Biotechnology was another increasingly fertile field in terms of patent applications. Overall, however, it was still one of the smaller fields. Cyprus led in biotechnology intensity patenting in 2009, with 16.4 % of all its patent applications being registered in this field. At EU level, only 3.5 % of all patent applications were related to biotechnology inventions.

Nanotechnology was a field of research still in its infancy and therefore small in terms of patenting. Nevertheless, in 2009, the EU-27 accounted for 45 % of all nanotechnology patent applications to the EPO, followed by the United States (22 %) and Japan (14 %).

In terms of the foreign ownership of domestic inventions in patent applications to the EPO, the EU-27 as an entity ranked third with 11.4 % of foreign ownership, behind Japan and South Korea (3 % each), but ahead of the United States, Taiwan and Switzerland. In the EU Member States, shares of more than 50 % of foreign ownership were registered in Romania, Hungary, Malta, Latvia, Cyprus and Bulgaria; in Germany and Finland they were below 20 %.

The vast majority of all EU patent applications to the EPO were co-patents involving several applicants from the same country (57.1 % in 2009).

Analysis of patenting behaviour at regional level in 2010 shows that the top thirty NUTS 3 regions in terms of patent applications included 10 in Germany, 8 in France, 3 in Sweden, 2 in the United Kingdom, in Italy and in Spain, and one in the Netherlands, Austria and Finland. High-tech patent applications represented 47.7 % of the total patent applications in Haute-Garonne (France). By contrast, Esslingen (Germany) reported only 6.9 % of high-tech patent applications.

Table 6.1: Patent applications to the EPO, total number, per million inhabitants and average annual growth rate (AAGR) (1)

	Total		Per million inhabitants		AAGR
	2005	2010 (2)	2005	2010 (3)	2005–2010 (4)
EU-27	56 788	54 721	116	109	– 0.7
BE	1 502	1 412	144	130	– 1.2
BG	24	12	3	2	– 12.9
CZ	109	270	11	26	19.9
DK	1 169	1 350	216	244	2.9
DE	23 914	21 880	290	267	– 1.8
EE	6	51	4	38	53.4
IE	275	353	67	79	5.1
EL	111	79	10	7	– 6.6
ES	1 356	1 458	32	32	1.5
FR	8 366	8 751	133	135	0.9
IT	4 894	4 443	84	74	– 1.9
CY	17	14	22	18	– 3.8
LV	19	24	8	12	6.1
LT	9	22	3	6	19.6
LU	101	83	219	165	– 3.8
HU	135	203	13	20	8.5
MT	11	7	28	16	– 11.5
NL	3 490	3 236	214	195	– 1.5
AT	1 515	1 581	185	189	0.9
PL	128	308	3	8	19.2
PT	124	110	12	10	– 2.4
RO	29	40	1	2	6.6
SI	109	165	54	81	8.6
SK	31	33	6	6	1.3
FI	1 322	1 167	253	218	– 2.5
SE	2 410	2 879	267	308	3.6
UK	5 614	4 795	94	77	– 3.1
IS	31	19	105	59	– 9.3
LI	26	47	738	1 310	12.6
NO	489	409	106	84	– 3.5
CH	3 199	2 971	431	382	– 1.5
HR	33	25	8	6	– 5.4
TR	166	321	2	4	14.1
AU	1 109	759	54	41	– 9.0
CA	2 446	1 793	76	62	– 7.5
CN	1 655	3 356	1	2	19.3
IL	1 404	1 069	210	169	– 6.6
IN	588	770	1	1	9.4
JP	21 764	16 777	170	148	– 6.3
KR	5 122	3 501	106	80	– 9.1
RU	304	212	2	1	– 7.0
TW	749	1 291	33	46	14.6
US	36 536	24 744	123	97	– 9.3

(1) The calculation of the AAGR is based on the total number of patent applications to the EPO.
(2) LV and MT, 2009.
(3) AU, CA, CN, IL, JP, KR, TW and US, 2008; IN, 2007.
(4) LV and MT, between 2005 and 2009.

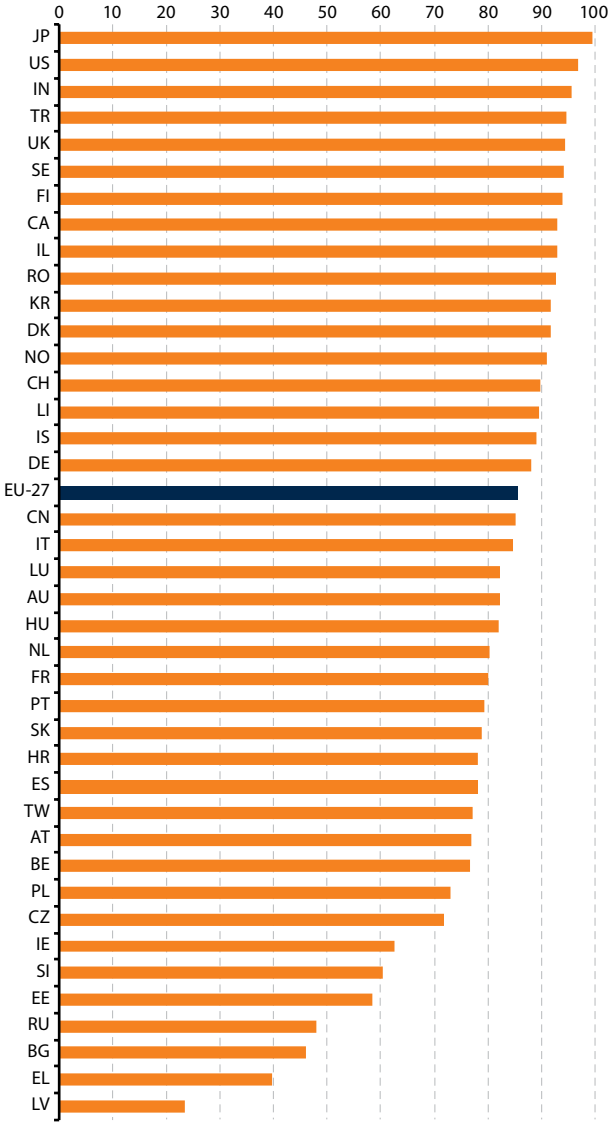
Source: Eurostat (online data code: pat_ep_ntot).

Table 6.2: Breakdown of patent applications to the EPO by IPC section as a percentage of total, 2009
(%)

	IPC section							
	Human necessities	Performing operations; transporting	Chemistry; metallurgy	Textiles; paper	Fixed constructions	Mechanical engineering; lighting;heating; weapons; blasting	Physics	Electricity
EU-27	16.4	20.4	11.2	1.6	5.3	13.6	14.5	17.1
BE	17.2	17.5	21.5	0.9	6.8	7.8	11.7	16.6
BG	16.9	14.0	10.8	1.3	6.3	10.3	9.9	30.5
CZ	16.0	18.4	12.8	4.4	9.4	14.9	13.6	10.5
DK	23.2	14.1	10.7	0.7	8.1	17.7	11.3	14.0
DE	14.1	23.8	10.9	1.7	4.7	16.6	13.2	14.9
EE	16.2	14.4	6.6	:	15.2	11.5	18.7	17.3
IE	30.8	11.9	8.8	0.3	5.2	6.1	16.0	20.8
EL	22.9	23.1	17.6	:	8.1	6.1	12.4	9.7
ES	21.1	20.2	11.8	1.6	6.2	13.6	11.4	13.9
FR	16.2	18.3	11.5	0.9	4.5	10.4	17.3	20.8
IT	20.2	25.7	9.0	3.3	7.2	14.2	9.9	10.5
CY	39.9	24.5	7.0	:	:	:	20.4	8.2
LV	34.0	9.0	38.8	:	4.5	13.6	:	:
LT	13.6	15.2	55.9	:	:	:	:	15.2
LU	4.4	14.2	25.7	0.8	12.9	26.6	10.0	5.5
HU	27.6	10.5	11.8	0.8	4.8	10.8	8.5	25.1
MT	70.5	15.1	5.9	:	:	:	:	8.5
NL	19.9	15.0	12.0	0.8	4.7	8.3	19.1	20.2
AT	15.4	20.5	11.9	2.2	8.9	16.0	13.8	11.4
PL	13.7	12.7	15.3	4.4	10.0	10.9	16.2	16.8
PT	18.4	20.0	12.0	1.0	7.8	12.4	17.7	10.6
RO	0.3	6.7	5.0	0.7	:	5.1	40.3	42.0
SI	34.6	5.4	19.4	1.0	12.7	6.1	13.7	7.1
SK	6.0	25.3	8.1	0.5	10.7	13.4	23.0	12.8
FI	8.7	16.5	10.1	4.2	6.2	8.5	15.3	30.3
SE	15.0	17.4	6.0	1.2	4.1	10.3	15.5	30.4
UK	19.4	13.0	12.4	0.5	4.8	11.8	18.4	19.5
IS	45.8	19.8	14.3	6.6	:	3.2	1.6	8.9
LI	28.4	14.9	14.5	:	5.1	25.0	5.1	6.9
NO	16.3	17.3	15.8	0.1	12.2	12.6	17.6	8.1
CH	24.8	20.5	10.4	1.8	5.0	8.2	16.6	12.8
HR	11.6	16.5	15.5	6.9	:	28.3	13.1	8.1
TR	30.3	13.6	4.7	7.3	4.2	21.3	8.8	9.7
AU	27.6	16.1	12.9	0.3	8.3	7.9	16.6	10.2
CA	13.0	9.8	10.2	0.9	2.9	5.2	24.3	33.7
CN	8.7	5.3	7.6	0.8	1.3	4.8	12.7	58.7
IL	34.6	10.7	8.3	0.1	1.2	5.9	23.4	15.9
IN	22.9	6.3	26.6	0.7	1.3	10.1	16.4	15.7
JP	9.4	16.3	13.4	1.0	0.7	10.2	21.7	27.2
KR	8.2	5.5	7.2	3.0	0.9	7.2	21.1	46.8
RU	18.1	11.2	14.7	0.7	6.1	8.4	27.0	14.0
TW	12.0	12.9	4.0	1.0	1.4	12.7	22.7	33.2
US	24.1	10.6	13.6	0.7	2.1	8.0	20.9	20.0

Source: Eurostata (online data code: pat_ep_nipc).

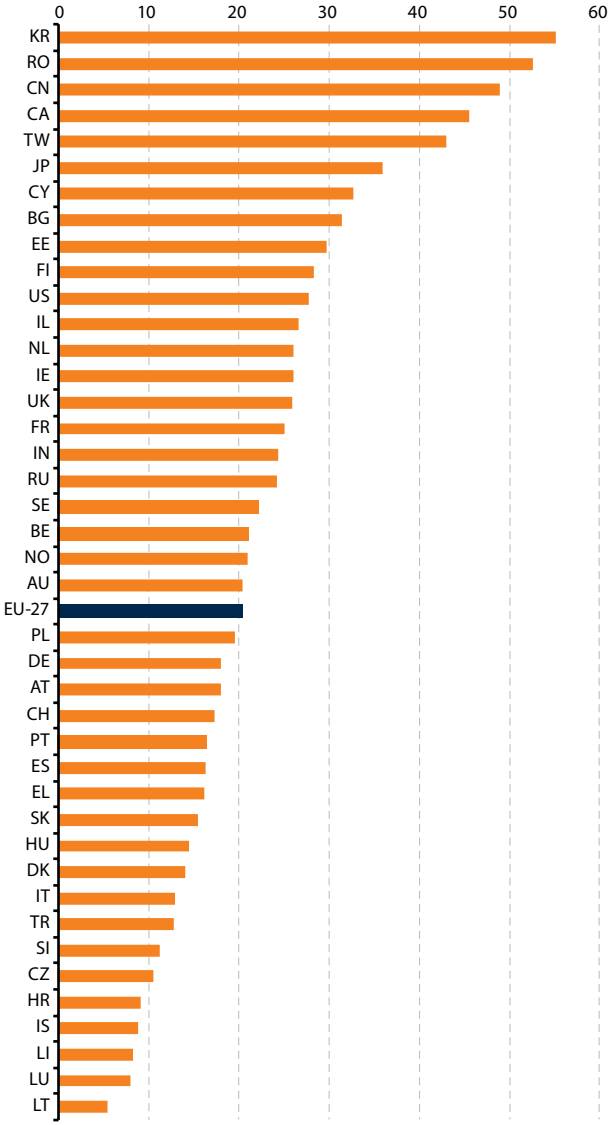
Figure 6.3: Patent applications submitted by business enterprise sector (BES) as a percentage of total, 2009 (1) (2) (%)



(1) Cut-off: at least 10 patent applications.
(2) IS, 2007.

