ISSN 1830-754X

eurostat
Pocketbooks

Science, technology and innovation in Europe

2012 edition

eurostat
EUROPEAN COMMISSION

eurostat
Pocketbooks

Science, technology and innovation in Europe

2012 edition

eurostat
EUROPEAN COMMISSION

Cataloguing data can be found at the end of this publication.

Luxembourg: Publications Office of the European Union, 2012

ISBN 978-92-79-21874-3
ISSN 1830-754X
doi:10.2785/19722
Cat. No KS-GN-12-001-EN-C

Theme: Science and technology
Collection: Pocketbooks

Printed in Belgium

Printed on elemental chlorine-free bleached paper (ECF)

This publication was managed and prepared by Eurostat:

- Directorate G: Global business statistics — **Maria Helena Figueira, Director**;
- Unit G-6: Innovation and information society — **Michail Skaliotis, Head of Unit.**

Coordinators:

Ilcho Bechev ilcho.bechev@ec.europa.eu

Silvia Crintea-Rotaru silvia.crintea-rotaru@ec.europa.eu

Bernard Félix bernard.felix@ec.europa.eu

Ángeles Hermosa López angeles.hermosa-lopez@ec.europa.eu

Sergiu Parvan

Reni Petkova reni.petkova@ec.europa.eu

Veijo Ritola veijo-ismo.ritola@ec.europa.eu

Eurostat, Unit G-6 — Innovation and information society

Statistical Office of the European Union

Joseph Bech Building

Alphonse Weicker, 5

L-2721, Luxembourg

Production:

Data processing, analysis, design and desktop publishing:

Sogeti Luxembourg S.A.: Marta Zimolag, Sammy Sioen, Sandrine Engel, Frédéric Stibling.

Published by

Publications Office of the European Union.

Table of contents

Table des matières

Inhaltsverzeichnis

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 how 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 EU's policy activities. Innovation indicators are seen as a key element in terms of the Innovation Union initiative and the European Research Area (ERA) in generating progress under the various Europe 2020 strategy priorities. Europe 2020 sets out a vision of Europe's social market economy for the 21st century, aiming to turn the EU into a smart, sustainable and inclusive economy that delivers high levels of employment, productivity and social cohesion.

This publication is by no means exhaustive: it is a showcase for the main available data sets. Any other 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, Liechtenstein, Norway, Switzerland, China, Japan, Russia, South Korea, the United States and 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
- Part 2 — Monitoring the knowledge workers
- Part 3 — Productivity and competitiveness

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

Part 2 sets out data on R&D personnel (Chapter 3) and human resources in science and technology (HRST — Chapter 4).

Part 3 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 on Eurostat's reference database at the time of writing (December 2011). However, the reference database is updated regularly as new data are received, so data that are more recent 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 using the search function which is found in the upper-right corner of the Eurostat homepage, at http://ec.europa.eu/eurostat. The PDF version contains hyperlinks leading directly 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
2010	calendar year (e.g. from 01.01.2010 to 31.12.2010)
2008/09	academic year (e.g. from 01.09.2008 to 31.8.2009)
2007–2010	period of several calendar years (e.g. from 01.01.2007 to 31.12.2010)

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 2008	Community Innovation Survey 2008
EU-LFS	European Union Labour Force Survey
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
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
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
SMEs	Small and medium-size enterprises
USPTO	United States Patent and Trademark Office
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

(1) Also a candidate country.

Candidate countries

HR	Croatia
MK (2)	Former Yugoslav Republic of Macedonia
ME	Montenegro
TR	Turkey

Other countries

ASI_OTH	Other Asian countries
AU	Australia
BR	Brazil
CA	Canada
CN	China
HK	Hong Kong
ID	Indonesia
IL	Israel
IN	India
JP	Japan
KR	South Korea
MX	Mexico
MY	Malaysia
PH	Philippines
RU	Russia
SG	Singapore
TH	Thailand
US	United States

(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 and therefore mean budget provisions, not actual expenditure.

In 2010, GBAORD expressed as a percentage of GDP stood at 0.76 % in the EU-27 and recorded a slight decrease compared to 2009 (0.77 %) but was still higher than its 2008 value (0.71 %). A similar share and tendency was observed in Japan (0.75 % in 2010 compared to 0.76 % in 2009). Two other major economic partners — the United States and South Korea — both maintained GBAORD shares higher than the EU-27 and both experienced quite a significant increase compared to previous years. The United States share grew from 1.01 % in 2008 to 1.19 % in 2009 and that of South Korea from 1 % in 2009 to 1.09 % in 2010. The share of South Korea shows a stable and continuous increase since the beginning of the observed period.

In 2010, wide disparities in GBAORD as a share of GDP were observed among the Member States, ranging from 1.14 % in Finland to 0.17 % in Lithuania. Finland and Portugal were the only Member States where this share exceeded 1 %. A further seven Member States recorded GBAORD levels above the EU-27 average (0.76 %): Denmark, Germany, the Netherlands, Sweden, France, Austria and Spain.

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).

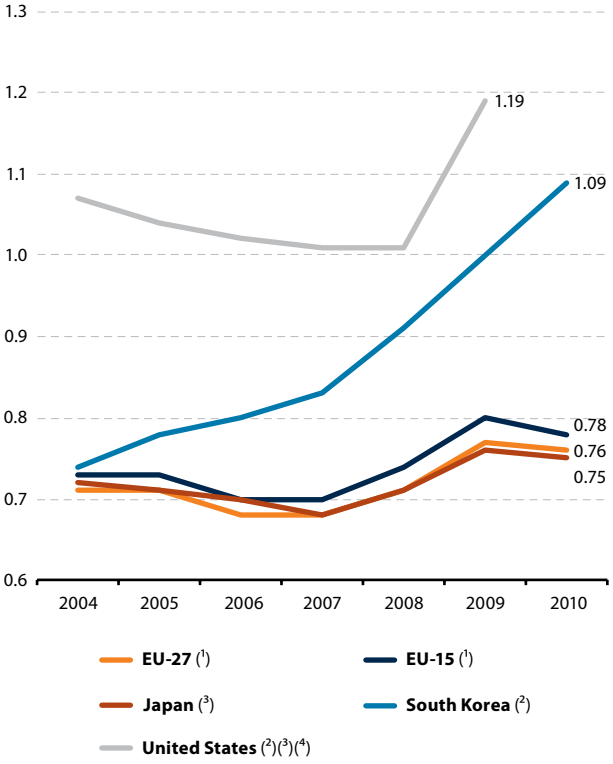
In 2010 the main socio-economic objective within the EU-27 was 'general advancement of knowledge: R&D financed from general university funds (GUF)', which accounted for 32.2 % of total GBAORD, followed by 'general advancement of knowledge: R&D financed from other sources than GUF' (16.7 %), 'industrial production and technology' (9.2 %), and 'health' (8.3 %).

In Japan, 'general advancement of knowledge: R&D financed from GUF' was also the foremost objective, which took 34.2 % of total GBAORD, while in the United States more than half of GBAORD (51.4 %, 2009 data) was allocated to 'defence'.

At country level, the two socio-economic objectives linked to 'general advancement of knowledge' accounted for the largest

shares of total GBAORD in 23 Member States. 'Industrial production and technology' was the top socio-economic objective in Belgium, while 'education' came first in Lithuania, 'health' in Estonia, and 'agriculture' in Romania.

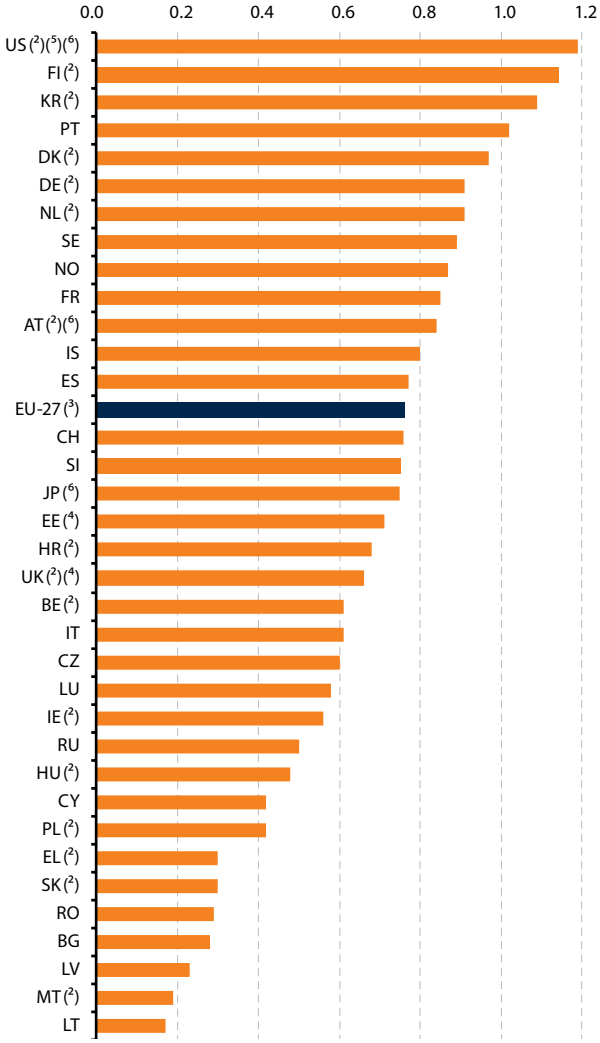
Figure 1.1: Total GBAORD as a percentage of GDP, EU-27, EU-15, Japan, South Korea and the United States, 2004–2010
(% of GDP)



(1) Eurostat estimate.
(2) KR (2008, 2009 and 2010), provisional data; US (2009), provisional data and break in series.
(3) Federal or central government only.
(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, 2010 (1)
(% of GDP)



(1) US, 2009; CH, EL, 2008.
(2) Provisional data.
(3) Eurostat estimate.
(4) National estimate.
(5) Break in series. Total excludes data for the R&D content of general payment to the higher education sector for combined education and research (public GUF).
(6) 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, 2010 ([1])

	Total GBAORD in million EUR		Exploration and exploitation of the earth		Environment		Exploration and exploitation of space		Transport, telecommunication and other infrastructures		Energy		Industrial production and technology		Health	
EU-27	92 729	s	1.8	s	2.7	s	4.9	s	3.7	s	4.2	s	9.2	s	8.3	s
BE	2 158	p	0.6	p	2.7	p	8.9	p	1.7	p	1.7	p	31.5	p	1.9	p
BG	100		7.6		4.7		0.6		0.5		0.2		9.2		0.7	
CZ	894		1.7		2.4		1.7		2.4		3.5		13.6		5.6	
DK	2 286	p	0.5		2.1		2.0		0.6		5.3		10.8		8.4	p
DE ([2])	22 569	p	1.7	ip	2.9	ip	4.7	ip	1.7	ip	4.0	ip	12.6	ip	4.6	ip
EE	102	e	1.7	e	10.6	e	1.4	e	7.1	e	3.3	e	11.7	e	20.8	e
IE	872	p	0.1	p	1.6	p	0.0	p	1.0	p	4.6	p	20.2	p	5.5	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	8 134		1.0		4.0		3.6		8.5		3.0		9.7		12.9	
FR ([2])	16 360		1.1	i	2.6	i	10.9	i	7.6	i	6.7	i	1.8	i	7.1	i
IT	9 548		4.5		3.0		7.0		1.7		6.2		11.8		10.4	
CY	72		0.9		1.1		0		1.0		0		0.0		4.1	
LV	41		3.1		4.1		1.4		9.0		9.3		12.1		12.4	
LT	47		0		2.0		0		0		0.1		0.1		10.5	
LU	234		0.8		2.9		0.2		3.2		1.6		5.0		16.6	
HU	469	p	0.5	p	2.0	p	0.5	p	18.7	p	1.0	p	16.7	p	10.0	p
MT	12	p	0	p	1.9	p	0	p	0.0	p	0.3	p	0	p	0.1	p
NL	5 333	p	1.6	p	0.1	p	2.8	p	3.1	p	2.6	p	8.0	p	4.7	p
AT ([2])	2 413	ip	1.5	ip	2.3	ip	0.4	ip	0.7	ip	1.8	ip	14.6	ip	3.3	ip
PL	1 052	b	1.3		3.6		1.6		3.7		4.1	b	19.4		7.9	b
PT	1 765		1.9		2.7		0.6		5.6		1.6		5.2		13.3	
RO	353		1.8		9.0		1.0		7.8		5.1		14.3		11.8	
SI	265		1.5		2.3		0.4		2.9		6.0		16.7		4.2	
SK	198	p	1.7	p	2.8	p	0.4	p	2.4	p	2.2	p	6.3	p	6.0	p
FI	2 055	p	1.0	p	1.5	p	1.5	p	1.9	p	8.1	p	23.9	p	5.2	p
SE ([2])	3 090		0.7	ip	1.8	ip	0.8	ip	5.7	ip	4.8	ip	3.4	ip	1.8	ip
UK	11 210	ep	2.7	ep	2.7	ep	1.9	ep	1.3	ep	1.0	ep	2.4	ep	18.1	ep
IS	76		0.5		3.1		:		0.8		1.0		1.3		9.8	
NO	2 698		1.7		2.3		2.7		2.1		4.2		8.0		15.2	
CH ([2])	2 621		0.1	i	0.4	i	4.1	i	0.2	i	0.7	i	0.4	i	0.5	i
HR	312	p	1.2	p	0.3	p	0	p	1.6	p	0.2	p	0.7	p	1.5	p
JP ([2])	30 866	i	1.4	i	1.1	i	6.8	i	3.6	i	12.2	i	7.0	i	4.6	i
KR ([2])([3])	7 806	p	1.8	p	4.6	p	3.0	p	1.9	p	7.9	p	27.1	p	9.1	p
RU ([3])	4 963		:		0.1		21.4		0.6		2.0		8.0		2.6	
US ([2])	118 523	bip	0.9	bip	0.3	bip	6.5	bip	1.0	bip	1.9	bip	0.6	bip	26.4	bip

([1]) PL, RU and US, 2009; EL and CH, 2008.