Source: Eurostat (online data code: pat_ep_nic).

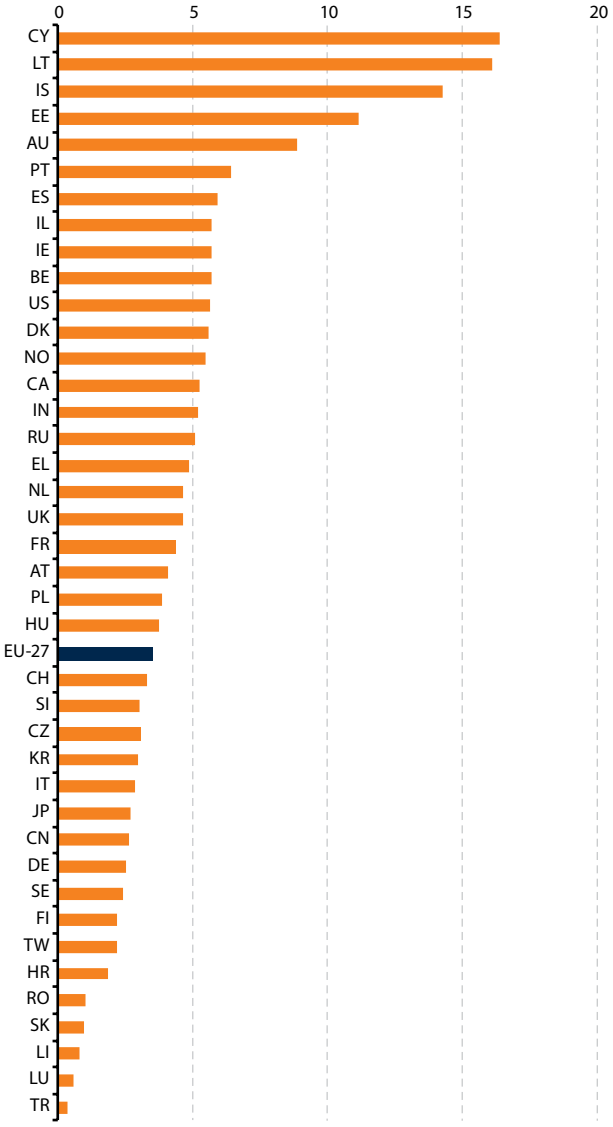
Figure 6.4: ICT patent applications to the EPO as a percentage of total, 2009 (1) (2)
(%)



(1) Cut off: at least 10 patent applications.
(2) LV, not available.

Source: Eurostat (online data codes: pat_ep_nict and pat_ep_ntot).

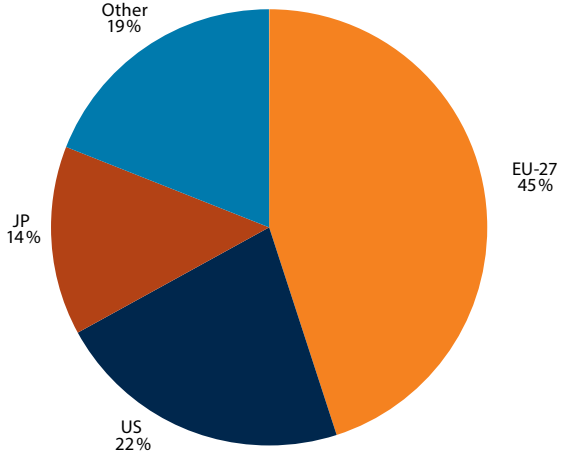
Figure 6.5: Biotechnology patent applications to the EPO as a percentage of total, 2009 (1) (2)
(%)



(1) Cut-off: at least 10 patent applications.
(2) EE, RO and SK, 2008.

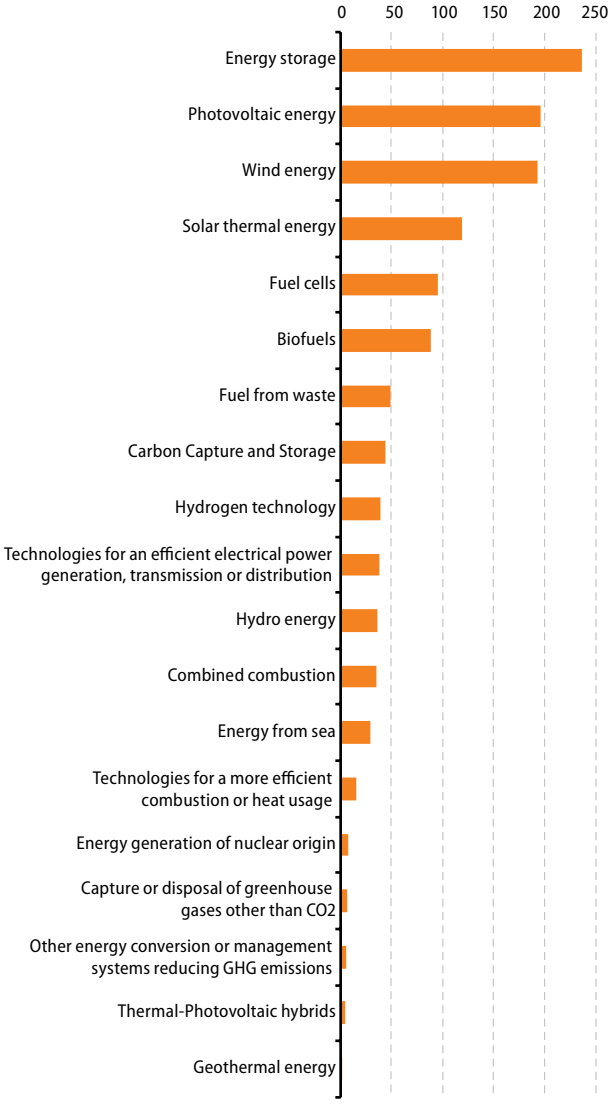
Source: Eurostat (online data codes: pat_ep_nbio and pat_ep_ntot).

Figure 6.6: Distribution of nanotechnology patent application to the EPO, EU-27, Japan and the United States, 2009
(%)



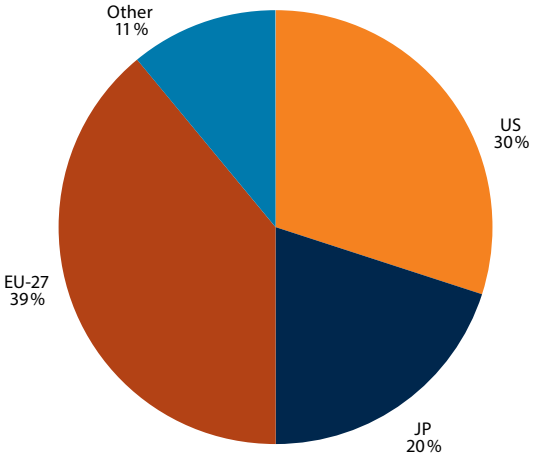
Source: Eurostat (online data code: pat_ep_nnano).

Figure 6.7: Distribution of energy technologies PCT applications designated to the EPO at EU-27 level, 2009
(Total number)



Source: Eurostat (online data code: pat_ep_nrgpct).

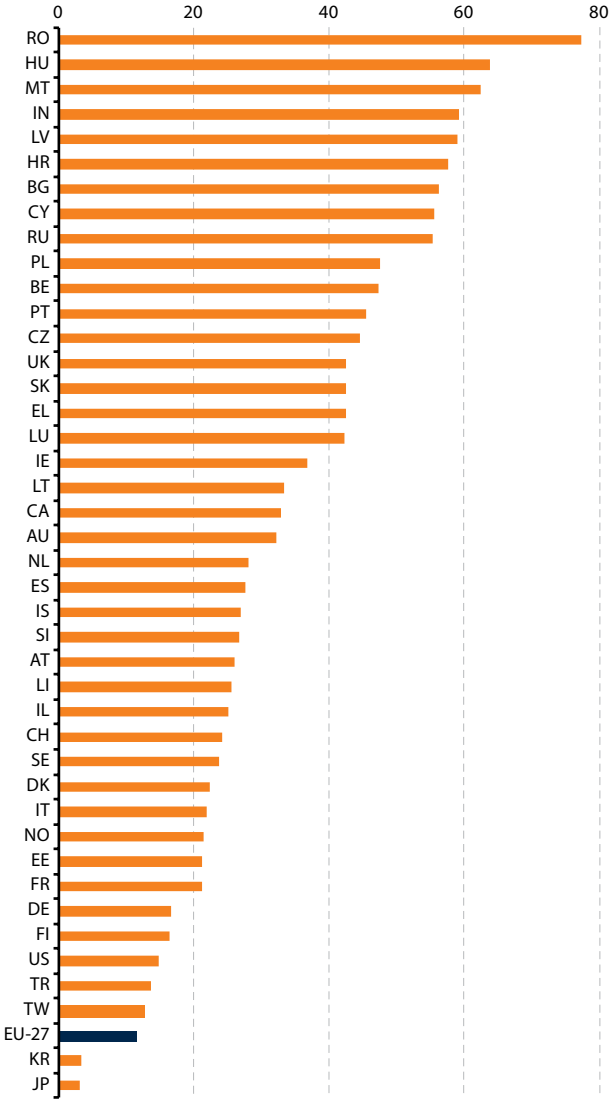
Figure 6.8: Distribution of patent applications to the EPO on radio navigation by satellite, EU-27, Japan and the United States, 2009
(%)



Source: Eurostat (online data code: pat_ep_nrns).

Figure 6.9: Foreign ownership of domestic inventions in patent applications to the EPO as a percentage of total, EU-27 and selected countries, 2009 (1)

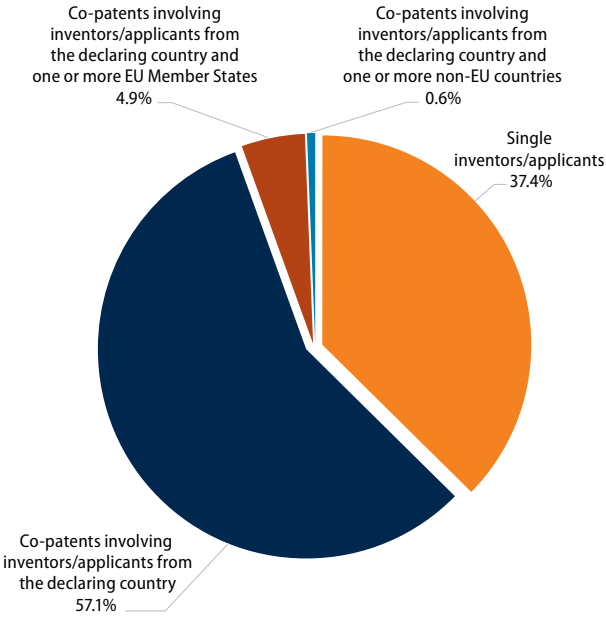
(%)



(1) LT, 2008.

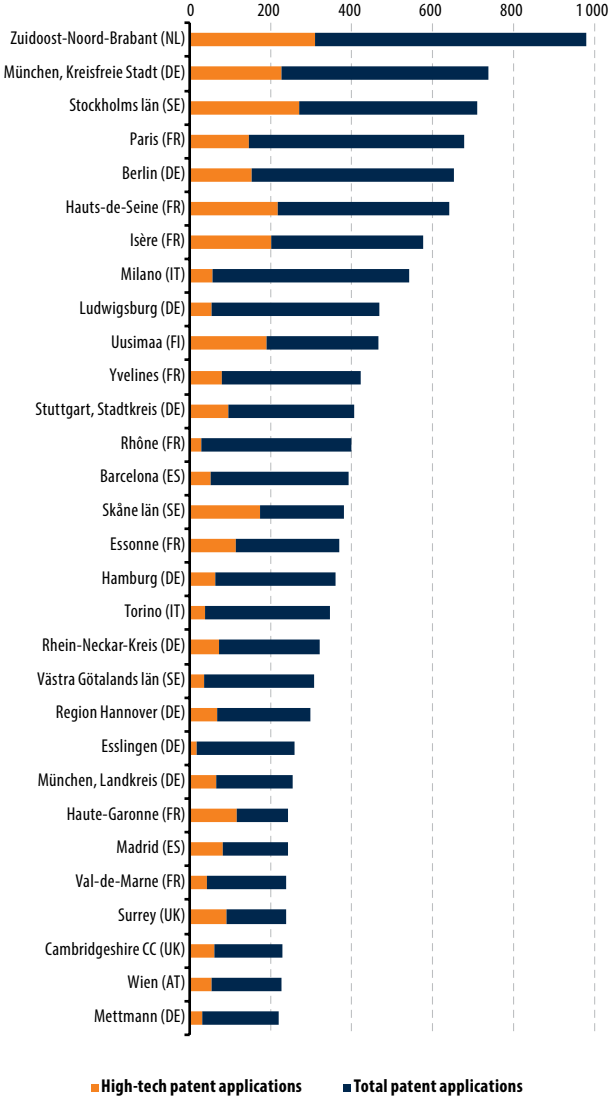
Source: Eurostat (online data code: pat_ep_nfgn).

Figure 6.10: Breakdown of EU co-patenting at the EPO according to inventors' country of residence, 2009
(%)



Source: Eurostat (online data code: pat_ep_cpi).

Figure 6.11: Top 30 regions at NUTS 3 level in terms of total patent applications to the EPO and share of high-tech patent applications, 2008
(Total number)



Source: Eurostat (online data codes: pat_ep_rtot and pat_ep_rtec).

7

High technology

The total venture capital investment (VCI) decreased in 2009 compared to 2008 in the majority of countries under review. It dropped by 57 % in the EU-15 from 2008 to 2009. Although investments increased sharply again in 2010 and 2011 in most of the countries, levels were still lower than in 2007 and 2008. In 2011, most of the investments were largely concentrated in buyouts and growth capital across the EU with the exception of Ireland and Greece.

In 2010, the European Union had almost 50 000 enterprises in high-tech manufacturing and over 800 000 enterprises in knowledge-intensive services.

In terms of turnover in high-tech manufacturing, the turnover generated by German enterprises (EUR 109 billion) represented one fifth of the EU-27 turnover (over EUR 522 billion), and far ahead of France (EUR 71 billion), Ireland (EUR 47 billion), the United Kingdom and Italy (almost EUR 46 billion each). The value added was distributed in a similar way, with the highest contribution coming from Germany (nearly EUR 38 billion), followed by the United Kingdom (EUR 21 billion), France (EUR 19 billion), Ireland (EUR 16 billion) and Italy (EUR 13 billion).

The United Kingdom was the leading EU Member State in high-tech knowledge-intensive services, with nearly 140 000 enterprises; it also ranked first in terms of turnover, production value and value added in the high-tech KIS sector.

In 2011 Germany was the leading exporter of high-tech products in the EU-27, followed by the Netherlands, France, the United Kingdom and Belgium. Except for the United Kingdom, these countries also had a positive high-tech trade balance from 2009 to 2011. At EU level as a whole, the high-tech trade balance was negative in 2011, with imports approximately EUR 27 billion higher than exports.

In terms of the share of high-tech exports of total exports in 2011, the EU average was 15.4 % with wide disparities across countries, ranging from more than 30 % in Malta to 3 % in Portugal. At the same time, the majority of the countries under review recorded a decrease in high-tech exports in 2011 as compared to 2009.

In the majority of EU Member States, the share of intra-EU exports of high-tech products in 2011 was higher than the share of extra-EU exports. Nevertheless, there were nine countries which exported more to countries outside the EU.

The share of extra-EU exports of the high-tech products of Sweden, Finland and the United Kingdom, for example, was around 60 % and in Malta the figure exceeded 80 % (of total exports of high-tech products).

In 2011, around 76 million people were employed in Knowledge Intensive Activities (KIA) in the EU-27, which represented 35.5 % of total employment. Belgium, Ireland, Luxembourg, Malta, Sweden and the United Kingdom ranked highest with over 40 % of employment in the KIA sectors. In Bulgaria, Poland and Portugal, the figure was below 30 % and in Romania it was just over 20 %.

In terms of employment growth in the KIA sectors, Turkey, and Malta saw an increase of 4 % annually between 2009 and 2011. The biggest fall, of more than 4 % per year in absolute terms, was registered in Bulgaria.

In the EU-27, women accounted for 56 % of employment in the KIA sectors compared with only 46 % in total employment (all sectors) in 2011. In the KIA sectors, women outnumbered men in all the countries under review except for Greece, the Former Yugoslav Republic of Macedonia, Luxembourg, Malta and Turkey. Gender parity in total employment (all sectors) was achieved only in Latvia, Lithuania and Estonia.

The share of employment in high-tech sectors (of total employment) at regional level in 2011 varied significantly from one country to another, and large discrepancies were observed between the highest and lowest shares. Capital regions and their environs often had the highest shares, e.g. Berkshire, Buckinghamshire and Oxfordshire (close to London) (UK) with 11.7 %, Province Brabant Wallon (BE) with 10.1 %, Hovedstaden (DK) with 9.2 %, as well as Praha (CZ) and Stockholm (SE) both with 8.8 %. By contrast, the lowest shares of employment in high-tech sectors, of less than 1 % of total employment, were registered in Región de Murcia (ES), Centro (PT), Nord-Est (RO), and Manisa, Afyonkarahisar, Kütahya and Usak (TR).

Table 7.1: Total Venture Capital Investment (VCI) (million EUR)

	2007	2008	2009	2010	2011
EU-15	69 357	51 105	21 806	39 713	42 977
BE	1 011	667	1 048	482	583
BG	39	15	6	5	11
CZ	70	36	61	38	193
DK	1 197	505	493	436	378
DE	8 144	7 100	2 412	4 804	4 397
IE	321	76	59	48	51
EL	90	232	41	10	9
ES	2 759	1 601	913	2 471	2 253
FR	12 105	8 517	3 445	5 939	9 249
IT	1 705	3 222	1 415	895	1 185
LU	43	368	78	85	221
HU	51	34	191	45	78
NL	3 498	1 707	764	1 318	2 048
AT	356	217	138	127	124
PL	781	727	480	504	689
PT	211	396	299	201	367
RO	156	123	83	80	48
FI	840	482	388	419	420
SE	2 543	3 270	1 261	3 114	2 164
UK	34 533	22 746	9 052	19 365	19 526
NO	757	760	623	984	721
CH	857	1 238	719	1 525	680

Source: Eurostat (online data code: htec_vci_stage2).

Table 7.2: Breakdown of Venture Capital Investment (VCI) by stage of development, 2011
(%)

	Venture capital				Other investments			
	Total	Seed stage	Start-up stage	Later stage venture	Buyouts	Growth capital	Rescue/ Turnaround capital	Replacement capital
EU-15	8.1	0.4	4.0	3.7	77.0	11.0	1.0	2.9
BE	19.1	0.3	14.1	4.7	36.3	44.1	0.3	0.3
BG	1.8	0.0	0.9	0.9	90.9	7.3	0.0	0.0
CZ	4.3	0.1	2.1	2.1	95.7	0.0	0.0	0.0
DK	41.0	2.0	21.1	17.9	56.8	0.6	1.7	0.0
DE	17.3	1.0	9.5	6.9	68.7	11.7	0.7	1.6
IE	79.6	1.5	72.6	5.4	7.0	9.9	3.5	0.0
EL	100.0	53.8	43.1	3.1	0.0	0.0	0.0	0.0
ES	5.9	0.8	2.2	2.9	80.0	10.7	0.5	3.0
FR	7.9	0.3	3.6	4.0	77.8	12.6	0.8	0.9
IT	4.3	0.3	3.0	1.1	81.2	13.0	0.6	0.8
LU	45.7	0.0	30.4	15.3	29.8	11.7	0.0	12.8
HU	39.1	4.4	21.8	12.8	60.3	0.6	0.0	0.0
NL	9.7	0.4	5.6	3.7	68.9	18.7	1.0	1.7
AT	20.4	6.0	7.1	7.4	50.5	16.4	3.0	9.7
PL	3.2	0.1	0.8	2.4	69.9	26.6	0.3	0.0
PT	3.5	0.1	2.6	0.8	92.0	3.0	1.5	0.0
RO	0.8	0.0	0.8	0.0	9.6	51.4	0.0	38.2
FI	18.5	0.8	11.5	6.2	58.6	10.4	11.9	0.5
SE	10.8	0.1	5.7	5.0	84.8	3.3	0.0	1.0
UK	4.2	0.1	1.5	2.5	80.6	9.4	1.0	4.8
NO	16.5	0.7	11.9	3.9	57.3	25.0	0.1	1.1
CH	35.4	1.0	21.0	13.4	58.1	6.4	0.2	0.0

Source: Eurostat (online data code: htec_vci_stage2).

Table 7.3: Economic statistics on high-technology manufacturing sector, 2010 (1)

	Number of enterprises	Turnover (EUR million)	Production value (EUR million)	Value added (EUR million)	Gross investment in tangible goods (EUR million)
EU-27	48 100 e	522 408 e	: c	163 649	:
BE	826	12 731	13 418	5 363	826
BG	424	: c	: c	: c	: c
CZ	3 958	12 123	11 663	1 220	273
DK	630	11 614	11 344	5 108	476
DE	8 975	108 936	98 505	38 432	4 460
EE	118	956	935	121	24
IE	166	47 100	46 541	15 774	576
EL	544	1 813	1 663	781	544
ES	3 027	20 946	18 405	5 954	669
FR	3 403	71 151	58 242	19 199	:
IT	6 909	45 682	43 010	13 319	1 359
CY	13	180	177	55	13
LV	131	: c	: c	: c	: c
LT	153	324	310	92	18
LU	10	: c	: c	: c	: c
HU	1 749	20 890	18 024	2 628	486
MT	:	:	:	:	:
NL	1 592	22 096	14 683	5 444	267
AT	648	8 397	7 356	3 281	316
PL	3 097	15 123	13 166	2 759	436
PT	479	2 885	2 604	697	84
RO	1 092	3 567	3 399	706	171
SI	325	2 040	1 910	822	167
SK	818	7 124	6 940	958	270
FI	597	32 326	16 655	3 902	302
SE	1 875	: c	: c	: c	: c
UK	6 831	45 923	42 866	21 127	1 216
NO	321 p	: c	: c	: c	: c
CH	1 718 b	81 820 b	85 459 b	26 998 b	1 960 b
HR	795	: c	: c	: c	: c
TR	797	7 235	6 759	2 020	279

(1) BE, EL, IT, CY and TR, 2009.

Source: Eurostat (online data code: htec_eco_sbs2).