([2]) Flag 'i': DE, unrevised breakdown not adding to the revised total; FR: the sum of the breakdown does not add to the total. 'Education' and 'Culture, recreation, religion and mass media' are included elsewhere; 'Political and social systems, structures and processes' includes other classes; AT, federal or central government only; SE: the sum of the breakdown does not add to the total; CH: federal or central government only; JP, federal or central government only. 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; US, federal or central government only. Total excludes data for the R&D content of general payment to the higher education sector for combined education and research (public GUF).

([3]) The sum of the breakdown is not equal 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, 2010 (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	92 729	s	3.5	s	1.3	s	1.2	s	3.5	s	32.2	s	16.7	s	6.8	s
BE	2 158	p	1.5	p	0.3	p	2.2	p	3.6	p	17.6	p	25.7	p	0.2	p
BG	100		13.9		12.1		0.7		0.6		10.6		35.6		3.1	
CZ	894		4.5		0.2		0.4		0.9		26.3		34.5		2.2	
DK	2 286	p	3.2		2.7	p	1.4	p	2.3	p	42.4		17.9		0.4	
DE (2)	22 569	p	3.5	ip	1.1	ip	1.3	ip	1.9	ip	39.0	ip	16.6	ip	5.1	ip
EE	102	e	8.1	e	3.0	e	8.8	e	3.2	e	0.0	e	20.1	e	0.4	e
IE	872	p	10.6	p	3.4	p	0.0	p	1.2	p	24.6	p	27.3	p	0.0	p
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	8 134		6.6		0.9		1.2		1.2		28.1		18.1		1.3	
FR (2)	16 360		1.9	i	:	i	:	i	4.5	i	23.0	i	16.7	i	14.7	i
IT	9 548		3.5		3.7		1.8		13.7		30.0		2.1		0.7	
CY	72		12.4		3.0		1		0.1		39		38.0		0.0	
LV	41		8.6		3.4		3.4		0.3		1.7		30.7		0.3	
LT	47		0		86.4		0		1		0.0		0.0		0.1	
LU	234		0.4		3.1		0.5		6.7		21.7		37.3		0.0	
HU	469	p	5.7	p	0.3	p	:		1.4	p	22.9	p	20.1	p	0.3	p
MT	12	p	4	p	0.1	p	0	p	0.0	p	93.0	p	0	p	0.0	p
NL	5 333	p	3.5	p	0.2	p	0.3	p	2.8	p	50.6	p	18.1	p	1.4	p
AT (2)	2 413	ip	1.6	ip	1.2	ip	0.4	ip	1.3	ip	56.6	ip	14.3	ip	0.0	ip
PL	1 052	b	4.2	b	1.0		1.1		9.9	b	16.4	b	22.3	b	3.4	
PT	1 765		4.2		2.4		2.0		1.4		41.1		17.8		0.1	
RO	353		16.8		3.3		3.7		8.9		:		14.6		1.8	
SI	265		3.1		0.0		0.1		6.0		0.7		51.0		5.1	
SK	198	p	5.9	p	1.5	p	3.8	p	1.4	p	28.9	p	34.6	p	2.2	p
FI	2 055	p	4.8	p	0.2	p	0.7	p	4.3	p	24.6	p	19.6	p	2.7	p
SE (2)	3 090		1.5	ip	0.6	ip	0.2	ip	2.3	ip	46.5	ip	20.9	ip	7.5	ip
UK	11 210	ep	2.8	ep	0.7	ep	1.9	ep	2.1	ep	24.6	ep	19.5	ep	18.3	ep
IS	76		25.0		:		:		6.6		49.2		2.8		0.0	
NO	2 698		7.0		0.8		0.8		5.1		33.0		12.8		4.4	
CH (2)	2 621		1.8	i	0.2	i	0.2	i	1.3	i	62.0		27.4		0.6	i
HR	312	p	0.7	p	0.2	p	2	p	2.4	p	56.2	p	33.3	p	0.1	p
JP (2)	30 866	i	3.5	i	0.2	i	0.3	i	0.3	i	34.2	i	20.0	i	4.8	i
KR (2)(3)	7 806	p	7.1	p	:		:		:		:	i	19.0	ip	16.0	p
RU (3)	4 963		2.1		3.0		0.2		0.1		:		:		:	
US (2)	118 523	bip	1.6	bip	0.3	bip	0.0	bip	0.5	bip	0.0	i	8.7	bip	51.4	bip

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

(2) Flag 'i': DE, unrevised breakdown not adding to the revised total; FR: the sum of the breakdown does not add to the total. 'Education' and 'Culture, recreation, religion and mass media' are included elsewhere; 'Political and social systems, structures and processes' includes other classes; AT, federal or central government only; SE: the sum of the breakdown does not add to the total; CH: federal or central government only; JP, federal or central government only. 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; US, federal or central government only. Total excludes data for the R&D content of general payment to the higher education sector for combined education and research (public GUF).

(3) The sum of the breakdown is not equal to the total.

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

2

R&D expenditure

In 2010, R&D intensity (R&D expenditure as a percentage of GDP) in the EU-27 stood at 2.00 %, which is below the 3 % target set for 2010 by the Lisbon strategy. The 3 % target will be maintained for the next ten years as one of the five key targets of the Europe 2020 strategy. R&D intensity in the EU was below that in Japan (2008: 3.45 %), South Korea (2008: 3.36 %) and the United States (2008: 2.79 %), but higher than in China (2008: 1.47 %).

Among the EU Member States, only Finland (3.87 %), Sweden (3.42 %) and Denmark (3.06 %) exceeded the EU goal of devoting 3 % of GDP to R&D and also outperformed the United States. Another four Member States, namely Germany (2.82 %), Austria (2.76 %), France (2.26 %) and Slovenia (2.11 %), although not achieving the 3 % goal, were above the EU-27 average.

R&D expenditure in the EU-27 increased by an average of 3.1 % a year between 2005 and 2010, reaching EUR 246 billion in 2010. Germany, France, Italy 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 2010, accounting for 61.5 % of EU-27 R&D expenditure. The higher education sector (HES) and government sector (GOV) followed with shares of 24.2 % and 13.3 % respectively.

In the EU-27, 54.1 % of R&D expenditure was financed by the BES and 34.9 % by the GOV. At national level, three EU Member States were close to achieving the second goal set by the Lisbon strategy of having two thirds of R&D expenditure financed by the BES: Finland (66.1 %), Germany (66.1 %) and Luxembourg (65.9 %).

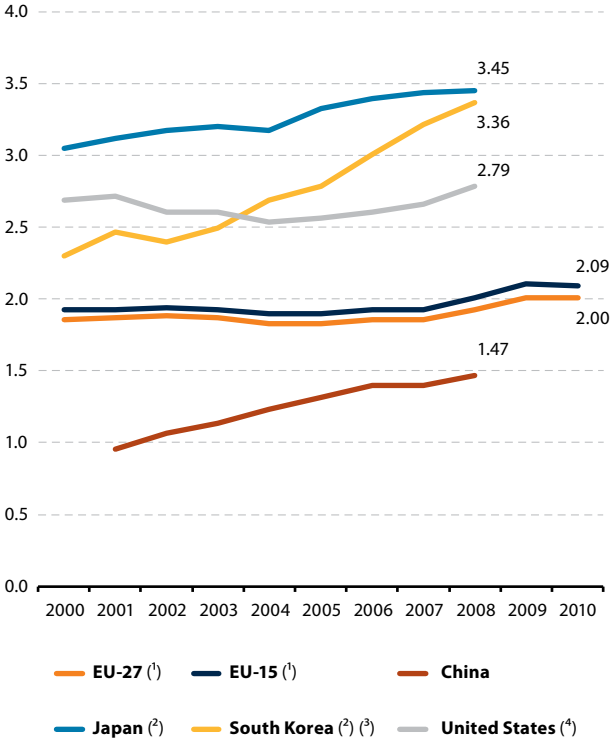
In many of the countries under review, the 'manufacturing' sector received the greatest share of business enterprise R&D expenditure. This was notably the case in Germany, Slovenia, Finland and Sweden, where 75 % or more of R&D expenditure by the BES was devoted to manufacturing. On the other hand, in Estonia three quarters of the expenditure went to 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, Sweden and the United Kingdom, such

large enterprises accounted for 80 % or more of BERD. On the other hand, in Estonia, Spain, Cyprus, Latvia and Malta, large enterprises accounted for less than 50 % of BERD.

The R&D expenditure per inhabitant of the leading regions in three EU Member States amounted to more than EUR 2 000, over four times as high as the EU-27 average (EUR 473). Hovedstaden recorded the highest regional R&D expenditure per inhabitant for Denmark (EUR 2 597), followed by Provence Brabant Wallon for Belgium (EUR 2 454) and Stuttgart for Germany (EUR 2 134). Regions from six more EU countries and Norway completed the list of the top 30 regions with the highest R&D expenditure per inhabitant: Finland, Austria, France, United Kingdom, Luxembourg and Sweden.

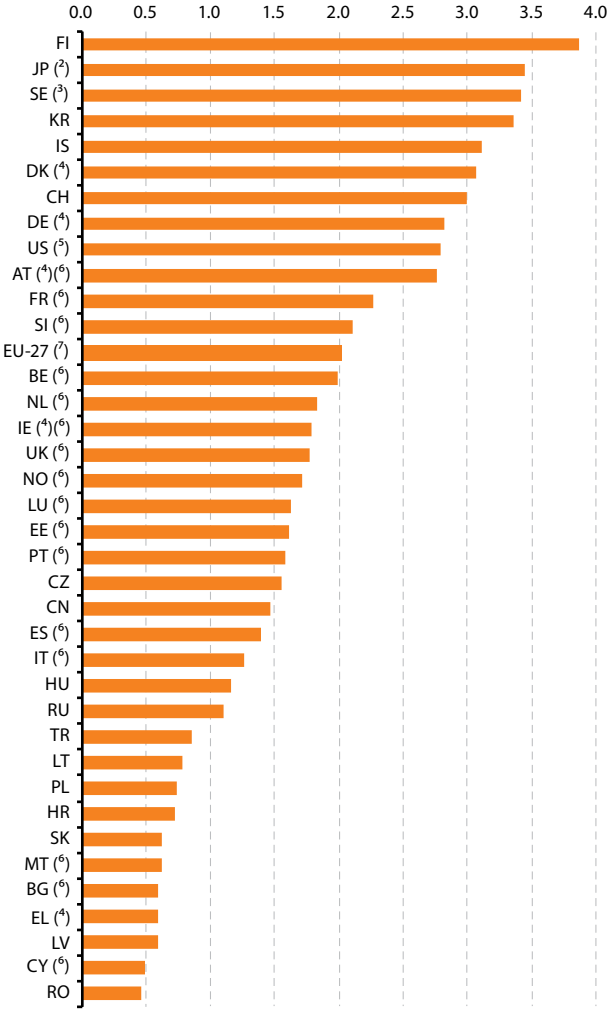
Figure 2.1: R&D intensity (R&D expenditure as % of GDP), EU-27, EU-15, China, Japan, South Korea and the United States, 2000–2010
(% of GDP)



(1) Eurostat estimate.
(2) JP (2008) and KR (2007), break in series.
(3) 2000–2006, excluding R&D in the social sciences and humanities.
(4) Excludes most or all capital expenditure; 2008, provisional.