Table 7.4: Economic statistics on high-technology knowledge intensive services, 2010 (1)

	Number of enterprises	Turnover (EUR million)	Production value (EUR million)	Value added (EUR million)	Gross investment in tangible goods (EUR million)
EU-27	833 763 e	: c	: c	:	:
BE	23 401	29 538	29 133	13 347	3 833
BG	7 199	3 184	3 061	1 565	366
CZ	30 625	12 390	11 856	5 660	799
DK	12 681	20 205	17 902	8 916	1 259
DE	83 584	185 905	145 154	85 133	10 108
EE	2 448	1 223	1 160	538	87
IE	: c	: c	: c	: c	: c
EL	13 466	12 682	10 283	6 102	13 466
ES	42 294	73 235	57 499	33 875	3 901
FR	98 183	157 163	156 157	68 564	:
IT	102 705	102 298	102 907	46 405	6 581
CY	696	1 047	1 021	599	145
LV	2 928	1 171	1 156	526	125
LT	1 873	1 326	1 249	562	116
LU	1 651	: c	: c	: c	: c
HU	33 846	9 296	6 763	3 769	603
MT	:	:	:	:	:
NL	52 438	50 155	46 351	24 112	2 704
AT	16 612	16 415	11 702	7 238	998
PL	50 430	22 094	20 544	10 382	1 806
PT	14 619	12 404	12 000	5 285	1 705
RO	15 201	7 786	7 420	3 508	1 321
SI	6 313	2 850	2 555	1 115	176
SK	8 913	4 115	3 796	2 002	302
FI	8 209	13 172	12 915	6 057	647
SE	48 404	35 130	32 885	14 483	1 405
UK	139 017	209 558	195 015	90 704	13 003
NO	12 759 p	19 375 p	18 946 p	8 912 p	1 194 p
CH	5 118 b	: c	: c	: c	: c
HR	4 890	: c	: c	: c	: c
TR	25 645	16 146	16 380	6 554	5 872

(1) EL, IT and TR, 2009.

Source: Eurostat (online data code: htec_emp_sbs2).

Table 7.5: High-technology trade
(million EUR)

	Imports			Exports		
	2009	2010	2011	2009	2010	2011
EU-27 (1)	217 038	273 378	267 152	187 600	218 566	240 164
BE	22 516	24 659	25 420	23 411	25 922	26 569
BG	1 219	1 434	1 827	534	644	763
CZ	13 069	18 190	18 977	12 331	16 123	18 923
DK	7 148	7 431	7 943	8 315	6 909	7 583
DE	99 213	124 248	126 613	112 642	133 196	142 239
EE	621	1 145	1 892	450	912	1 787
IE	11 729	9 085	8 878	18 351	16 642	18 876
EL	4 604	4 235	3 486	967	938	958
ES	19 914	22 559	21 602	7 793	9 119	10 464
FR	59 454	67 804	69 289	68 533	80 085	79 732
IT	29 154	40 492	38 174	19 849	22 091	24 221
CY	407	790	475	181	205	195
LV	501	669	974	294	344	633
LT	720	881	1 107	689	945	1 138
LU	5 256	3 627	3 502	6 413	4 376	3 883
HU	11 062	13 521	13 802	13 243	15 670	16 790
MT	780	849	946	722	891	948
NL	58 688	74 038	74 850	65 621	80 538	83 055
AT	11 940	13 927	14 390	11 509	13 620	14 274
PL	12 617	15 611	15 328	5 585	7 289	7 006
PT	4 956	4 526	4 172	1 159	1 083	1 255
RO	4 196	5 700	5 928	2 389	3 668	4 077
SI	1 439	1 688	1 704	1 033	1 167	1 328
SK	4 221	5 358	6 343	2 358	3 216	3 738
FI	6 114	5 853	6 004	6 250	5 241	4 540
SE	12 823	16 792	17 851	13 914	17 322	18 662
UK	61 710	78 407	72 121	48 446	55 295	59 714
HR	1 353	1 288	1 222	569	616	558
MK	283	287	313	31	61	93
TR	9 859	13 730	14 947	1 119	1 445	1 572

(1) EU-27 does not include intra-EU trade and therefore does not correspond to the sum of Member States.

Source: Eurostat (online data code: htec_trd_tot4).

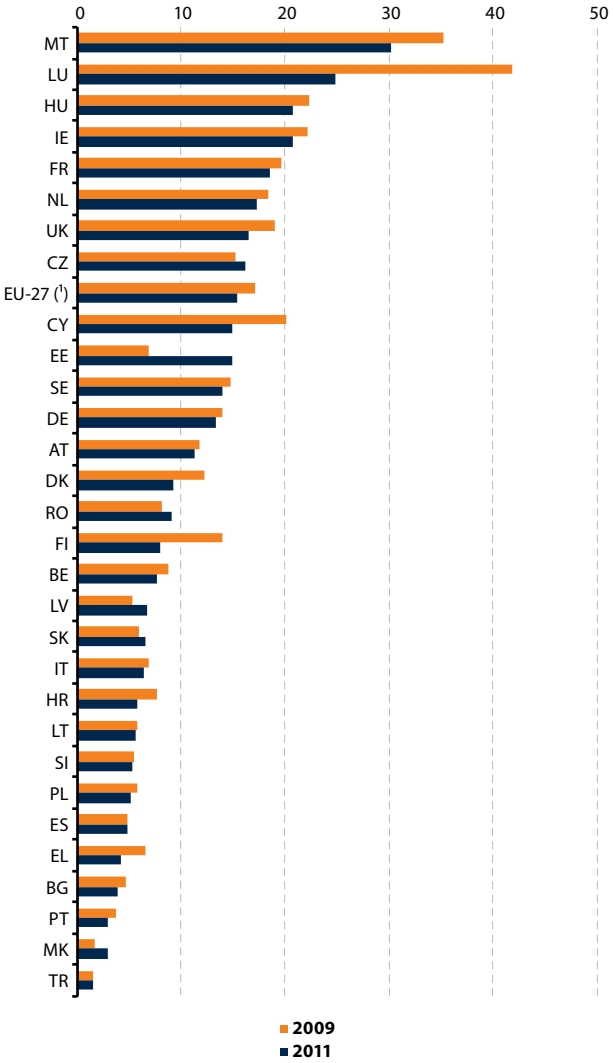
Table 7.6: High-tech trade balance and trade ratio

	Balance (million EUR)			Export/import ratio (%)		
	2009	2010	2011	2009	2010	2011
EU-27 (1)	– 29 438	– 54 812	– 26 988	86.4	80.0	89.9
BE	895	1 263	1 149	104.0	105.1	104.5
BG	– 685	– 790	– 1 064	43.8	44.9	41.8
CZ	– 738	– 2 067	– 54	94.4	88.6	99.7
DK	1 167	– 522	– 360	116.3	93.0	95.5
DE	13 429	8 948	15 626	113.5	107.2	112.3
EE	– 171	– 233	– 105	72.5	79.7	94.5
IE	6 622	7 557	9 998	156.5	183.2	212.6
EL	– 3 637	– 3 297	– 2 528	21.0	22.1	27.5
ES	– 12 121	– 13 440	– 11 138	39.1	40.4	48.4
FR	9 079	12 281	10 443	115.3	118.1	115.1
IT	– 9 305	– 18 401	– 13 953	68.1	54.6	63.4
CY	– 226	– 585	– 280	44.5	25.9	41.1
LV	– 207	– 325	– 341	58.7	51.4	65.0
LT	– 31	64	31	95.7	107.3	102.8
LU	1 157	749	381	122.0	120.7	110.9
HU	2 181	2 149	2 988	119.7	115.9	121.6
MT	– 58	42	2	92.6	104.9	100.2
NL	6 933	6 500	8 205	111.8	108.8	111.0
AT	– 431	– 307	– 116	96.4	97.8	99.2
PL	– 7 032	– 8 322	– 8 322	44.3	46.7	45.7
PT	– 3 797	– 3 443	– 2 917	23.4	23.9	30.1
RO	– 1 807	– 2 032	– 1 851	56.9	64.4	68.8
SI	– 406	– 521	– 376	71.8	69.1	77.9
SK	– 1 863	– 2 142	– 2 605	55.9	60.0	58.9
FI	136	– 612	– 1 464	102.2	89.5	75.6
SE	1 091	530	811	108.5	103.2	104.5
UK	– 13 264	– 23 112	– 12 407	78.5	70.5	82.8
HR	– 784	– 672	– 664	42.1	47.8	45.7
MK	– 252	– 226	– 220	11.0	21.3	29.7
TR	– 8 740	– 12 285	– 13 375	11.4	10.5	10.5

(1) EU-27 does not include intra-EU trade and therefore does not correspond to the sum of Member States.

Source: Eurostat (online data code: htec_trd_tot4).

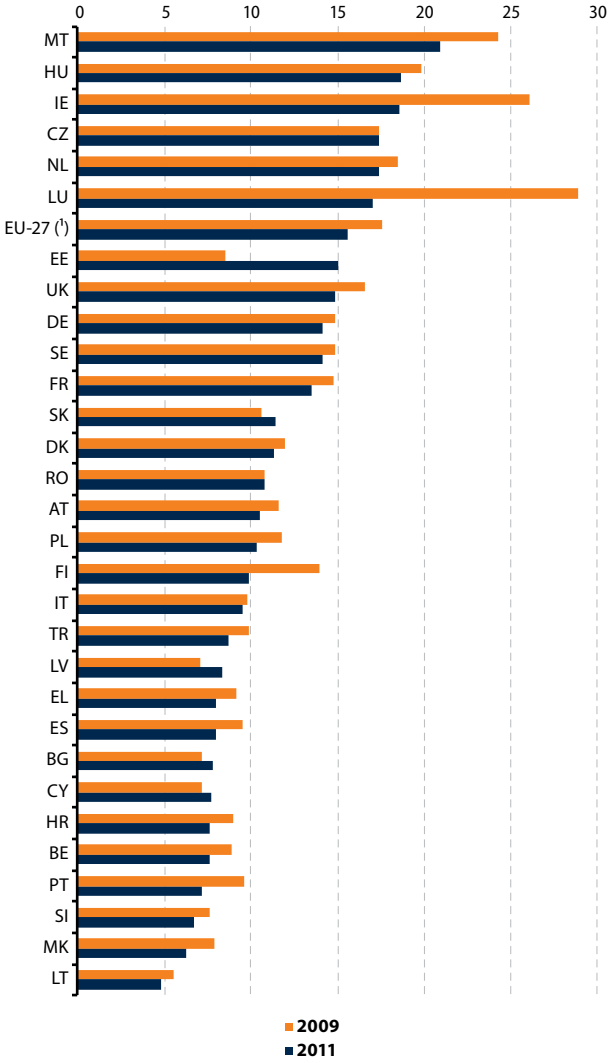
Figure 7.7: High-tech exports as a percentage of total, EU-27 and selected countries
(%)



(1) EU-27 does not include intra-EU trade.

Source: Eurostat (online data code: htec_trd_tot4)

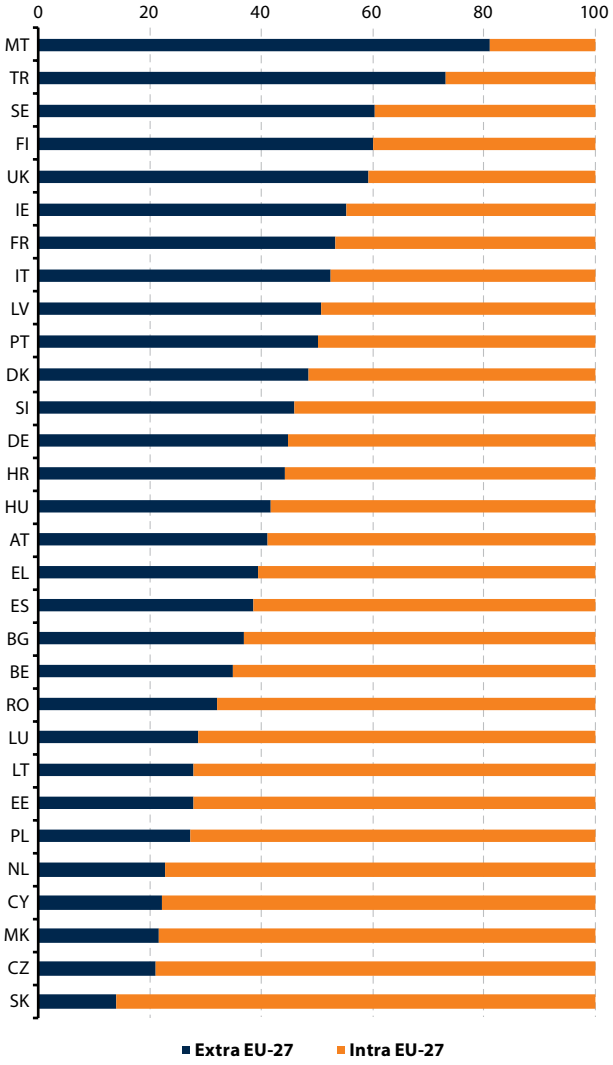
Figure 7.8: High-tech imports as a percentage of total, EU-27 and selected countries
(%)



(1) EU-27 does not include intra-EU trade.

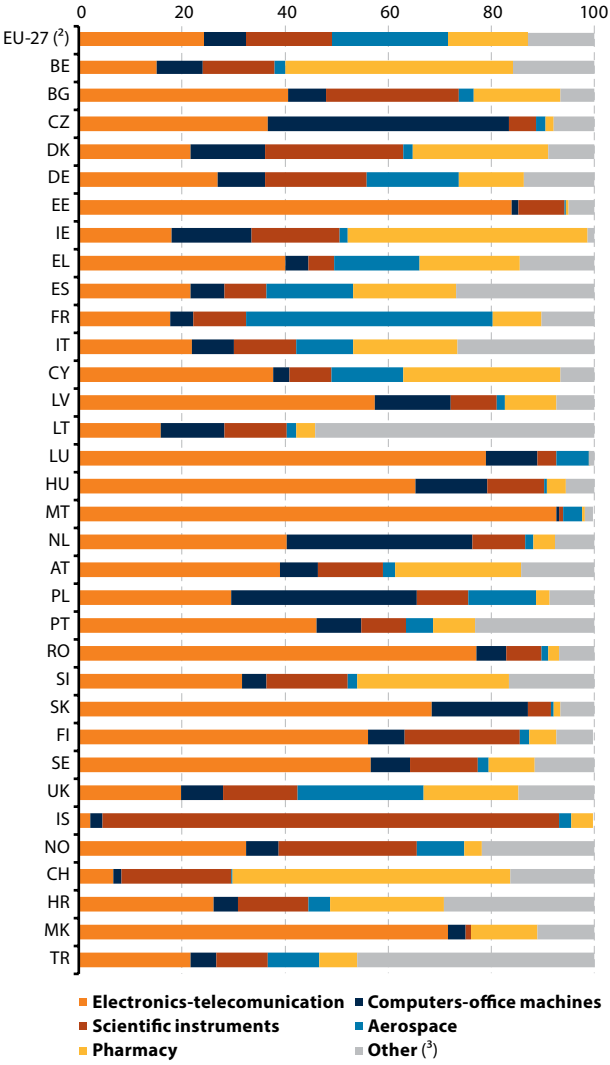
Source: Eurostat (online data code: htec_trd_tot4).

Figure 7.9: Intra and extra EU exports of high-tech products, 2011
(%)



Source: Eurostat (online data code: htec_trd_tot4).

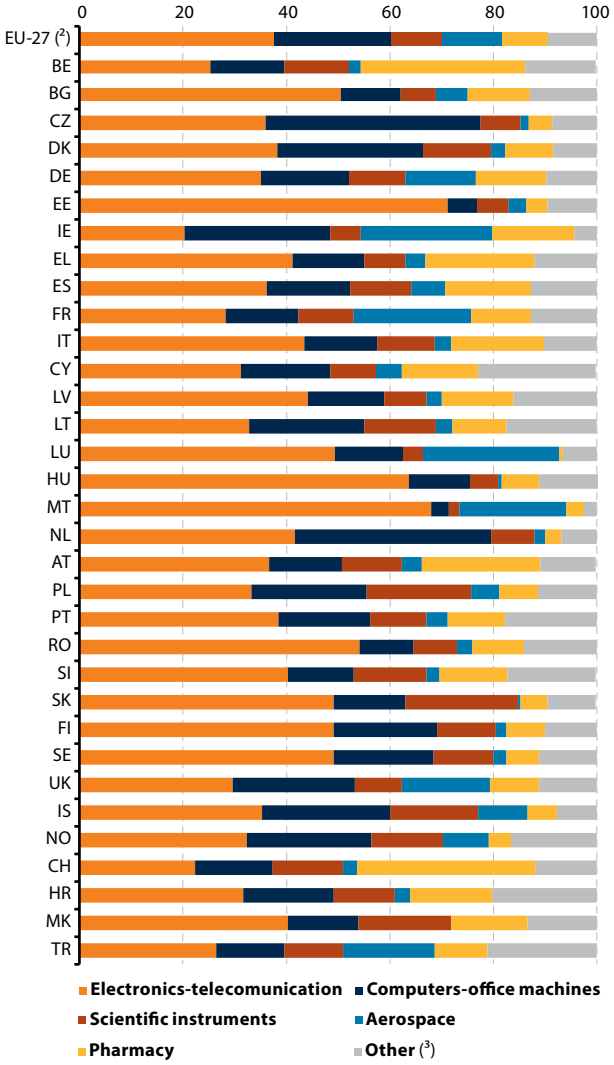
Figure 7.10: High-tech exports by high-technology group of products, EU-27 and selected countries, 2011 (1)
(%)



(1) IS, NO and CH, 2009.
(2) Extra-EU trade.
(3) 'Other' includes 'Electrical machinery', 'Chemistry', 'Non-electrical machinery' and 'Armament'.

Source: Eurostat (online data code: htec_trd_group4).

Figure 7.11: High-tech imports by high-technology group of products, EU-27 and selected countries, 2011 (1)
(%)



(1) IS, NO and CH, 2009.
(2) Extra-EU trade.
(3) 'Other' includes 'Electrical machinery', 'Chemistry', 'Non-electrical machinery' and 'Armament'.

Source: Eurostat (online data code: htec_trd_group4).

Table 7.12: Statistics on employment in high-technology manufacturing sector, 2011

	Total in 1000's		% of total employment		% of women		AAGR 2008–2011	
EU-27	2364		1.1		40.0		–2.4	
BE	59		1.3		40.7		–1.6	
BG	21		0.7		52.4	u	–8.0	
CZ	86		1.8		50.0		5.1	
DK	47		1.7		44.7		2.2	
DE	611		1.5		40.1		–0.8	
EE	9	u	1.6	u	:	u	8.7	u
IE	54		3.0		37.0		–4.0	
EL	16		0.4		50.0		–8.7	
ES	111		0.6		43.2		–9.5	
FR	272		1.1		41.5		–3.5	
IT	220		1.0		33.2		–3.5	
CY	1	u	0.3	u	:	u	–20.6	u
LV	:	u	:		:	u	:	u
LT	:	u	:	u	:	u	:	u
LU	:	u	:	u	:	u	:	u
HU	117		3.1		50.4		2.7	
MT	4		2.3		50.0	u	0.0	
NL	50		0.6		30.0		–8.4	
AT	44		1.1		36.4		0.0	
PL	131		0.8		49.6		1.6	
PT	24		0.5		54.2		–10.1	
RO	59		0.6		42.4		5.0	
SI	16		1.7		43.8	u	–2.0	
SK	38		1.6		57.9		–4.0	
FI	34		1.4		35.3		–10.2	
SE	29		0.6		37.9		–5.2	
UK	303		1.0		27.4		–4.0	
IS	:	u	:	u	:	u	:	u
NO	10		0.4		:	u	–14.5	
CH	110		2.5		36.4		–0.9	
HR	8	u	0.5	u	:	u	–12.6	u
MK	4	u	0.6		25.0	u	:	u
TR	71		0.3		25.4		:	

Source: Eurostat (online data code: htec_emp_nat2).

Table 7.13: Statistics on employment in high-tech knowledge-intensive services sector, 2011

	Total in 1000's	% of total employment	% of women	AAGR 2008–2011
EU-27	5 932	2.7	30.6	1.4
BE	149	3.3	27.5	4.1
BG	70	2.4	47.1	–1.4
CZ	138	2.8	27.5	5.7
DK	100	3.7	26.0	0.0
DE	1 051	2.7	30.8	3.4
EE	15	2.5	: u	2.3
IE	75	4.2	30.7	2.3
EL	70	1.7	35.7	–2.7
ES	525	2.9	31.8	2.0
FR	777	3.0	34.0	5.3
IT	535	2.3	30.7	0.3
CY	9	2.3	33.3	0.0
LV	27	2.8	40.7	4.0
LT	26	1.9	42.3 u	2.7
LU	8	3.6 b	25.0 u	4.6
HU	85	2.2	29.4	–1.1
MT	6	3.4	: u	0.0
NL	260	3.1	22.7	–3.6
AT	102	2.5	27.5	1.3
PL	307	1.9	36.2	2.4
PT	76	1.6	31.6	–2.9
RO	123	1.3	35.8	3.2
SI	31	3.3	29.0 u	3.5
SK	58	2.5	32.8	8.8
FI	105	4.2	34.3	0.0
SE	201	4.3	28.9	2.1
UK	1 004	3.5	26.5	–2.0
IS	8	4.7	25.0	4.6
NO	86	3.4	26.7	5.6
CH	137	3.2	29.2	3.7
HR	33 u	2.2 u	27.3 u	–1.0 u
MK	9 u	1.3	33.3 u	: u
TR	190	0.8	22.6	:

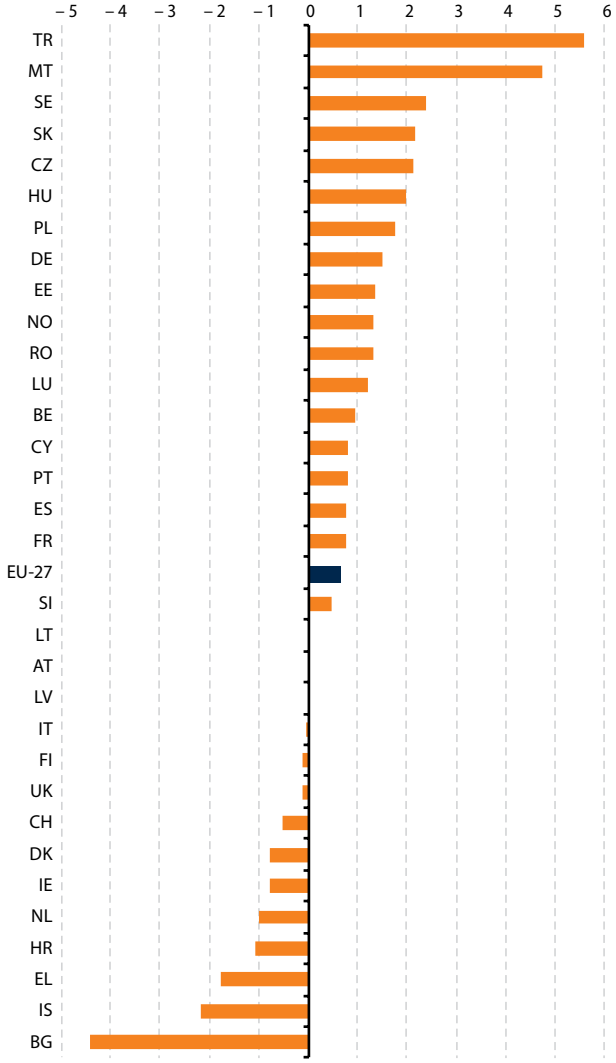
Source: Eurostat (online data code: htec_emp_nat2).