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

Figure 2.2: R&D intensity (R&D expenditure as % of GDP), 2010 ([1])
(% of GDP)



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

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

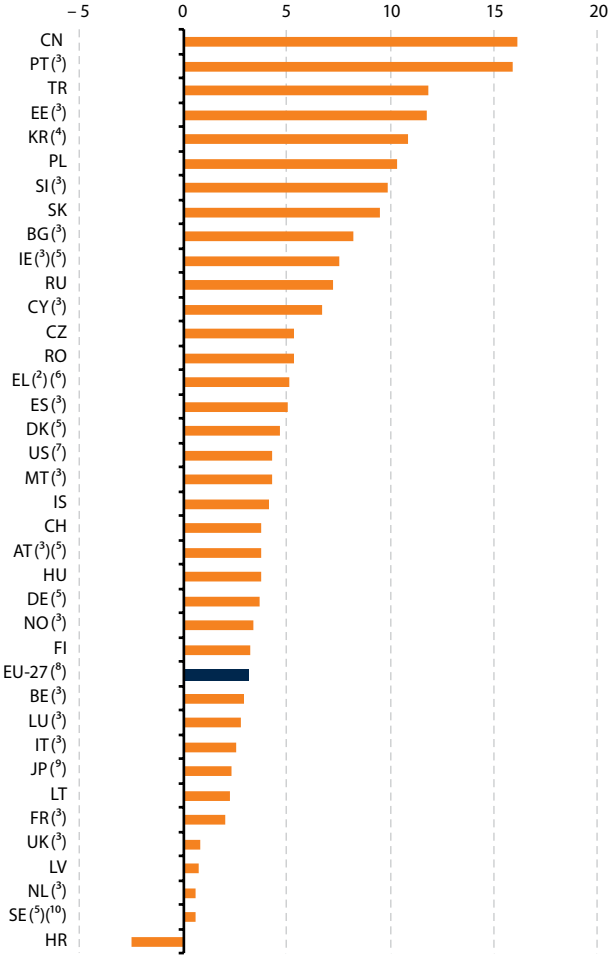
Table 2.3: R&D expenditure by sector of performance, 2010 (1) (million EUR)

	All sectors		Business enterprise sector		Government sector		Higher education sector		Private non-profit sector	
EU-27	245 673	s	151 126	s	32 602	s	59 509	s	2 436	s
BE	7 047	p	4 671	p	662	p	1 644	p	71	p
BG	215	p	108	p	80	p	25	p	1	p
CZ	2 335		1 448		454		420		13	
DK	7 208	e	4 909	e	151	e	2 117	e	31	e
DE	69 810	e	46 980	p	10 230	e	12 600	e	:	
EE	232	p	116	p	25		89		3	
IE	2 796	ep	1 905	e	91	p	800	e	:	
EL	1 342	e	384		281	e	661	e	17	e
ES	14 588	p	7 506	p	2 931	p	4 123	p	28	p
FR	43 633	p	26 684	p	7 138	p	9 295	p	516	p
IT	19 539	p	10 465	p	2 788	p	5 657	p	629	p
CY	87	p	15	p	17	p	43	p	12	p
LV	109		40		25		43		:	
LT	219		64		39		117		:	
LU	658	p	466	p	117	p	75	p	:	
HU (2)	1 126		674	i	209	i	224	i	:	
MT	39	p	23	p	1	p	14	p	0	
NL (2)	10 769	p	5 095	p	1 279	ip	4 395	p	:	i
AT	7 891	ep	5 373	ep	421	ep	2 059	ep	38	ep
PL	2 608		694		936		970		7	
PT	2 748	p	1 249	p	197	p	1 016	p	286	p
RO	573		220		211		140		2	
SI	746	p	506	p	136	p	104	p	0	p
SK	416		175		125		115		1	
FI	6 971		4 854		645		1 425		47	
SE (2)	11 870	ei	8 160	e	578	e	3 127	e	4	ei
UK	30 072	p	18 322	p	2 830	p	8 192	p	728	p
IS	269		142		54		67		6	
NO	5 343	p	2 738	p	877	p	1 728	p	:	
CH (2)	10 268		7 547		76	i	2 482		164	
HR	335		148		92		95		1	
TR	3 739		1 496		470		1 773		:	
CN	45 151		33 077		8 257		3 816		:	
JP	113 986	b	89 436		9 494		13 264	b	1 792	b
KR	21 480		16 188		2 590		2 394		307	
RU	12 999		7 866		4 023		1 086		24	
US (2)	270 733	ip	196 563	ip	28 709	i	34 786	i	10 675	i

(1) IS and TR, 2009; CH, CN, JP, KR and US, 2008; EL, 2007.
(2) Flag 'i':
HU: incomplete breakdown of R&D expenditure by sector of performance;
NL: GOV sector includes PNP sector;
SE: Underestimated or based on underestimated data;
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, KR, JP and US, OECD-MSTI.

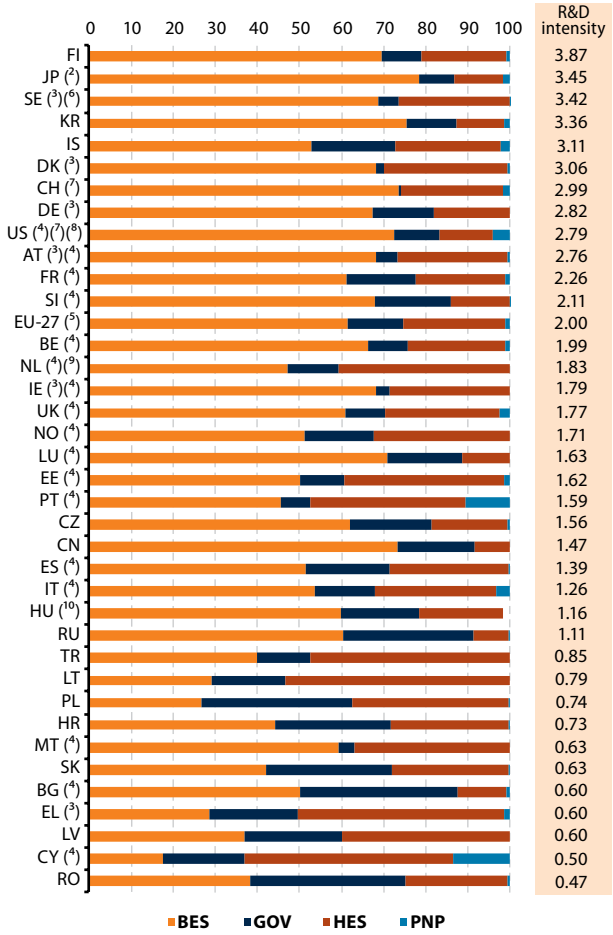
Figure 2.4: Average annual growth rate (AAGR) of R&D expenditure, 2005–2010 (1) (2)
(%)



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

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

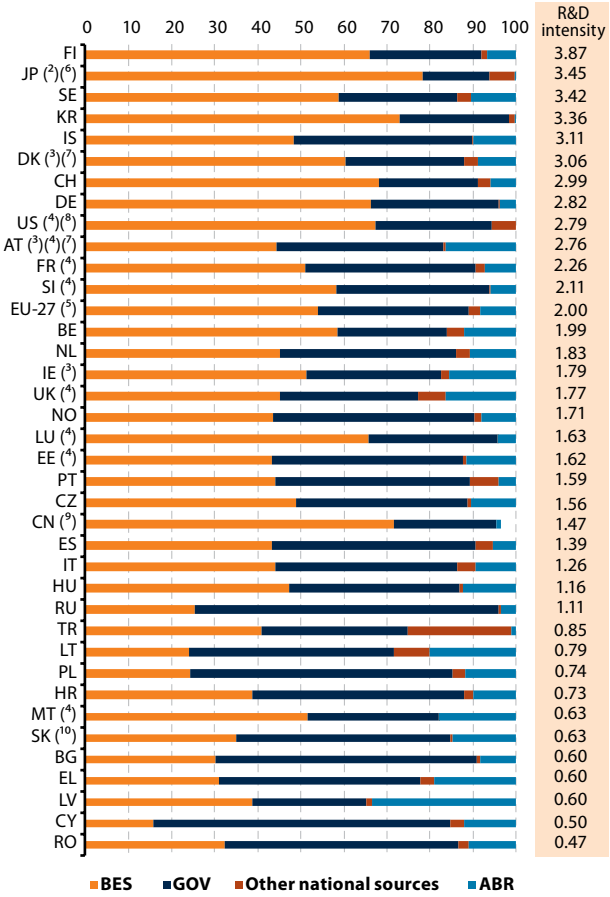
Figure 2.5: R&D expenditure by sector of performance as a percentage of total, ranked by R&D intensity, 2010 ([1])
(%)



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

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

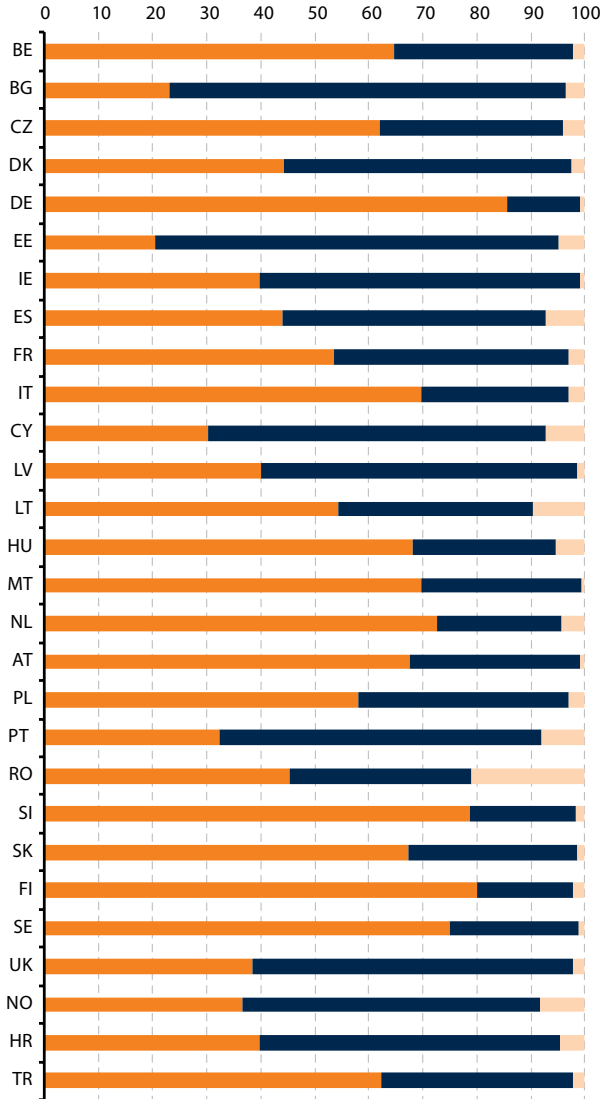
Figure 2.6: R&D expenditure by source of funds as a percentage of total, ranked by R&D intensity, 2010 (1)
(%)



(1) Exceptions to the reference year for R&D expenditure: SE, IS, DE, BE, EU-27, NL, NO, IE, PT, ES, IT, TR, BG and CY, 2009; CH, JP, KR, CN and US, 2008; EL, 2005. Exceptions to the reference year for R&D intensity: IS and TR, 2009; CH, CN, KR, JP and US, 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.
(9) The sum of the breakdown does not add to the total.
(10) Underestimated or based on underestimated data.

Source: Eurostat (online data code: rd_e_gerdfund); 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, 2009 (1)
(%)



(1) EL, not available; LU, confidential data.

Source: Eurostat (online data code: rd_e_berdindr2).

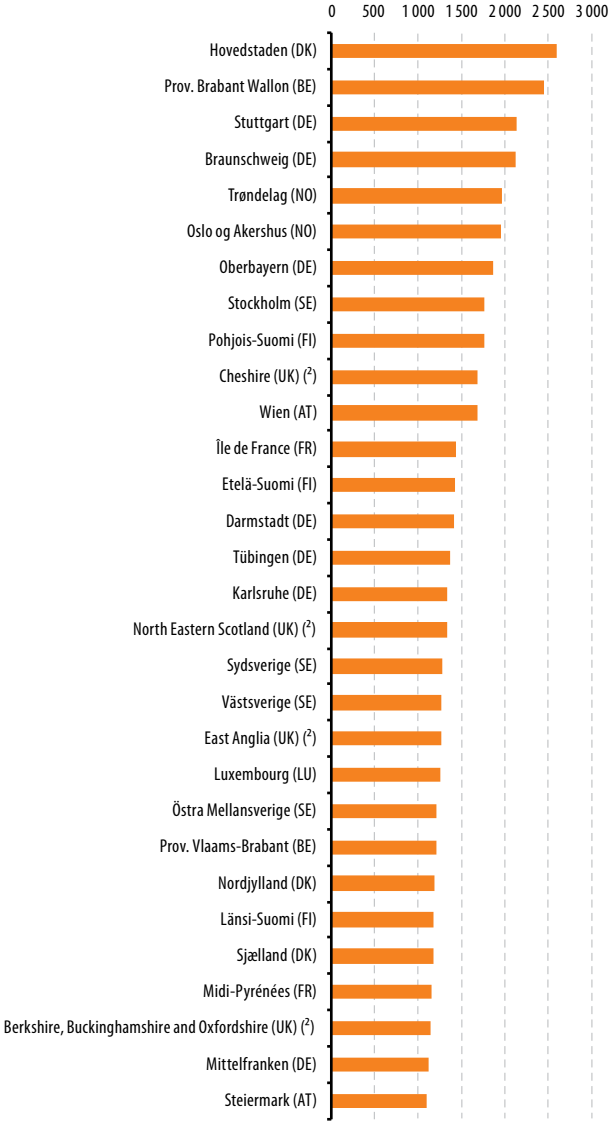
Table 2.8: Business enterprise R&D expenditure (BERD) in million EUR and by size class as a percentage of total, 2009 (1)

	Total in million EUR	Less than 10 employees	Between 10 and 49 employees	Between 50 and 249 employees	More than 250 employees
EU-27	146 012 s	:	:	:	:
BE	4 575	2.3	9.6	22.3	65.8
BG	55	: c	16.6	48.6	: c
CZ	1 257	2.1	10.1	27.1	60.7
DK	4 666	4.0	10.7	13.9	71.4
DE	45 275	0.6	3.0	7.5	89.0
EE	88	13.1	26.3	21.4	39.3
IE (2)	1 466	3.3 i	18.4 i	27.4 i	57.3 i
EL	384	6.1	11.9	2.6	79.4
ES	7 568	5.3	20.0	25.8	48.9
FR	26 341	2.3	7.0	12.1	78.6
IT	9 455	1.1	7.6	13.1	78.2
CY	16	37.3	21.5	5.2	36.0
LV	31	20.6	18.8	26.6	33.9
LT	53	2.7	8.0	25.2	64.1
LU	471	:	7.0	9.6	83.4
HU	611	11.4	13.8	13.0	61.8
MT	20	:	26.1	29.3	44.6
NL	4 900	:	8.4	19.3	72.3
AT	5 093	2.8	8.2	17.7	71.3
PL	597	1.2	5.5	18.5	74.8
PT	1 311	2.1	10.0	23.4	64.5
RO	223	3.7	9.0	36.6	50.8
SI	424	3.8	12.2	21.4	62.5
SK	124	2.4	5.6	20.8	71.3
FI	4 847	2.4	6.9	9.2	81.5
SE	7 405	:	6.5	12.1	81.5
UK	17 537	0.9	2.9	12.6	83.6
NO	2 475	:	20.6	29.9	49.5
CH	7 547	2.9	7.7	18.4	71.0
HR	154	1.1	6.6	34.9	57.4
JP (2)	89 436	:	:	6.0 i	:
KR	16 188	0.9 b	10.0 b	14.0 b	75.0 b
US (2)	196 474 i	: i	7.0 i	8.7 i	84.3 i

(1) CH, JP and KR, 2008; EL, IT and US, 2007; IE, 2006.
(2) Flag 'i':
IE: Unrevised breakdown not adding to the revised total;
JP: Underestimated or based on underestimated data;
US: Excludes most or all capital expenditure; data for between 10 and 49 employees include data for less than 10 employees'.