Table 7.14: Employment in knowledge-intensive activities (KIA)

	2009		2010		2011	
	1000	% of total	1000	% of total	1000	% of total
EU-27	74 769	35.1	74 953	35.3	75 699	35.5
BE	1 818	41.4	1 866	41.9	1 853	41.5
BG	831	25.9	787	26.2	759	26.1
CZ	1 416	29.2	1 459	30.3	1 477	30.6
DK	1 051	38.6	1 049	39.5	1 035	39.2
DE	14 139	37.5	14 185	37.2	14 564	37.4
EE	183	31.8	179	32.4	188	32.0
IE	772	40.9	772	42.8	760	43.1
EL	1 399	31.6	1 392	32.3	1 350	33.6
ES	5 674	30.3	5 760	31.4	5 763	32.1
FR	9 962	39.2	9 991	39.1	10 118	39.6
IT	7 481	33.0	7 419	33.0	7 478	33.1
CY	125	33.8	127	34.2	127	34.9
LV	286	30.1	285	31.0	286	30.1
LT	433	31.2	432	32.7	433	32.2
LU	122	56.5	125	56.3	125	56.2
HU	1 255	33.5	1 292	34.4	1 305	34.5
MT	62	38.9	63	39.2	68	40.8
NL	3 092	37.0	3 045	37.0	3 030	36.8
AT	1 415	35.4	1 437	35.7	1 415	34.8
PL	4 380	28.0	4 512	28.7	4 534	28.6
PT	1 321	27.9	1 306	28.0	1 342	29.4
RO	1 744	19.8	1 756	19.9	1 790	20.5
SI	305	31.9	309	32.9	308	33.6
SK	686	29.1	698	30.3	716	30.6
FI	893	36.9	873	36.2	891	36.6
SE	1 856	42.3	1 902	42.9	1 946	43.0
UK	12 069	42.9	11 933	42.5	12 038	42.7
IS	70	43.6	69	43.5	67	41.9
NO	944	38.7	928	38.2	969	39.4
CH	1 735	41.9	1 679	40.4	1 717	40.6
HR	425	27.4	426	28.6	416	28.9
MK	:	:	:	:	166	25.9
TR	3 815	18.4	4 031	18.3	4 254	18.1

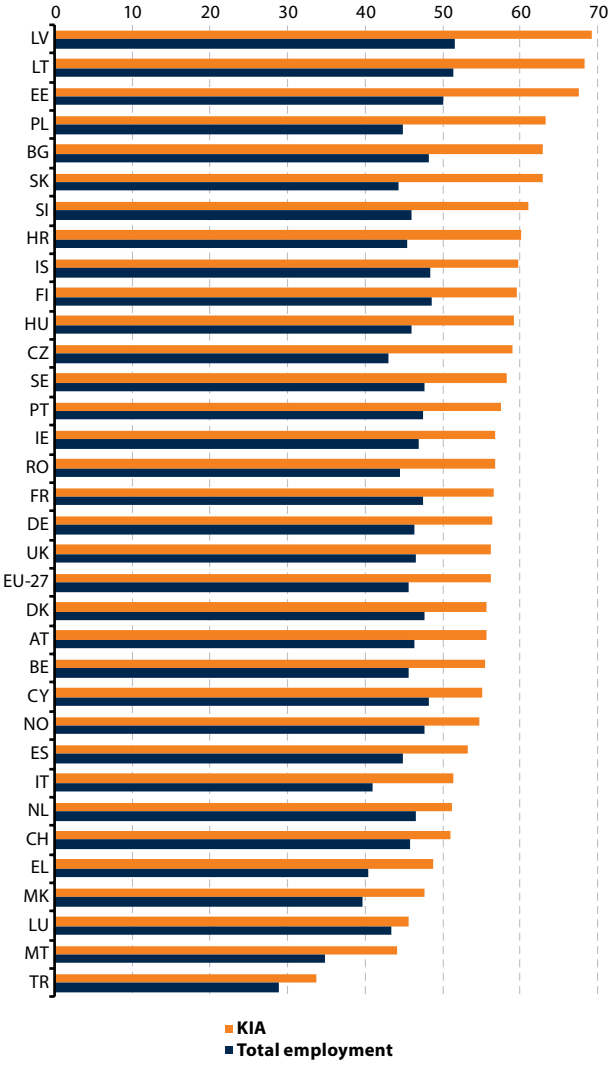
Source: Eurostat (online data code: htec_kia_emp2).

Figure 7.15: Annual average growth rate (AAGR) of employment in knowledge-intensive activities (KIA), 2009–2011
(%)



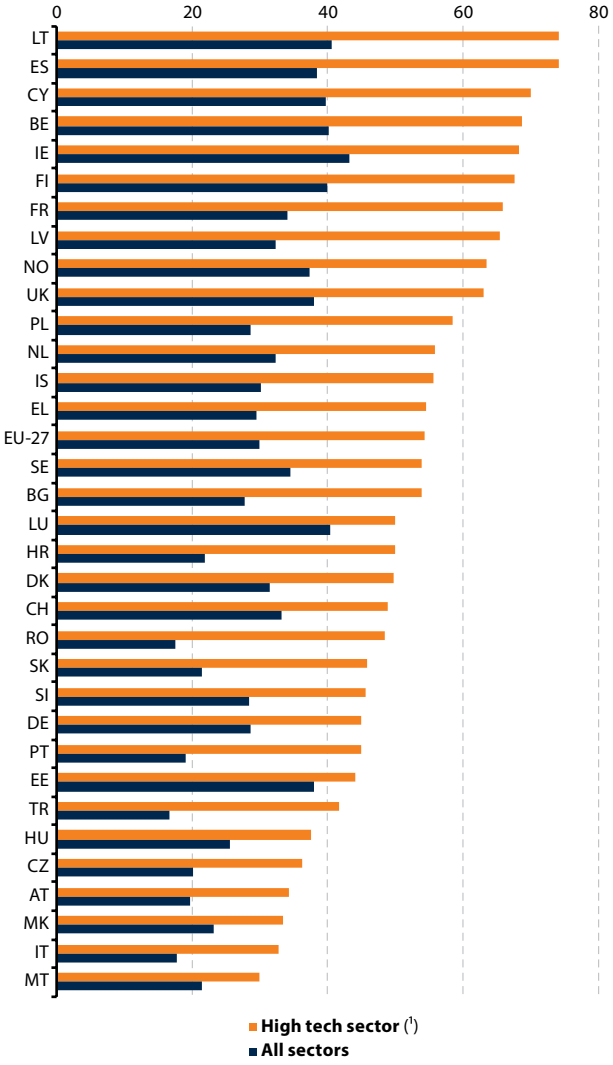
Source: Eurostat (online data code: htec_kia_emp2).

Figure 7.16: Share of women in knowledge-intensive activities (KIA) and in total employment, 2011
(%)



Source: Eurostat (online data codes: htec_kia_emp2 and lfsa_egan).

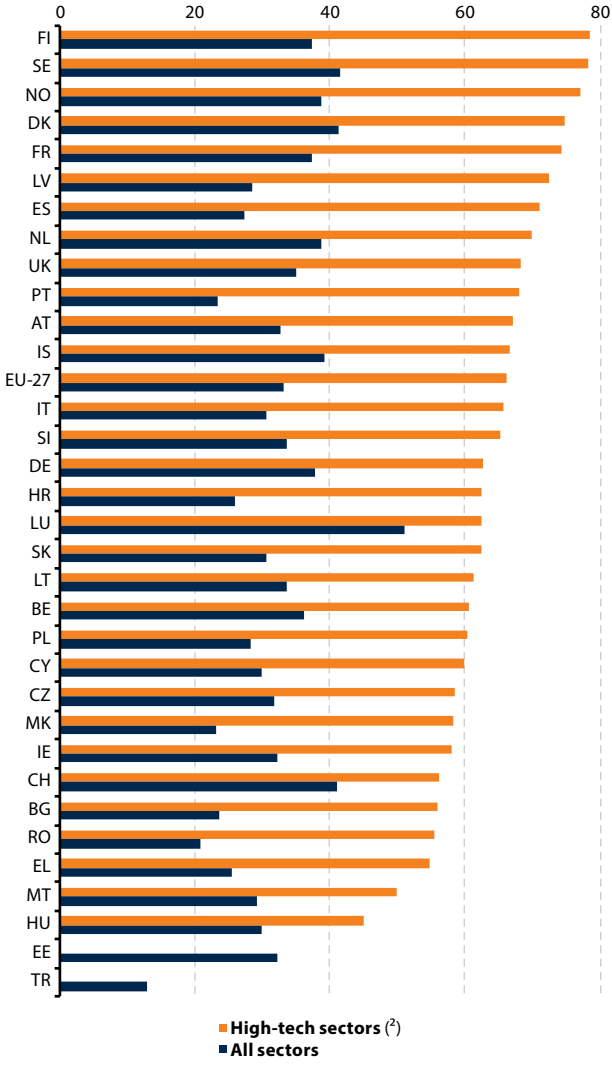
Figure 7.17: Share of tertiary educated persons in all sectors and in high-tech sectors, 2011
(%)



(1) High-tech sectors = High-tech manufacturing and high-tech KIS.

Source: Eurostat (online data code: htec_emp_nisced2).

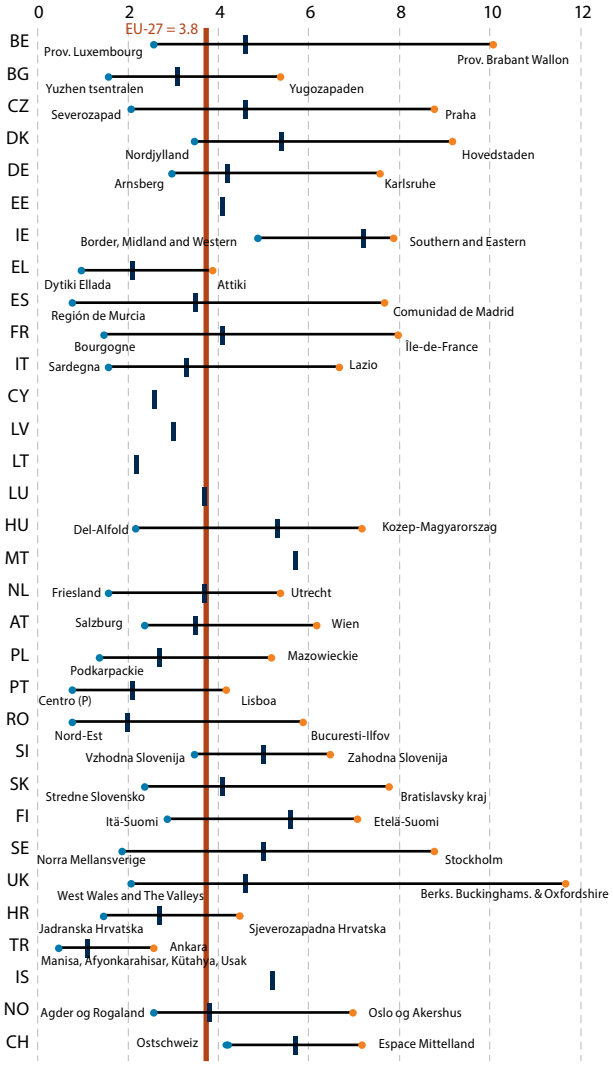
Figure 7.18: Technicians and professionals in high-tech sectors and in all sectors, 2011 (1)
(%)



(1) TR, 2010.
(2) High-tech sectors = High-tech manufacturing and high-tech KIS.

Source: Eurostat (online data code: htec_emp_nisco2).

Figure 7.19: Regional disparities in employment in high-tech sectors as a percentage of total employment (NUTS 2 level), 2011 (1) (2)



(1) High-tech sectors = High-technology manufacturing and high-tech KIS.
(2) Data lack reliability due to small sample size but are publishable in region with the smallest share in EE, CY, LV, LT, LU, HR and IS.

Source: Eurostat (online data code: htec_emp_reg2).

Methodological notes

GBAORD

1. Concepts and definitions

Government budget appropriations or outlays on R&D (GBAORD) are all the appropriations allocated to R&D in the central government or federal budgets, and therefore refer to budget provisions rather than to actual expenditure. Provincial or state governments should be included where the contribution is significant. Unless stated otherwise, the data include both current and capital expenditure and not only cover government-financed R&D performed in government establishments, but also government-financed R&D in the business enterprise, private non-profit and higher education sectors, as well as abroad. Data on actual R&D expenditure are only available in their final form some time after the end of the budget year concerned, and they may well differ from the original budget provisions. This and further methodological information can be found in the *Frascati Manual* (OECD, 2002).

GBAORD data are compiled by national statistical authorities from data on public budgets. These measure government support for R&D activities, i.e. they determine how much priority governments give to the public funding of R&D.

Eurostat collects aggregated data, validates them and compiles all the necessary EU aggregates.

2. Sources

The basic data are forwarded to Eurostat by the national administrations of Member States and other countries. Data for South Korea, Japan and the United States are taken from the OECD's Main Science and Technology Indicators (MSTI).