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

Figure 2.9: Top 30 regions at NUTS 2 level in terms of R&D expenditure per inhabitant, 2009 (1)
(EUR per inhabitant)



(1) CH, NUTS 2 level regional data is not available.
(2) National estimate.

Source: Eurostat (online data code: rd_e_gerdreg).

II

Monitoring the knowledge workers

3

R&D personnel

In 2009, R&D personnel accounted for 1.68 % of total employment in the EU-27 (in head count — HC). At national level, the highest shares of R&D personnel in total employment were observed in Iceland (3.3 %), Finland (3.23 %) and Denmark (2.94 %).

In 2010, the EU-27 counted 2.5 million people in full-time equivalents (FTE) 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 (1.3 million FTE). However, for certain countries this pattern differed at national level. In Bulgaria, the government sector employed the most R&D personnel, while the higher education sector accounted for the highest shares of R&D personnel in Estonia, Greece (2007), Cyprus, Latvia, Lithuania, Poland, Portugal, Romania, Slovakia and the United Kingdom.

Between 2005 and 2010, the total number of R&D personnel measured as FTE grew by 2.6 % a 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 (15.3 %), Slovenia (7.5 %) and Hungary (6.3 %). Five EU Member States reported a decrease in R&D personnel — Romania (– 4.7 %), Finland (– 0.6 %), the United Kingdom (– 0.3 %), Latvia (– 0.3 %) and Sweden (– 0.1 %).

The breakdown of researchers by institutional sector reveals a complex picture across the EU-27, where 45.3 % of researchers (in FTE) were employed in the business enterprise sector in 2010, while 40.9 % were employed in the higher education sector and 12.7 % in the government sector.

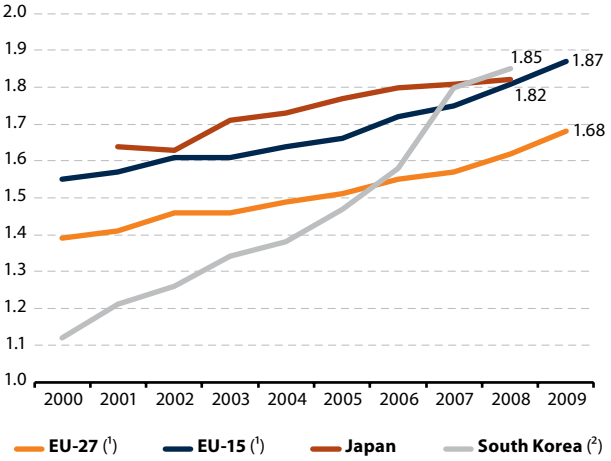
R&D activity largely remains a male field of work: in 2009, women working in R&D (35.4 %) and female researchers (32.9 %) in HC comprised a minority in the EU-27. Lithuania (54.6 %), Latvia (53.8 %) and Bulgaria (51.2 %) were the only countries where women accounted for more than half of R&D personnel. As regards researchers, only Lithuania and Latvia reached a gender balance, with respectively 50.9 % and 52.4 % of female researchers.

In the business enterprise sector, 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 FTE) were employed in services of the business economy.

In 2009, North Eastern Scotland (UK) was the leading European region as regards the share of R&D personnel in total employment, with 6.0 %. This was followed by two capital regions, namely Hovedstaden (DK) with 5.2 %, and Wien (AT) with 4.7 %. Apart from Trøndelag (NO) and Praha (CZ), the share of R&D personnel in total employment stood below 4.5 % in all other European regions.

The largest discrepancy between the highest- and lowest-ranking regions within a given country was found in the United Kingdom (5.8 percentage points); conversely, the smallest gap was registered in Ireland, at 0.26 percentage points.

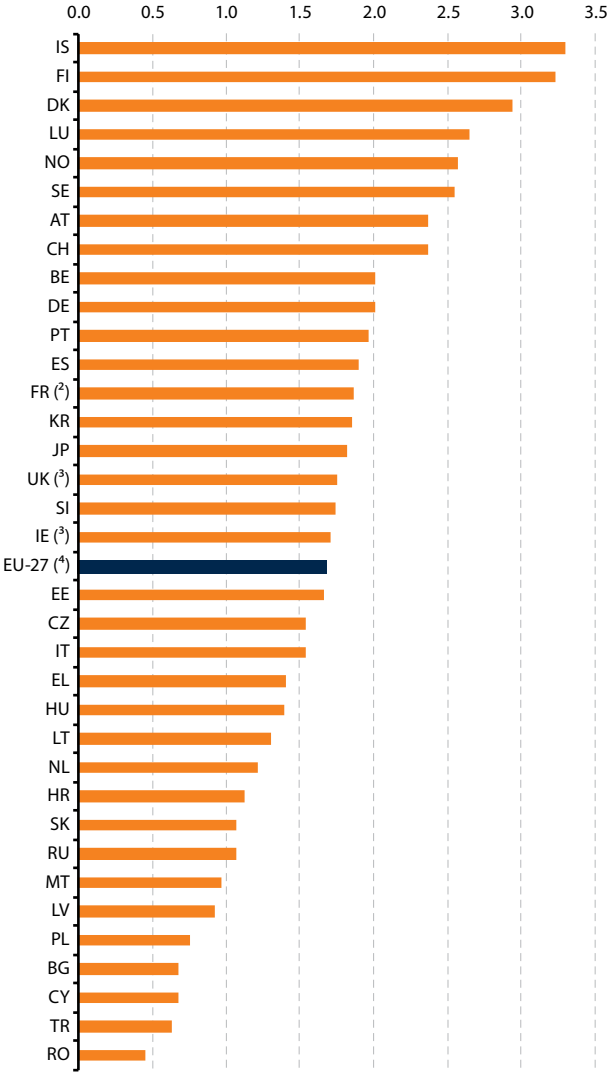
Figure 3.1: R&D personnel (HC) as a percentage of persons employed, EU-27, EU-15, Japan and South Korea
(% of persons employed)



(1) Eurostat estimate.
(2) 2004–2006, 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, 2009 (1)
(% of persons employed)



(1) CH, RU, JP and KR, 2008; EL, 2005.
(2) Defence excluded (all or mostly).
(3) National estimate.
(4) Eurostat estimate.

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

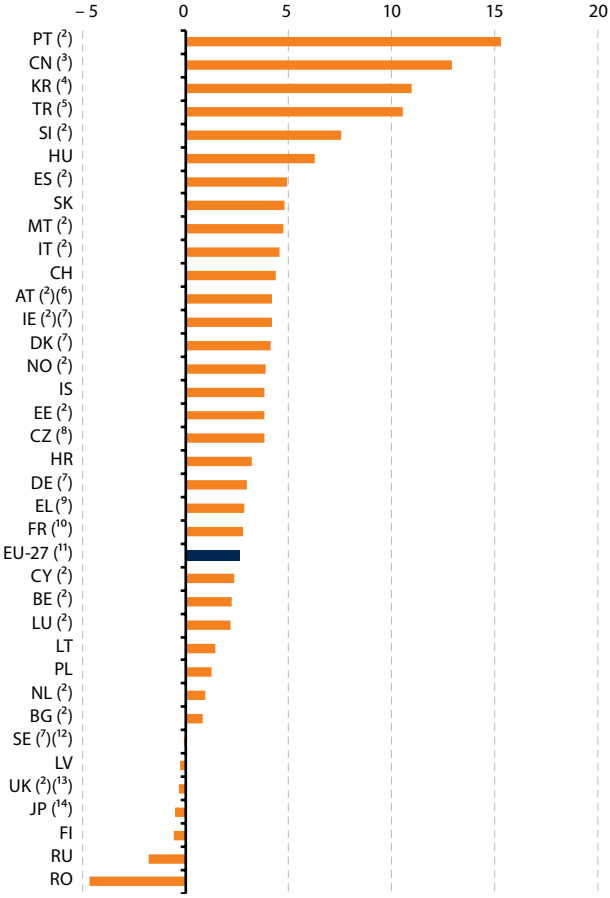
Table 3.3: R&D personnel in FTE by sector of performance, 2010 (1)
(FTE)

	All sectors		Business enterprise sector		Government sector		Higher education sector		Private non-profit sector	
EU-27	2 486 743	s	1 280 305	s	350 323	s	826 965	s	29 149	s
BE	59 851	p	32 691	p	4 942	p	21 633	p	585	p
BG	16 509	p	2 713	p	9 346	p	4 362	p	88	p
CZ	52 290		26 998		10 926		14 056		310	
DK	53 191	e	34 174	e	1 474	e	17 278	e	266	e
DE	550 300	e	340 000	p	89 000	e	121 300	e	:	
EE	5 261	p	1 939	p	772		2 465		85	
IE	20 483	ep	12 194	e	987	p	7 302	e	:	
EL	35 531	e	11 562		4 584	e	19 172	e	213	e
ES	222 022	p	92 221	p	46 008	p	83 300	p	493	p
FR (2)	390 374	i	226 051		53 148	i	105 048		6 127	
IT	218 837	p	103 858	p	33 574	p	73 287	p	8 119	p
CY	1 300	p	300	p	265	p	595	p	140	p
LV	5 409		1 217		907		3 285		:	
LT	11 822		2 069		2 555		7 198		:	
LU	4 889	p	3 289	p	1 006	p	594	p	:	
HU	31 480		14 999		8 225		8 256		:	
MT	1 039	p	669	p	59	p	311	p	0	
NL (2)	98 074	p	51 650	p	11 424	ip	35 000	p	:	i
AT	58 519	ep	39 716	ep	2 778	ep	15 614	ep	411	ep
PL	81 843		18 424		20 180		43 111		128	
PT	52 378	p	13 695	p	3 639	p	30 429	p	4 615	p
RO	26 171		8 271		8 704		9 054		142	
SI	12 940	p	7 056	p	3 141	p	2 727	p	16	p
SK (2)	18 188		3 230		4 359	i	10 535		63	
FI	55 897		30 559		6 836		17 924		579	
SE (2)	77 418	ei	54 797	e	3 110	ei	19 471	e	40	ei
UK (2)	319 487	ip	142 374	p	17 410	p	152 999	ip	6 704	p
IS	3 753		1 577		816		1 250		110	
NO	36 245	p	17 944	p	6 331	p	11 970	p	:	
CH	62 066		39 832		809	i	21 425		:	
HR	10 859		2 610		3 622		4 609		18	
TR	73 521		31 476		11 007		31 037		:	
CN	1 965 357		1 395 943		302 601		266 813		:	
JP	882 739	b	625 264		61 901		181 946	b	13 628	
KR	294 440		208 428		21 768		60 372		3 872	
RU	839 992		444 111		280 506		113 353		2 022	

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

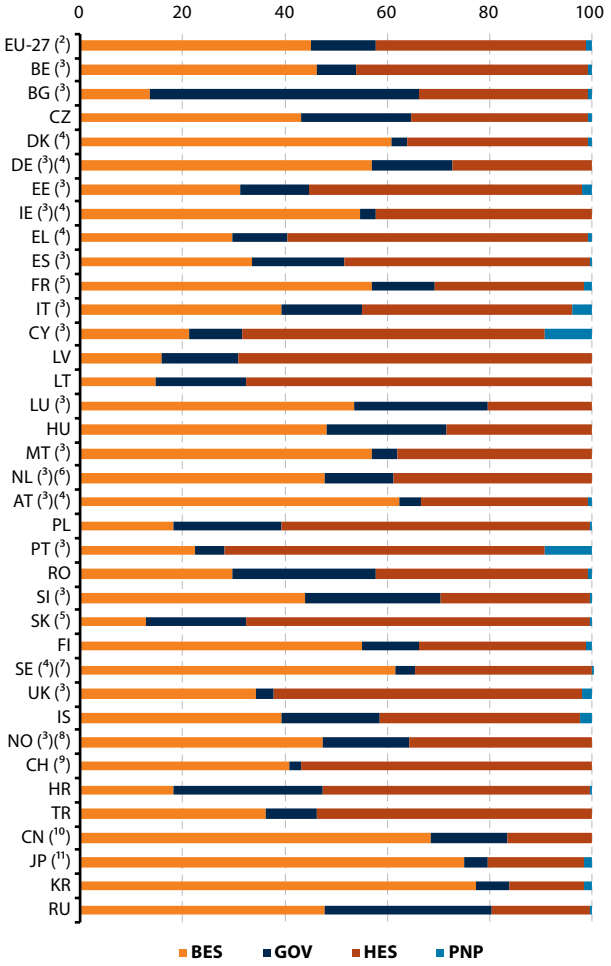
Source: Eurostat (online data code: rd_p_persocc); for CN, JP and KR, OECD-MSTI.