3. Data compilation

Until 2003, data on GBAORD were collected under a gentleman's agreement. From the reference year 2004 onwards, data collection has been based on Commission Regulation No 753/2004 on statistics on science and technology (OJ L 118, 23.4.2004, p. 23).

4. Breakdown by socio-economic objectives

Government appropriations or outlays on R&D are broken down by socio-economic objectives on the basis of the NABS – *Nomenclature for the analysis and comparison of scientific programmes and budgets*.

NABS 2007

The latest version of the nomenclature (NABS 2007) has been applied since the reference year 2007. Its earlier version (NABS 1992) was used prior to that.

Not all countries collect the data directly by NABS. Some follow other compatible classifications (OECD, Nordforsk), which are then converted to the NABS classification (see Table 8.2 of the *Frascati Manual*).

5. Time series

The analysis in the present publication covers the period from 2005 to 2011.

R&D expenditure and personnel

1. Concepts and definitions

The basic concepts and guidelines for collecting data and the classifications used in compiling statistics on research and experimental development (R&D) are given in the *Frascati Manual* (OECD, 2002). Specific details on R&D expenditure and personnel are presented in chapters 6 and 5 respectively.

R&D activities comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications. There are two basic statistical variables in this domain, namely R&D expenditure and personnel.

R&D expenditure

Intramural R&D expenditure is all expenditures for R&D performed within a statistical unit or sector of the economy during a specific period, whatever the source of funds (*Frascati Manual*, § 358).

R&D intensity

R&D intensity is R&D expenditure expressed as a percentage of GDP.

To calculate R&D intensity at national level (EEA countries), GDP from the National Accounts is used as reference data. The data series were extracted from Eurostat's reference database (Eurobase).

Purchasing power standard (PPS)

The purchasing power standard, abbreviated as PPS, is an artificial currency unit. PPS is the technical term chosen by Eurostat for the common currency in which National Accounts aggregates are expressed when they are adjusted for price level differences using purchasing power parities (PPPs). PPPs can therefore be interpreted as the exchange rate of the PPS against the euro. An economic aggregate of a given country, expressed in national currency, should be divided by the relevant PPP in order to obtain an internationally comparable figure expressed as PPS.

Purchasing power standard at constant year 2000 prices

The purchasing power standard at constant year 2000 prices is based on the GDP price deflator with base year 2000 and the PPPs for that year. The reason for calculating this measure is to produce figures that are adjusted for price differences between countries and over time.

R&D personnel

Data on R&D personnel measure the resources going directly to R&D activities. The total R&D personnel are defined as follows:

> 'All persons employed directly on R&D should be counted, as well as those providing direct services such as R&D managers, administrators and clerical staff. Those providing indirect services, such as canteen and security staff, should be excluded' (*Frascati Manual*, § 294-295).

Full-time equivalent (FTE)

A full-time equivalent corresponds to one year's work by one person. Consequently, someone who normally spends 40 % of his or her time on R&D and the rest on other activities (e.g. teaching, university administration or counselling) should be counted as only 0.4 FTE.

Personnel in head count (HC)

Head count corresponds to the number of individuals who are employed mainly or partly in R&D. In order to facilitate comparison between different regions and periods, this indicator is often used in conjunction with employment or population variables.

2. Institutional classification

Intramural R&D expenditure and R&D personnel are broken down by institutional sector, i.e. the sector in which the R&D is performed. There are four main sectors:

- the business enterprise sector (BES);
- the government sector (GOV);
- the higher education sector (HES);
- the private non-profit sector (PNP).

3. Sources

The basic data are forwarded to Eurostat by the national administrations of Member States and other countries. Data for South Korea, China, Japan and the United States are taken from the OECD's Main Science and Technology Indicators (MSTI).

4. Data compilation

Until 2003, data on R&D were collected under a gentleman's agreement. From the reference year 2003 onwards, data collection has been based on Commission Regulation No 753/2004 on statistics on science and technology (OJ L 118, 23.4.2004, p. 23).

5. Geographical coverage

These data are available for the EU-27 Member States, Croatia, Turkey, Iceland, Norway, Switzerland, China, South Korea, Russia, Japan, and the United States at national level, and for the European countries also at regional level (NUTS level 2).

6. Aggregates

For both R&D expenditure and personnel, EU totals are calculated as the sum of the national data by sector. If data are missing, estimates are made for the country in question, for the reference period, and for the institutional sector or relevant R&D variable, as appropriate. The method of calculating R&D personnel in head count (HC) is somewhat different. The

estimates for R&D personnel in full-time equivalents (FTEs) serve as a basis for the HC calculation. An FTE/HC ratio based on available FTE and HC personnel data at national level is estimated for the EU aggregates, by institutional sector and by year. This ratio is then applied to the FTE data to calculate the EU totals in HC. EU aggregates are estimated values.

7. Time series

Data are presented for the period 2005–2011. However, data series in Eurostat's reference database (Eurobase) are available from 1981 onwards, although availability differs depending on the variables and institutional sectors. Not all years are complete. For this reason, the figures for the latest year available for each country are analysed.

Additional information on the method used can be found in Eurostat's reference database (Eurobase).

Human resources in science and technology

1. Concepts and definitions

Statistics on human resources in science and technology — HRST — improve our understanding of both demand and supply in regard to highly qualified personnel. The data presented in this publication focus on two main aspects: stocks and flows. The former serve to show the needs and the current situation of the highly skilled labour force, and the latter indicate to what degree this demand is likely to be met in the future.

Human resources in science and technology are defined according to the OECD Canberra Manual as persons fulfilling at least one of the following conditions:

- successfully completed at tertiary level in a Science and Technology (S&T) field or study (ISCED-97 version levels 5a, 5b or 6);

OR/AND

- not formally qualified as above but employed in an S&T occupation where the above qualifications are

normally required (ISCO-88 COM codes 2 or 3 until 2010, ISCO-08 COM codes 2 or 3 from 2011 on).

Starting with the 2011 reference year, the new version of ISCO has been implemented in the data source EU-LFS. As there is no one-to-one correspondence between the two versions of the classification, there is a break in series for 2011 data.

The conditions for the above mentioned educational or occupational requirements are defined according to internationally harmonised standards:

- The International Standard Classification of Education — ISCED — gives the level of formal education achievement;
- The International Standard Classification of Occupation — ISCO — details the type of occupation.

Stocks and inflows

HRST stocks provide information on the level of human resources in S&T at a particular point in time. Stock data relate to the employment status as well as the occupational and educational profiles of individuals in a given year.

HRST stock data and their derived indicators are extracted and built up using data from the EU Labour Force Survey — EU-LFS. The EU-LFS is based on a sample of the population. All results must conform to Eurostat guidelines on sample-size limitations and are therefore not published if the degree of sampling error is likely to be high. They are flagged as 'unreliable' if the degree of reliability is too small.

It should be noted that the relevant population excludes anyone below the age of 15 or over the age of 74. This is for data quality reasons and also because no-one below the age of 15 will fulfil either of the requirements for being classified as HRST.

The operational definitions of the main HRST categories are as follows:

HRST — Human Resources in Science and Technology

- successfully completed at tertiary level (ISCED'97 version levels 5a, 5b or 6); or
- not formally qualified as above but employed in an S&T occupation where the above qualifications are normally required (ISCO'88 COM codes 2 and 3 until 2010, ISCO'08 COM codes 2 or 3 from 2011 on).

HRSTO — Human Resources in Science and Technology — Occupation

- employed in an S&T occupation (ISCO'88 COM codes 2 or 3 until 2010, ISCO'08 COM codes 2 or 3 from 2011 on).

HRSTE — Human Resources in Science and Technology — Education

- successfully completed at tertiary level (ISCED'97 version levels 5a, 5b or 6).

HRSTC — Human Resources in Science and Technology — Core

- successfully completed at tertiary level (ISCED'97 version levels 5a, 5b or 6); and
- not formally qualified as above but employed in an S&T occupation where the above qualifications are normally required (ISCO'88 COM codes 2 and 3 until 2010, ISCO'08 COM codes 2 and 3 from 2011 on).

SE — Scientists and Engineers

- Employed in 'Physical, mathematical and engineering' occupations or in 'life science and health occupations' (ISCO'88 COM codes 21 and 22 until 2010, ISCO'08 COM codes 21, 22 and 25 from 2011 on).

HRSTU — Human Resources in Science and Technology — Unemployed

- successfully completed at tertiary level (ISCED'97 version levels 5a, 5b or 6) but currently unemployed.

NHRSTU — Unemployed and non-HRST

- no tertiary level and currently unemployed.

HRST inflows are the people who do not fulfil any of the conditions for inclusion in HRST at the beginning of a time period but fulfil at least one condition during the period. The number of graduates from a country's higher education system represents the main inflow into the national stock of HRST.

HRST education inflow data are extracted from the Eurostat Education database built on data coming from the UNESCO/

OECD/Eurostat questionnaire on education based on the ISCED classification. Users should note that European education systems differ among countries and that duplications of degrees might exist for some countries.

This publication includes the following totals and sub-totals (ISCED 1997 version):

Total: sum of all fields of study

Science and Engineering (S&E):

Science covers the educational fields of Life sciences, Physical sciences, Mathematics and statistics, and Computing (codes 42, 44, 46, 48).

Engineering groups the fields of education in Engineering and engineering trades, Manufacturing and processing, and Architecture and building (codes 52, 54, 58).

2. Sources

The data on stocks and job-to-job mobility are obtained from the EU Labour Force Survey — EU-LFS. The National Statistical Institutes are responsible for conducting the surveys and forwarding the results to Eurostat.

The data on education inflows are obtained from Eurostat's Education database and via the UNESCO/OECD/Eurostat questionnaire on education. The National Statistical Institutes are responsible for conducting the surveys, compiling the results and forwarding the results to Eurostat.

3. Geographical coverage

Geographical coverage in the case of HRST data depends on the data source. For HRST stocks these data are available for the EU-27 Member States, candidate countries and EFTA countries. HRST inflows from education are available for the EU-27 Member States, candidate countries, EFTA countries, the United States and Japan.

4. Time series

Data are available in many countries from 1994 onwards, but differences exist and certain years are missing. Users should note that the existence of data in this Eurobase domain also depends on their reliability. The guidelines on the sample size reliability of the data established by the EU-LFS are applied to the HRST database. Therefore, the breakdowns for which

quality levels are considered insufficient are flagged as either not available or unreliable.

Innovation

1. Concepts and definitions

1.1 Community Innovation Survey

At European level, the **Community Innovation Survey (CIS)** data are the main source of information for studying innovation drivers and company behaviour towards innovation.

Since 2004 the data have been collected every two years. The last survey, CIS 2010, was carried out in 26 Member States ([1]), Iceland, Norway, Croatia, Serbia and Turkey. The reference period of most CIS 2010 indicators covered three years and was from 2008 to 2010 inclusive.

In order to ensure comparability across countries, Eurostat developed the harmonised survey questionnaire in close cooperation with the participating countries, accompanied by a set of definitions and methodological recommendations.

The CIS 2010 questionnaire is based on the third revision of the Oslo Manual, 2005 edition, which gives methodological guidelines and defines the concept of innovation, and on Commission Regulation No 1450/2004.

1.2 Oslo Manual 2005

An **innovation** is the implementation of a new or significantly improved product (goods or service) or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.

Innovations are based on the results of new technological developments, new combinations of existing technology or the utilisation of other knowledge acquired by an enterprise. Innovations may be developed by the innovating enterprise or by another enterprise. The simple resale of new goods and services purchased from other enterprises is not considered as innovation. Innovations should be new to the enterprise concerned. In the case of product innovations, they do not necessarily have to be new to the market; for process

([1]) In all the EU countries except Greece.

innovations, the enterprise does not necessarily have to be the first one to have introduced the process.

A **product innovation** is the introduction of goods or services that are new or significantly improved with respect to their characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.

A **process innovation** is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software. Process innovations can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products.

An **organisational innovation** is a new organisational method in an enterprise's business practices (including knowledge management), workplace organisation or external relations that has not yet been used by the enterprise. It must be the result of strategic decisions taken by management; this excludes mergers or acquisitions, even if for the first time.