Figure 3.4: Average annual growth rate (AAGR) of R&D personnel (FTE), 2005–2010 (1)
(%)



(1) FR, IS and TR, 2005–2009; EL, 2005–2007; CH, 2004–2008; CN, JP and KR, 2005–2008.
(2) 2010, provisional data.
(3) 2005, do not correspond to Frascati Manual recommendations.
(4) 2005, excluding R&D in the social sciences and humanities.
(5) 2005, underestimated or based on underestimated data.
(6) 2005 and 2010, national estimate.
(7) 2010, national estimate.
(8) 2005, break in series.
(9) 2007, national estimate.
(10) 2009, defence excluded (all or mostly).
(11) Eurostat estimate.
(12) 2010, underestimated or based on underestimated data; 2005, break in series.
(13) Underestimated or based on underestimated data. 2005, national estimate; 2005, break in series.
(14) 2008, break in series.
Source: Eurostat (online data code: rd_p_persocc); for CN, JP and KR, OECD-MSTI.

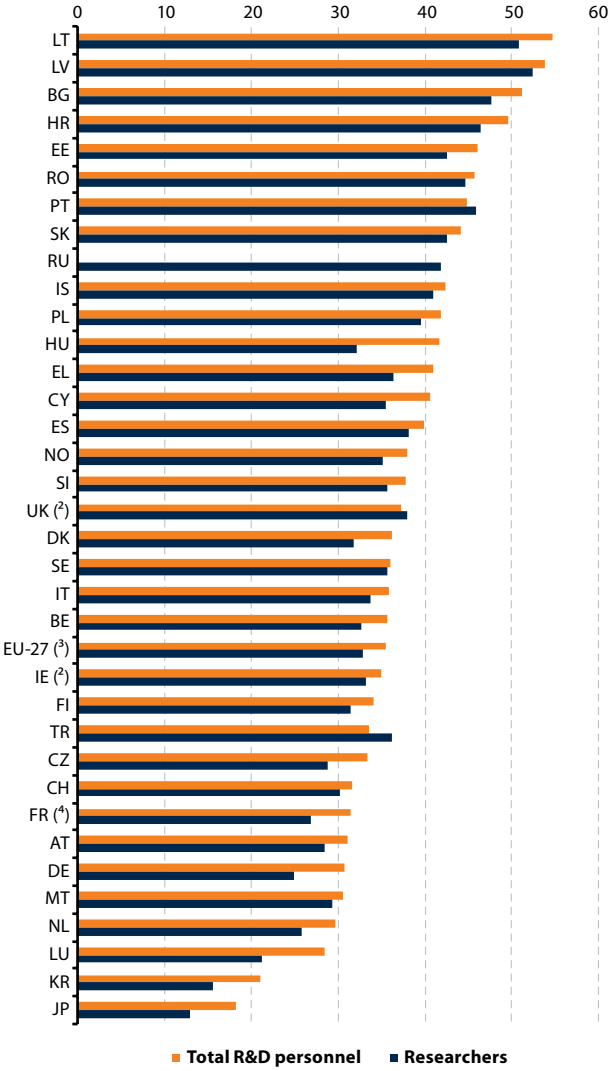
Figure 3.5: Researchers (FTE) by sector of performance as a percentage of total, 2010 (1)
(%)



(1) FR, IS and TR, 2009; CH, CN, JP and KR, 2008; EL, 2007.
(2) Eurostat estimate.
(3) Provisional data; DE and EE, provisional data for BES only; IE, provisional data for GOV only;
(4) National estimate; DE and EL, excluding BES; IE and SE, excluding GOV;
(5) GOV: defence excluded (all or mostly).
(6) PNP is included in government sector.
(7) PNP: underestimated or based on underestimated data.
(8) BES: university graduates instead of researchers.
(9) GOV: federal or central government only.
(10) Do not correspond to Frascati Manual recommendations.
(11) HES: break in series.

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

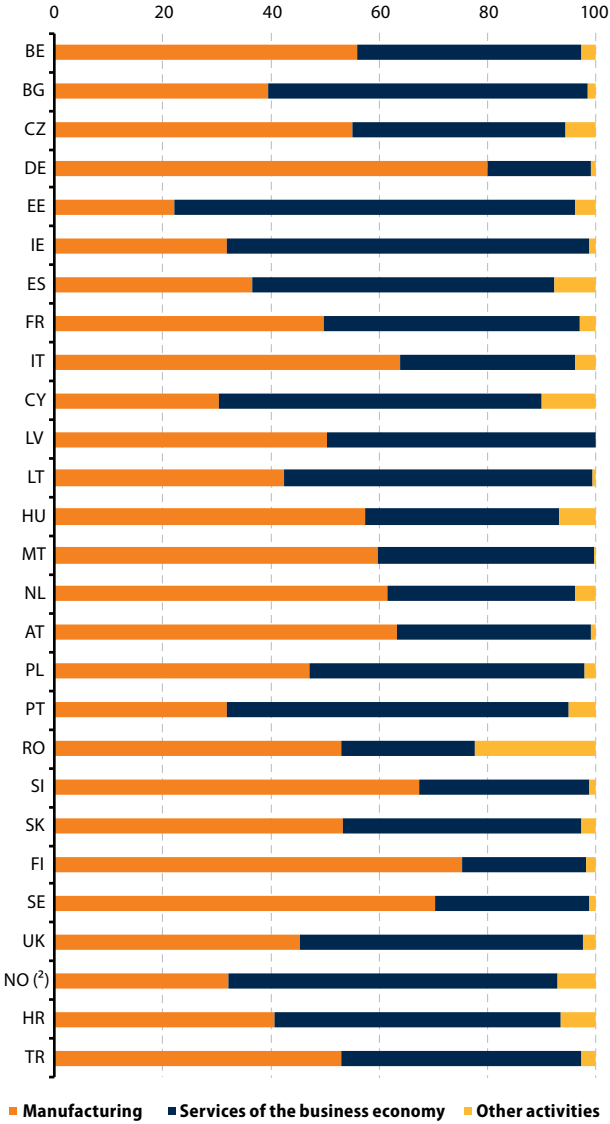
Figure 3.6: Percentage of women in total R&D personnel and among researchers (HC), 2009 (1)
(%)



(1) CH, JP, KR and RU, 2008. EL, 2005.
(2) National estimate.
(3) Eurostat estimate.
(4) Defence excluded (all or mostly).

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

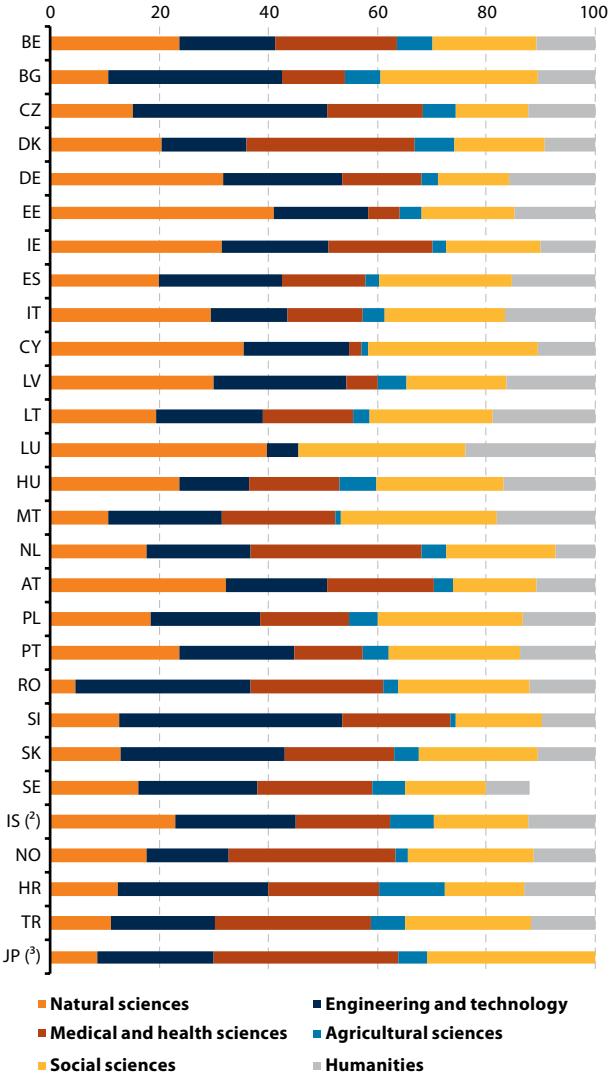
Figure 3.7: Business enterprise sector researchers in FTE by sector of activity (NACE Rev.2) as a percentage of total, 2009 ([1]) (%)



([1]) DK and EL, breakdown not available; LU, confidential data.
([2]) University graduates instead of researchers.

Source: Eurostat (online data code: rd_p_bempoccr2).

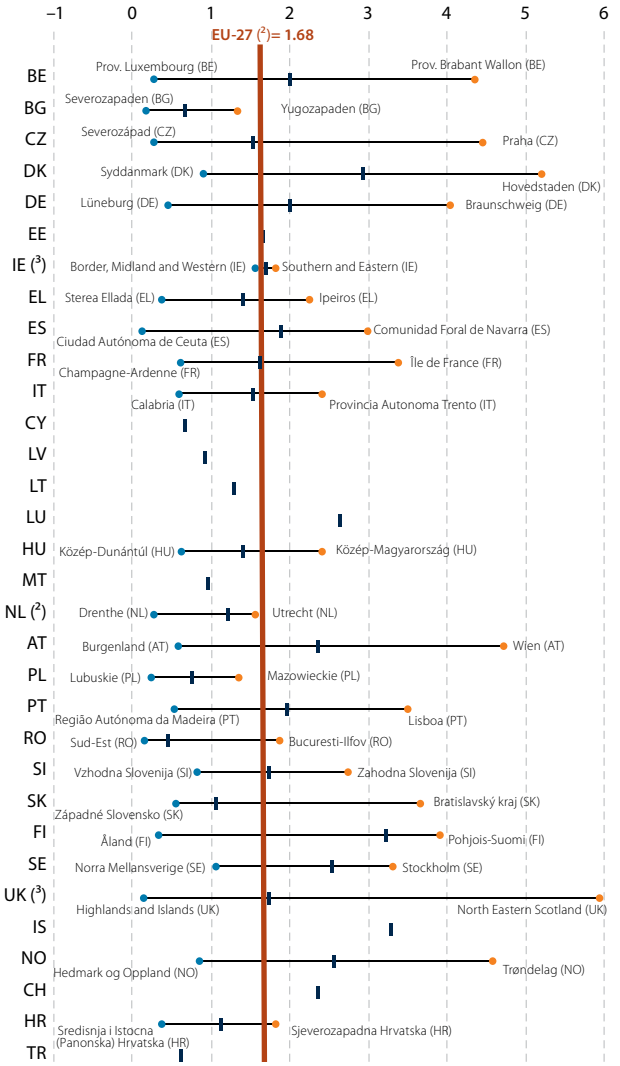
Figure 3.8: Researchers (FTE) in higher education sector by field of science as a percentage of total, 2009 (1)
(%)



(1) SE and IS, 2001; JP, 2008; EL, FR, FI and UK, breakdown not available.
(2) Unrevised breakdown not adding to the revised total.
(3) Social sciences include Humanities; break in series.

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, 2009 (1) (%)



(1) CH, 2008; EL, 2005; FR, 2001.
(2) Eurostat estimate.
(3) National estimate.

Source: Eurostat (online data code: rd_p_persreg).

Human resources in science and technology (HRST)

4

Statistics on human resources in science and technology (HRST) monitor supply and demand in highly qualified persons in science and technology by measuring HRST stocks and flows.

In 2009, close to one third (29.6 %) 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. Finland counted the highest proportion of tertiary-education students among the population aged 20–29 years (46.5 %), followed very closely by Greece with approximately the same proportion (46.5 %), Lithuania (41.5 %) and Slovenia (40.2 %).

At EU level, about one quarter of tertiary-education students chose science and engineering (S&E) as their main field of study, representing 7.2 % of the population aged 20–29 years.

In the EU-27, the share of women in higher education reached 55.5 % in 2009, yet women accounted for only 30.3 % of tertiary-education students in science and engineering. Whereas the number of tertiary-education students grew on average by 1.3 % a year between 2004 and 2009, the number of students in the S&E fields increased at a slower pace (0.6 %).

In terms of HRST stocks, the EU counted more than 93 million highly qualified knowledge workers in 2010. Of this population, 70 million were considered as HRST by virtue of education (HRSTE), 62 million as HRST by virtue of occupation (HRSTO) and 39 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.

In the EU-27, the HRST population increased at an average rate of 2.4 % a year between 2005 and 2010. This was even higher than the increase in the total labour force over the same period (0.9 %). The HRST population grew faster than the total labour force in all EU-27 Member States except Spain and Bulgaria.

In 2010, HRST accounted for 40.5 % of the active population aged 25–64 years in the EU-27. At country level the proportions exceeding 50 % were observed in Luxembourg (55.9 %), followed by Switzerland (54.4 %), Denmark (51.9 %), the Netherlands (51.9 %) and Scandinavian countries (Norway with 51.9 %, Sweden with 50.8 % and Finland with 50.6 %).

In 2010 in the EU, the distribution of HRSTC by age group was fairly homogeneous, with approximately one third of all HRSTC aged 25–34, one third aged 35–44 and the last third

aged 45–64. However, some countries such as Turkey, Malta and Poland recorded a large proportion of HRSTC aged 25–34 years, whereas in Croatia and Germany a large share of HRSTC was aged 45–64 years.

The composition of the HRSTO population varied considerably in the countries studied: 'professionals' accounted for 74.6 % of HRSTO in Ireland, with the EU average standing at 48.0 %. In contrast, 'technicians and associate professionals' represented 70.1 % of HRSTO in the Czech Republic.

Unemployment rates were generally significantly higher among non-HRST than among HRST. Although unemployment levels in both categories remained comparable in the EU-27 between the years 2000 and 2010, substantial variations were observed 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. In contrast, the opposite trend was observed in Ireland, Hungary, Portugal, Luxembourg and Switzerland, where unemployment rates increased significantly for both categories. In 2010, Praha (CZ) was the leading region when considering the proportion of HRSTO in the labour force, with 53.1 %, and it was also the only region where HRSTO accounted for more than half of the labour force. As a rule, capital regions were well represented among the 30 leading regions in terms of HRSTO as a share of the labour force. Some countries counted several regions in the top 30, including Germany (with 7 regions), Switzerland (5), the Netherlands (5), Belgium (2), Norway (2) and Sweden (2). All other countries were represented by only one region.

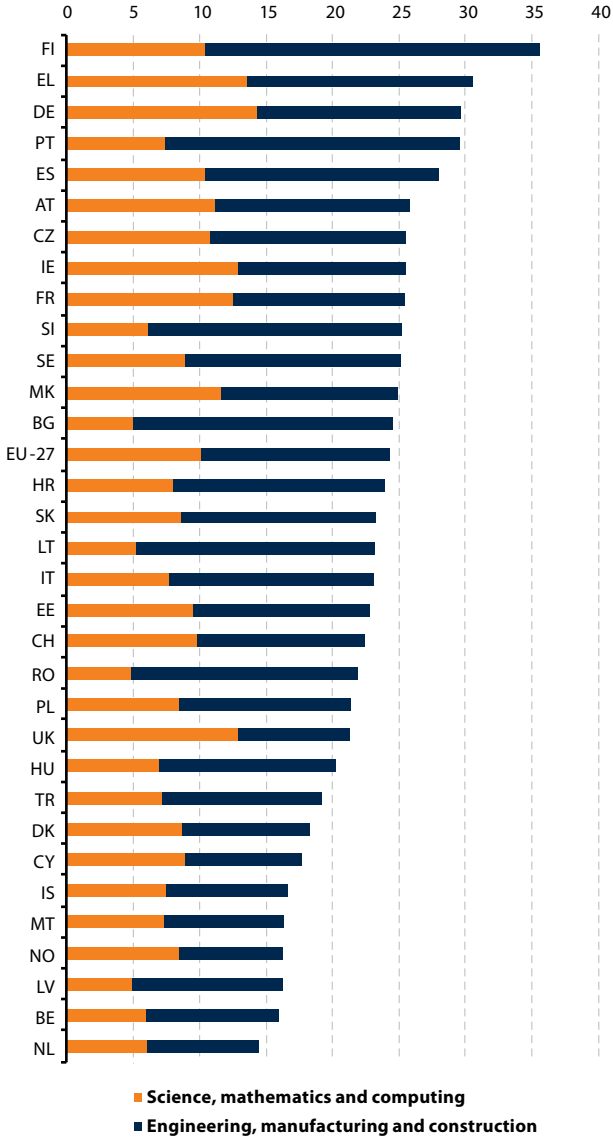
Table 4.1: Students participating in tertiary education, 2009 (1)

	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 (2)	19 470 s	29.6 s	1 974 s	3.0 s	2 757 s	4.2 s
BE	425	31.6	25	1.9	43	3.2
BG	274	30.8	14	1.5	54	6.1
CZ	417	28.2	45	3.0	61	4.2
DK	235	37.3	20	3.2	23	3.6
DE	2 439	25.3	348	3.6	375	3.9
EE	68	33.6	6	3.2	9	4.5
IE	183	25.6	24	3.3	23	3.2
EL	638	46.5	87	6.3	108	7.9
ES	1 801	30.4	187	3.2	316	5.3
FR	2 173	28.5	272	3.6	281	3.7
IT	2 012	30.3	154	2.3	310	4.7
CY	31	26.7	3	2.4	3	2.4
LV	125	35.5	6	1.8	14	4.0
LT	211	41.5	11	2.2	38	7.5
LU	:	:	:	:	:	:
HU	398	30.0	28	2.1	53	4.0
MT	10	17.4	1	1.3	1	1.5
NL	619	31.5	38	1.9	52	2.6
AT	308	29.3	34	3.3	45	4.3
PL	2 150	37.0	182	3.1	279	4.8
PT	373	27.3	27	2.0	83	6.1
RO	1 098	32.7	54	1.6	186	5.6
SI	114	40.2	7	2.5	22	7.7
SK	235	26.4	20	2.3	34	3.9
FI	297	46.5	31	4.8	75	11.7
SE	423	36.6	37	3.2	69	5.9
UK	2 415	29.1	313	3.8	201	2.4
IS	17	37.6	1	2.8	2	3.5
LI	1	-	-	-	0	-
NO	219	36.9	19	3.2	17	2.9
CH	233	24.3	23	2.4	29	3.1
HR	139	28.2	11	2.3	22	4.5
MK	65	19.9	8	2.3	9	2.6
TR	2 924	25.2	209	1.8	351	3.0

(1) EL, 2008.
(2) EU-27 estimate including EL data from 2008 and excluding LU.

Source: Eurostat (online data code: hrst_fl_tepart).

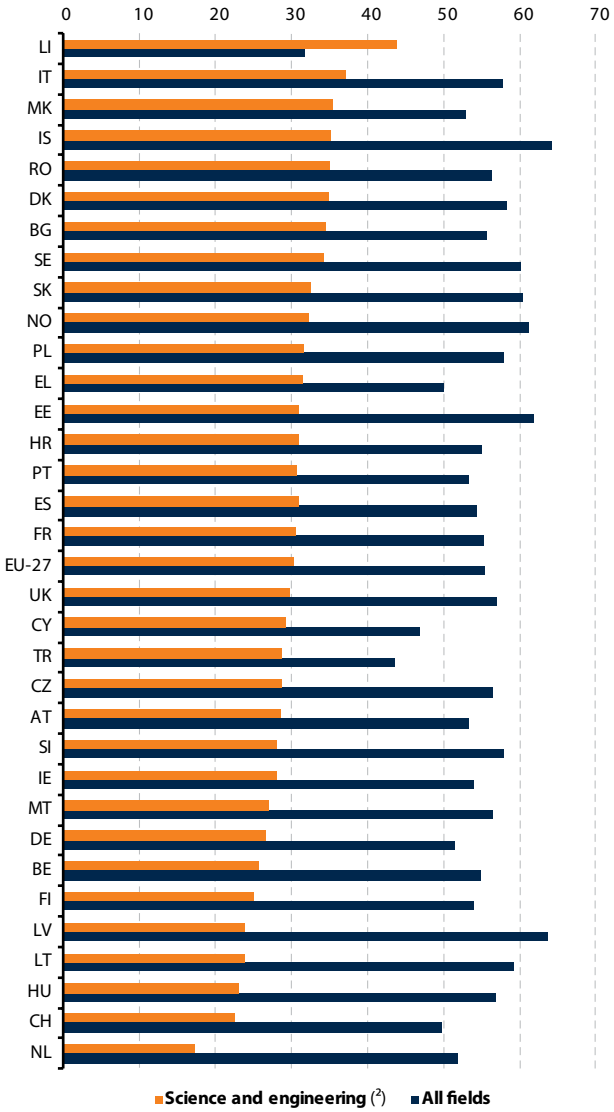
Figure 4.2: Students in science and engineering as a percentage of tertiary students, 2009 (1)
(%)



(1) LU, not available; EL, 2008; EU-27, estimate.

Source: Eurostat (online data code: hrst_fl_tepart).

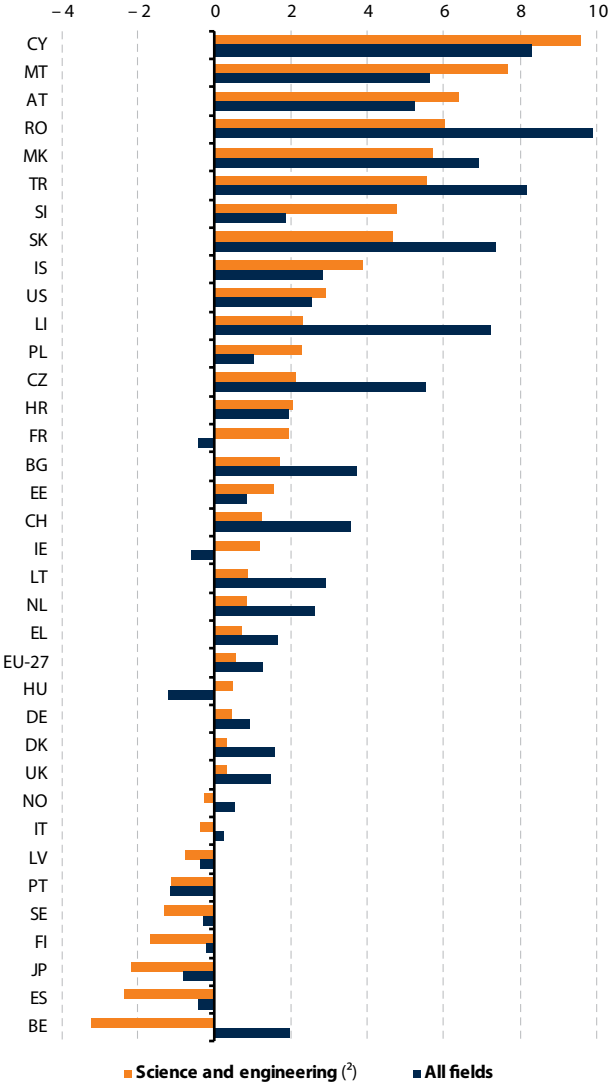
Figure 4.3: Share of female students in tertiary education, 2009 (1)
(%)



(1) LU, not available; EL, 2008; EU-27, estimate.
(2) Science and engineering corresponds to the following fields of study: Science, mathematics and computing and Engineering, manufacturing and construction.

Source: Eurostat (online data code: hrst_fl_tepart).

Figure 4.4: Average annual growth rate (AAGR) of students participating in tertiary education, 2004–2009 (1)
(%)



(1) LU, not available; FR, between 2006 and 2009; EL, between 2004 and 2008; US, between 2005 and 2009; EU-27, estimate.
(2) Science and engineering corresponds to the following fields of study: Science, mathematics and 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, 2010 (1)

	HRST		HRSTC	
	Total in 1 000	% of women	Total in 1 000	% of women
EU-27	93 265	51.7	38 746	52.7
BE	2 437	50.8	1 056	52.9
BG	1 092	59.8	509	68.2
CZ	1 958	51.4	677	46.5
DK	1 343	51.1	661	55.8
DE	17 547	49.2	7 058	46.2
EE	299	64.2	115	72.2
IE	967	53.8	383	55.4
EL	1 670	49.8	818	51.5
ES	9 024	50.9	3 748	53.3
FR	12 194	51.5	5 189	52.8
IT	8 582	50.8	2 953	52.5
CY	175	50.3	79	49.4
LV	412	62.6	172	69.8
LT	663	62.1	317	71.0
LU	132	46.2	70	42.9
HU	1 497	58.9	633	57.7
MT	50	46.0	20	55.0
NL	4 056	48.6	1 801	47.5
AT	1 531	45.8	504	47.8
PL	6 250	59.2	2 893	61.1
PT	1 238	54.3	594	62.5
RO	2 290	54.2	1 124	53.2
SI	401	55.6	173	60.1
SK	894	58.1	334	56.6
FI	1 309	55.2	594	59.3
SE	2 271	52.4	1 141	58.5
UK	12 986	50.3	5 128	51.2
IS	75	57.3	36	58.3
NO	1 186	52.6	669	56.2
CH	2 134	43.9	914	39.1
HR	544	51.8	254	57.9
MK	213	48.4	85	50.6
TR	5 061	36.7	1 877	40.1

(1) CH, 2009.

Source: Eurostat (online data code: hrst_st_ncat).