A **marketing innovation** is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. Marketing innovations are aimed at better addressing customer needs, opening up new markets, or newly positioning a firm's product on the market, with the objective of increasing the firm's sales. This excludes seasonal, regular and other routine changes in marketing methods.

2. Statistical units, population

The statistical unit used in the Community Innovation Survey is the **enterprise**.

The target population ([2]) of the CIS 2010 is the total population of enterprises (with 10 or more employees) engaged primarily in the following economic activities according to NACE Rev.2: mining and quarrying (NACE B); manufacturing (NACE C); electricity, gas stream and air conditioning supply (NACE D); water supply: sewerage, waste management and remediation activities (NACE E); wholesale trade, except for motor vehicles and motorcycles (NACE G46); transportation

([2]) CORE NACE activities.

and storage (NACE H); publishing activities (NACE J58); telecommunications (NACE J61); computer programming, consultancy and related activities (NACE J62); information services activities (NACE J63); financial and insurance activities (NACE K); and architectural and engineering activities, technical testing and analysis (NACE M71).

3. Type of Survey

The participating countries carried out the CIS 2010 by means of a stratified survey over the frame population, a census, or a combination of the two.

4. Reference period

The reference period of most CIS 2010 indicators is from the beginning of 2008 to the end of 2010. However, some indicators are only based on one calendar year and their reference period is 2008 or 2010.

Patents

1. Concepts and definitions

A patent is a legal title granting its holder the exclusive right to make use of an invention for a limited area and time. An invention needs to fulfil three criteria to be granted a patent: (1) novelty, (2) inventive step, and (3) industrial applicability. All patent applications and granted patents are published. They provide a useful indicator of innovative developments in all areas of technology, and can also indicate the level of innovative activity.

2. Sources

Eurostat's production of European Patent Office (EPO) and United States Patent and Trademark Office (USPTO) data are based on the EPO Worldwide Statistical Patent Database (PATSTAT), which was developed by the EPO in 2005, using its collection and knowledge of patent data, in cooperation with the WIPO, OECD, USPTO and Eurostat, in the framework of the inter-institutional Patent Statistics Task Force.

EPO patent applications / USPTO patents granted by priority year

European patent applications refer to applications filed directly under the European Patent Convention (EPC) or

to applications filed under the Patent Cooperation Treaty (PCT) and designated to the EPO (Euro-PCT). All direct patent applications to the EPO (EPO-direct) are taken into account, but among the PCT applications made to the EPO (applications following the procedure laid down by the Patent Cooperation Treaty — PCT) only those that have entered into the regional phase are selected. As PCT patent applications in the international phase designating the EPO will no longer be included in the calculation of indicators on patent applications to the EPO, the resulting data shown here are lower than those in former publications. This new methodological approach is in line with the methodology also applied by the OECD. By 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.

Triadic patent families by earliest priority year

A patent family is defined as a set of patents taken out in various countries for protecting the same invention, i.e. relation patents that are grouped into a single record to derive a unique patent family. A patent is a member of a triadic patent family if (and only if) it has been applied for and filed at the European Patent Office (EPO) and the Japanese Patent Office (JPO), and if it has been granted by the United States Patent and Trademark Office (USPTO). Patent families, as opposed to patents, are intended to improve international comparability (the home advantage is eliminated and the values of the patents are more homogenous).

Data on triadic patent families are presented by priority year, i.e. the year of the first international filing of a patent. This exacerbates the disadvantage of traditional patent counts with respect to timeliness, and for this reason the latest available data, while still provisional, refer to 2006 only.

3. Reference year (or date)

All patent - statistics from Eurostat are shown by priority date, i.e. the first date of filing of the patent application anywhere in the world. This is the earliest possible date and it is chosen in order to be the closest to the date of the invention, thus providing more accurate data on the real inventive activity of a country/region. Patent procedures always take several years.

The drawback of this option is that data on USPTO patents that have been granted have declined in recent years, due to administrative delays between the priority date and the date of granting the patent. To a lesser extent, this is also the case for EPO data.

4. Counting patents with multiple inventors from different countries

Eurostat has chosen fractional counting as the counting method. This means that when a patent has been invented by several inventors from different countries, the respective contributions of each country are taken into account. This is done in order to eliminate multiple counting of such patents. For example, a patent co-invented by 1 French, 1 American and 2 German residents will be counted as ¼ of a patent for France, ¼ for the US and ½ a patent for Germany.

5. Counting patents in the case of multiple IPC codes

Patents data are treated by taking into account all levels of the International Patent Classification (IPC). If a patent is assigned to more than one IPC, all of the IPC codes are taken into account, not only the main (first) one. The application is divided equally among all IPC codes (fractional counting), thus avoiding double counting. Once the fractional counting has been done, the IPC codes are rounded at class level.

6. International Patent Classification

On 1 January 2006 the eighth edition of the International Patent Classification (IPC) entered into force. The World Intellectual Property Organisation (WIPO), a specialised agency of the United Nations, is responsible for updating the IPC. The IPC is a comprehensive subject classification system applied to all patents by the patent-issuing authorities. It is a hierarchical system divided into sections, classes, subclasses and groups. Each IPC code is a combination of letters and numbers referring to the different categories of the system. A patent can have one or more IPC codes.

Biotechnology sector

The OECD defines biotechnology as: 'the application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services'. The choice of the IPC subclasses used for this sector is based on the OECD definition.

High-technology groups in accordance with International Patent Classification (IPC)

AVI	Aviation
CAB	Computer and automated business equipment
CTE	Communication technology
LSR	Lasers
MGE	Micro-organism and genetic engineering
SMC	Semi-conductors

Nanotechnology

In contrast to the data of the other technological fields shown above, nanotechnology patent applications are not directly based on an aggregation of patent applications with the same IPC codes. The EPO introduced 'Y01N' tags to label nanotechnology in their databases because it was too difficult to retrieve these specific patent data from the available databases due to the interdisciplinary nature of the field. The Y01N code is not static, but is constantly updated and improved as new aspects of this young technology emerge.

Co-patenting

Data on co-patenting for patent applications to the EPO and patents granted by the USPTO are available at national level according to both the inventor's and the applicant's country of residence as follows:

- Total patents in the declaring country;
- Single inventors/applicants;
- Co-patents involving inventors/applicants from the declaring country and one or more EU Member States;
- Co-patents involving inventors/applicants from the declaring country, one or more EU Member States and one or more non-EU countries;
- Co-patents involving inventors/applicants from the declaring country and one or more non-EU countries.

Patent citations

Total number of publications cited in patents: the total number is equal to the number of patent publications to which the identified citation in patents to the EPO corresponds.

EU Patents: patent applications to the EPO that have only EU inventors (applicants).

Number of citations referring to non-EU patent publications: In the patent applications to the EPO that have only EU inventors (applicants), the citations and the corresponding patent publications are identified. For the cited patent publications, those with at least one EU inventor (applicant) and those with only non-EU inventors (applicants) are determined.

High-technology

1. Concepts and definitions

High-tech statistics comprise economic, employment and 'science, technology and innovation' (STI) data describing manufacturing and services industries, broken down by technological intensity.

Two main approaches are used to identify technological intensity: the sectoral approach and the product approach.

The sectoral approach

The sectoral approach is based on the Statistical Classification of Economic Activities (NACE). This classification looks at the technological intensity of sectors expressed as R&D expenditure/value added, and classifies the sectors as high, medium or low technology according to the score obtained. A second classification within the sectoral approach — KIA (Knowledge Intensive Activities) — is based on the high share of tertiary-educated persons in the economic sector relative to total employed; this classification covers both manufacturing and services.

The first sectoral approach covers manufacturing only. Services are also classified according to their technological intensity based on the number of highly qualified personnel. The following high-tech aggregates are used in this publication:

High-tech manufacturing

The High-tech manufacturing aggregate comprises the following NACE Rev. 2 codes: 21, 26.

High-tech Knowledge Intensive Services

The High-tech Knowledge Intensive Services aggregate comprises the following NACE Rev. 2 codes: 59 to 63 and 72.

High-tech sectors total

The High-tech sectors total is the sum of high-tech manufacturing and high-tech knowledge intensive services.

Knowledge Intensive Activities (KIA)

The KIA employment indicator was developed to offer a harmonised mean across all the sectors for comparing economies with respect to their knowledge intensity. An activity is classified as knowledge intensive if tertiary-educated persons employed (according to ISCED-97, levels 5 and 6) represent more than 33 % of the total employment in that activity. There are two aggregates in use based on this classification: total Knowledge Intensive Activities (KIA) and Knowledge Intensive Activities — Business Industries (KIABI).

KIA covers the following NACE Rev. 2 sectors: 9, 19, 21, 26, 51, 58 to 63, 69 to 75, 78, 79, 84, 85, 86, 90, 91, 94, 99.

KIABI covers the following NACE Rev. 2 sectors: 9, 19, 21, 26, 51, 58 to 63, 64 to 66, 69 to 75, 78, 79, 80.

The product approach

The product approach was devised to complement the sectoral approach. It opens the way for a far more detailed analysis of trade.

High-technology product groups are defined according to the R&D intensity of products following the concepts developed by the OECD — R&D expenditure/total sales. These can be classified in the following nine groups: Aerospace, Computers-Office machines, Electronics-Telecommunications, Pharmacy, Scientific instruments, Electrical machinery, Chemistry, Non-electrical machinery and Armament. The groups classified as high-technology products are aggregated on the basis of the Standard International Trade Classification (SITC).

The high-tech product groups in this publication are presented according to SITC Rev. 4.

For further details, please consult the Eurostat metadata on high-technology statistics disseminated on the Eurostat reference website.

Venture capital investments

Data are broken down into these investment stages:

- Seed stage;
- Start-up stage;
- Later stage venture;
- Total venture;
- Growth capital;
- Rescue/turnaround capital;
- Replacement capital;
- Buyouts;
- Total funds raised.

The basic data are provided by the European Private Equity and Venture Capital Association (EVCA). For more information on venture capital, please refer to: http://www.evca.eu

High-tech economic statistics

Data on high-tech enterprises are extracted and built up using data from the Structural Business Statistics — SBS.

Number of enterprises includes all units active during at least a part of the reference period.

Turnover comprises the totals invoiced by the observation unit during the reference period, and this corresponds to market sales of goods or services supplied to third parties.

Value added at factor cost is the gross income from operating activities after adjustment for operating subsidies and indirect taxes.

Production value measures the amount actually produced by the unit, based on sales, including changes in stocks and the resale of goods and services.

For further details, please consult the Eurostat metadata on high-technology statistics disseminated on the Eurostat reference website.

2. Data sources

The domain uses various other domains and sources, mainly within Eurostat's official statistics.

Data on high-tech economic statistics and derived indicators are extracted and built up using data from the Structural Business Statistics (SBS) according to NACE Rev. 2. Data on high-tech employment make use of EU-LFS data. High-tech trade data are extracted from the COMEXT database — Eurostat's database of official statistics on EU external trade and trade between EU Member States.

For Venture Capital Investment, the basic data are provided by the European Private Equity and Venture Capital Association (EVCA). For more information on venture capital, please refer to: http://www.evca.eu

3. Time series

Data are available in many countries from 1994 onwards, but differences exist and certain years are missing. Users should note that the existence of data in this domain also depends on their reliability and availability from different sources.

European Commission

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Science, technology and innovation in Europe

2013 edition

This pocketbook gives an overview of science, technology and innovation (STI) statistics. Only the most relevant indicators have been selected in order to provide an overall statistical picture of science, technology and innovation in Europe and a ranking of the EU in relation to its partners.

This publication is a compendium of data available at Eurostat, but it is by no means exhaustive: it is a showcase for the main available data sets.

The focus is on the EU-27 and the candidate countries. However, to allow international comparisons, data for Iceland, Liechtenstein, Norway, Switzerland, China, Japan, Russia and the United States are included when available.

The pocketbook is divided into seven chapters, including: Government budget appropriations or outlays on R&D (GBAORD), R&D expenditure, R&D personnel and human resources in science and technology (HRST), statistics on innovation, patents and high-technology.

http://ec.europa.eu/eurostat

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