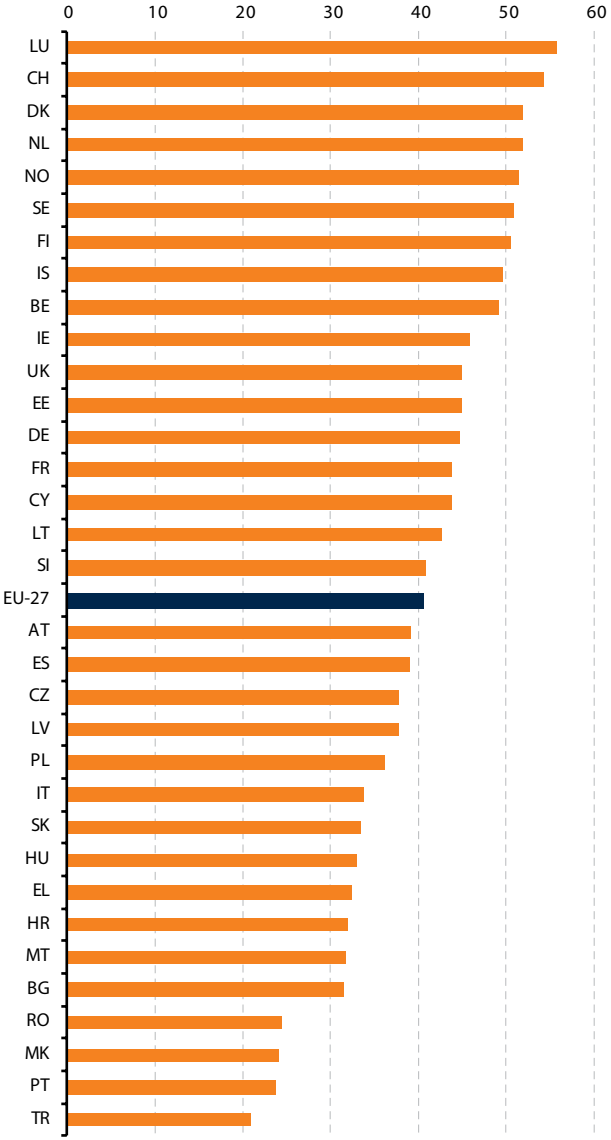
Table 4.6: Stocks of HRSTE and HRSTO aged 25–64 years old, total and percentage of women, 2010 (1)

	HRSTE		HRSTO	
	Total in 1 000	% of women	Total in 1 000	% of women
EU-27	69 955	52.0	62 056	51.9
BE	2 051	52.7	1 443	49.7
BG	950	61.8	651	63.6
CZ	1 023	48.1	1 611	51.4
DK	965	53.7	1 040	51.6
DE	11 699	44.3	12 906	51.9
EE	254	65.0	160	68.8
IE	885	54.6	464	53.4
EL	1 466	50.3	1 022	50.4
ES	8 113	51.9	4 659	50.9
FR	9 476	54.0	7 908	49.3
IT	4 955	55.6	6 580	48.0
CY	157	51.0	97	47.4
LV	329	63.5	255	66.3
LT	580	61.6	400	69.8
LU	95	45.3	107	44.9
HU	1 121	57.3	1 009	60.0
MT	31	51.6	39	46.2
NL	2 910	46.7	2 947	49.8
AT	890	45.2	1 145	47.2
PL	4 905	58.8	4 238	60.9
PT	919	60.9	913	52.9
RO	1 661	50.9	1 753	56.8
SI	280	58.2	293	56.3
SK	543	55.1	685	59.9
FI	1 090	57.4	813	55.4
SE	1 656	56.9	1 755	52.2
UK	10 950	51.3	7 164	49.4
IS	53	56.6	58	60.3
NO	940	55.4	915	52.3
CH	1 512	39	1 536	46
HR	410	54.4	388	53.1
MK	177.0	47.5	122	50.0
TR	4 289	39.7	2 649	34.3

(1) CH, 2009.

Source: Eurostat (online data code: hrst_st_ncat).

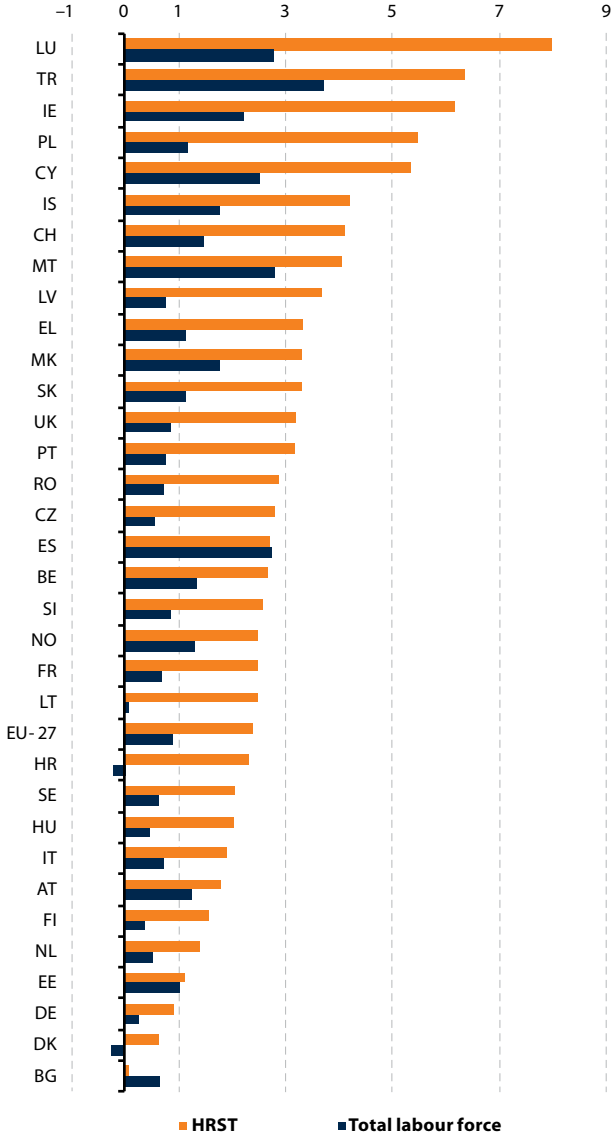
Figure 4.7: Share of HRST aged 25–64 years old in active population, 2010 (1)
(%)



(1) CH, 2009.

Source: Eurostat (online data code: hrst_st_ncat).

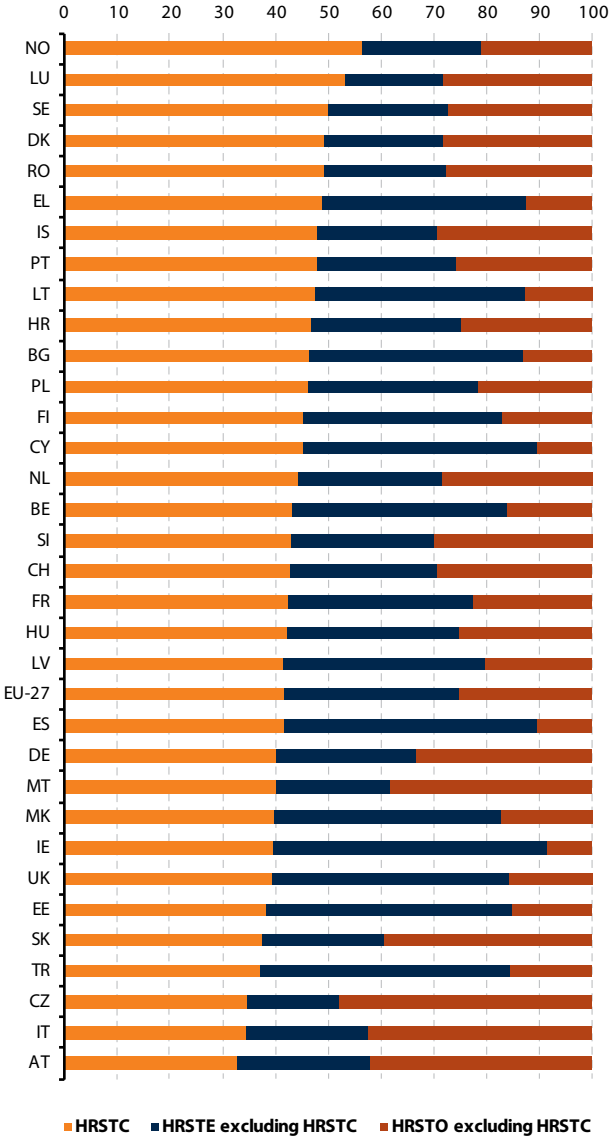
Figure 4.8: Average annual growth rate (AAGR) of HRST and of total labour force, 2005–2010 (1)
(%)



(1) CH, between 2005 and 2009; MK and TR, between 2006 and 2010.

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

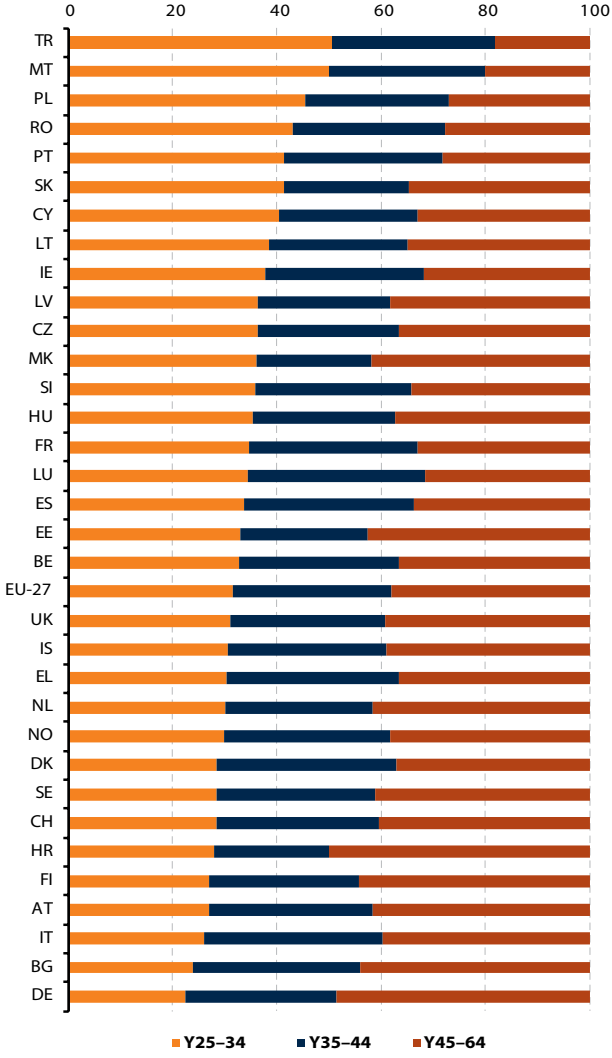
Figure 4.9: Distribution of HRST by category, 2010 (1)
(%)



(1) CH, 2009.

Source: Eurostat (online data code: hrst_st_ncat).

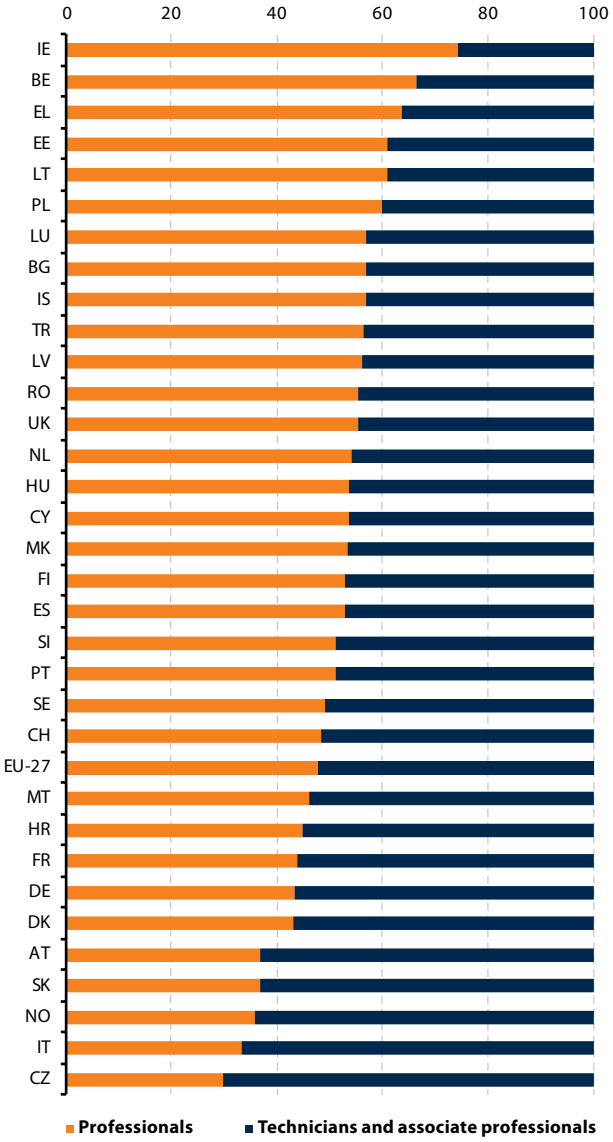
Figure 4.10: HRSTC by age group, 2010 (1)
(%)



(1) CH, 2009.

Source: Eurostat (online data code: hrst_st_ncat).

Figure 4.11: HRSTO aged 25–64 years old by occupation, 2010 (1)
(%)



(1) CH, 2009.

Source: Eurostat (online data code: hrst_st_nocc).

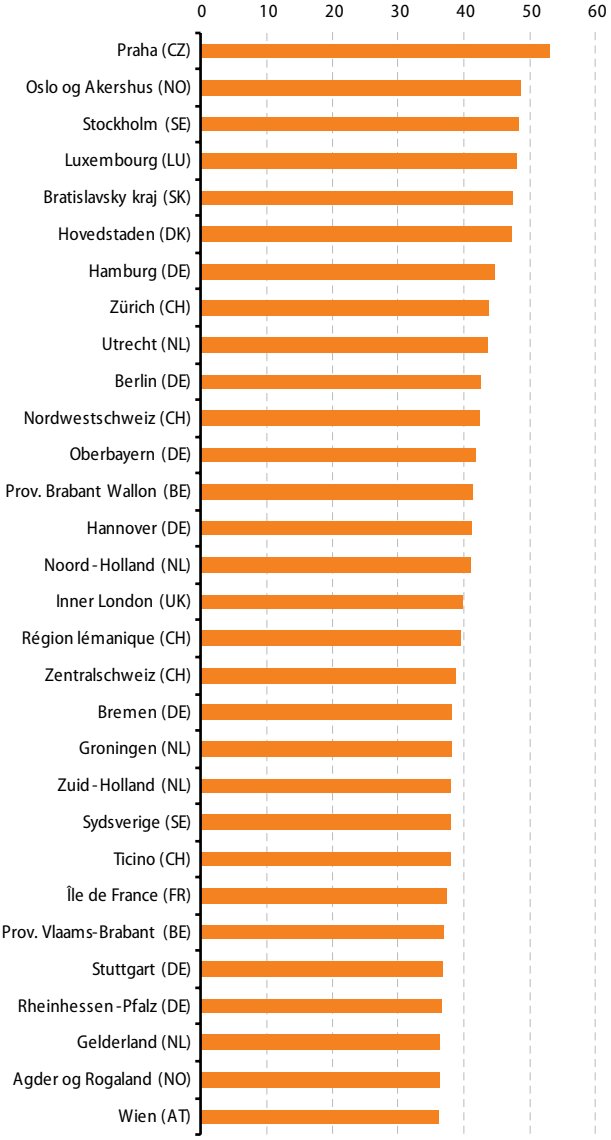
Figure 4.12: Percentage of unemployment among HRST and NON-HRST
(%)

	2000 (1)				2010 (2)			
	HRST		NON-HRST		HRST		NON-HRST	
EU-27	3.2		12.1		3.9		13.1	
BE	2.6		10.0		3.7		12.5	
BG	5.0		20.6		3.3		13.2	
CZ	1.2		12.0		1.3		10.8	
DK	1.7		6.0		3.3		10.6	
DE	2.6		11.3		1.8		11.0	
EE	3.8	bu	18.7	bu	7.6		23.9	
IE	1.4		5.7		6.8		18.8	
EL	6.6		12.7		8.4		14.4	
ES	9.3		15.9		10.4		25.8	
FR	4.0		13.4		4.1		13.1	
IT	2.6		13.8		3.0		11.0	
CY	2.4		6.3		5.0		7.2	
LV	4.7		18.3		7.9		24.8	
LT	8.9		21.7		6.6		25.7	
LU	0.9	u	2.3	u	2.6		6.6	
HU	0.8		8.8		3.3		14.9	
MT	:	u	:	u	:	u	:	u
NL	1.0	b	3.8	b	1.8		6.8	
AT	1.2		6.1		1.2		6.2	
PL	2.9	b	20.4	b	3.8		12.8	
PT	1.7	u	4.3	u	5.2		12.7	
RO	2.0		8.1		3.8		8.3	
SI	1.3	u	9.2	u	2.9		10.0	
SK	2.1		25.0		3.3		19.7	
FI	3.8	b	16.7	b	3.6		12.5	
SE	2.1		7.9		3.1		12.9	
UK	1.9		7.5		3.5		11.0	
IS	:	u	:	u	2.4		11.5	
NO	1.9		4.3		1.3		5.1	
CH	0.7		4.2		1.8		6.5	
HR	6.5		17.9		5.7	u	14.4	u
MK	15.8	b	41.3	b	17.8		36.3	
TR	5.9	b	8.9	b	8.0		11.4	

(1) LU, 2001; HR, 2002; MK and TR, 2006.
(2) CH, 2009.

Source: Eurostat (online data code: hrst_st_nunesex).

Figure 4.13: Top 30 regions ranked according to the proportion of HRSTO in the labour force (NUTS level 2), 2010 (1) (%)



(1) CH, 2009.

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 effects of innovation on the economy (including competitiveness, employment, economic growth, trade patterns, etc.).

A full survey is conducted every four years and a reduced survey every two years after the main one. Six waves of CIS have been launched so far. The latest wave had 2008 as reference year with the observation period 2006 to 2008 and its results are available on Eurostat's reference database (Eurobase).

The 2008 Community Innovation Survey (CIS 2008), in contrast to previous CIS surveys which collected mostly information about product and process innovation, introduced questions about also on organisational and marketing innovation. The CIS 2008 was also the first to use the NACE Rev.2 classification of economic activities.

Some results of CIS 2008

In the EU-27 Member States (excluding Greece), 51.6 % of enterprises from industry and services reported innovation activity between 2006 and 2008. The highest proportions of enterprises with innovation activity were recorded in Germany (79.9 %), Luxembourg (64.7 %), Belgium (58.1 %), Portugal (57.8 %) and Ireland (56.5 %). The lowest rates were observed in Latvia (24.3 %), Poland (27.9 %), Hungary (28.9 %), Lithuania (30.3 %) and Bulgaria (30.8 %).

When questioned about the objectives of innovation, more than half of innovative enterprises in the EU-27 mentioned the improvement of quality of goods and services as the primary driver and an increased range of goods and services as second. Around 39.6 % of them pointed to gaining market shares and entry into new markets. The distribution of responses at country level did not differ from the average picture, with small exceptions. Enterprises in Denmark prioritised an increase in market share and enterprises in France and Slovenia mentioned first the increased range of goods and services.

CIS 2008 makes a distinction between technological (product and process) and non-technological (organisational and marketing) innovation.

In 2008, 39.8 % of enterprises in the EU-27 (excluding Greece

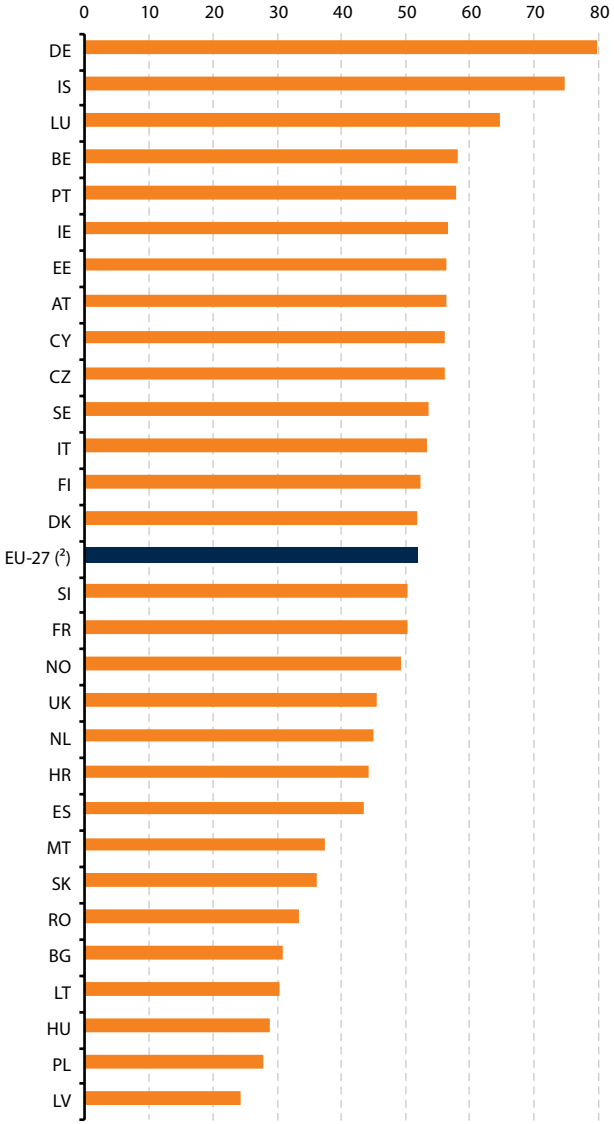
and the United Kingdom) were considered innovative in terms of technological innovation (regardless of organisational and/or marketing innovation). Enterprises reporting marketing or organisational (non-technological) innovation were slightly more numerous and represented at EU-27 level 41.0 % of all enterprises (excluding Greece and the United Kingdom). At country level, in twelve observed countries, enterprises with marketing or organisational innovation outnumbered enterprises with technological innovation.

As for the type of organisational innovation implemented, new methods of organising work responsibilities and decision-making were the leading innovation in twenty countries. In contrast in Belgium, Germany, the Netherlands, Slovakia, Finland and Sweden, the foremost organisational innovation implemented was new business practice. In third place came a new method of organising external relations. For the majority of enterprises introducing organisational innovation, the leading reason was the improvement of quality of goods or services. Eight countries were aiming primarily to reduce the time taken to respond to customer or supplier needs. In Belgium the first objective was to reduce cost per unit output. Improved communication or information sharing and improved ability to develop new products or processes were signalled as secondary objectives.

Enterprises questioned about the types of marketing innovation firstly indicated the new media or techniques for product promotion in seventeen countries. However, priority was given to significant changes to aesthetic design or packaging in Bulgaria, Estonia, Latvia and Norway. Lithuania, Hungary, Poland, Romania and Croatia implemented mostly new methods of pricing goods or services.

The enterprises in all the countries, when asked about the objectives of marketing innovation, wanted first to increase or maintain market share, second to introduce products to new customer groups, and third to introduce products to new geographic markets.

Figure 5.1: Enterprises with innovation activity, 2008 (1)
(%)



(1) Innovative enterprises mean enterprises with innovation activity (product, process, ongoing or abandoned, organisational and marketing innovation).
(2) EU-27 excluding EL.

Source: Eurostat (online data code: inn_cis6_type).

Table 5.2: Highly important innovation objectives during 2006–2008
(% of enterprises with technological innovation)

	Increase range of goods or services	Replace outdated products or processes	Enter new markets	Increase market share	Improve quality of goods or services	Improve flexibility for producing goods or services	Increase capacity for producing goods or services	Improve health and safety	Reduce labour costs per unit output
EU-27 (1)	52.2	34.5	39.6	42.4	56.6	33.9	31.7	24.9	28.1
BE	48.4	32.4	27.1	39.8	48.7	28.1	25.7	16.1	21.1
BG	30.7	24.9	29.7	29.6	35.8	16.7	18.4	23.4	18.2
CZ	46.7	34.9	24.0	32.2	47.0	27.3	24.0	18.5	28.8
DK	25.0	27.7	23.8	33.4	30.3	18.8	18.5	11.1	30.0
DE	54.3	34.6	46.1	42.5	54.7	36.5	28.5	21.0	26.5
EE	36.5	35.8	24.1	32.3	50.8	31.1	33.9	18.7	21.3
IE	46.3	31.8	40.5	48.4	48.8	30.9	28.7	23.7	38.9
EL	:	:	:	:	:	:	:	:	:
ES	33.7	26.3	25.7	28.7	42.3	31.4	35.9	20.4	22.1
FR	56.3	35.1	40.9	47.9	49.7	25.0	25.7	20.8	22.7
IT	43.7	26.9	27.0	28.2	50.0	24.9	27.1	28.0	18.3
CY	63.4	66.4	45.1	62.0	77.3	64.4	61.4	40.5	37.0
LV	12.2	9.3	11.3	8.9	12.6	7.4	10.3	8.0	6.9
LT	30.3	26.4	26.5	32.8	42.8	26.6	27.7	17.6	28.3
LU	68.8	36.9	47.5	59.5	69.5	44.4	34.6	29.5	20.5
HU	62.1	46.5	56.1	61.3	65.7	49.6	37.2	34.8	27.8
MT	41.6	22.3	31.0	34.0	45.7	29.4	27.4	19.3	27.4
NL	32.4	18.6	28.1	34.2	36.3	21.7	17.5	11.3	14.7
AT	55.1	41.4	42.8	49.4	62.5	37.1	28.3	18.0	21.3
PL	50.5	37.8	36.1	42.3	54.3	26.7	36.9	27.8	25.5
PT	42.0	34.5	39.8	44.5	58.3	38.6	39.7	35.2	41.0
RO	50.0	34.4	35.5	34.1	55.5	30.6	32.2	27.5	24.4
SI	79.0	48.8	45.3	61.2	73.6	42.9	41.9	34.3	54.6
SK	45.5	27.8	22.5	34.7	50.1	32.0	26.5	21.9	15.6
FI	41.2	29.3	29.6	37.9	43.0	30.2	23.7	13.1	30.2
SE	43.9	32.0	28.3	45.2	45.2	28.3	25.5	16.1	34.1
UK	:	:	:	:	:	:	:	:	:
IS	:	:	:	:	:	:	:	:	:
NO	49.3	39.1	36.6	60.8	71.6	37.7	34.5	49.2	37.6
HR	47.3	42.2	30.5	31.1	56.8	38.6	32.7	20.2	28.3

(1) EU-27 excluding EL and UK.

Source: Eurostat (online data code: inn_cis6_obj).

Table 5.3: Enterprises by type of innovation activity, 2008
(% of all enterprises)

	Enterprises with innovation activity (product, process, ongoing or abandoned, organisational and marketing innovation)	Enterprises with technological innovation (product, process, ongoing or abandoned), regardless organizational or marketing innovation	Enterprises with non-technological innovation (organisational and/or marketing innovations)	Technological innovation only (product, process, ongoing or abandoned)	Non-technological innovation only (organisational and/or marketing innovation)	Technological and non-technological innovation
EU-27 (1)	51.6	39.8	41.0	11.2	12.5	28.5
BE	58.1	47.9	45.0	13.2	10.2	34.8
BG	30.8	23.9	18.4	12.4	6.8	11.6
CZ	56.0	39.3	47.0	9.0	16.7	30.3
DK	51.9	42.5	41.5	10.4	9.4	32.1
DE	79.9	63.8	69.0	10.9	16.2	52.9
EE	56.4	47.9	35.2	21.2	8.5	26.7
IE	56.5	44.9	42.6	13.9	11.6	31.0
EL	:	:	:	:	:	:
ES	43.5	31.9	30.9	12.6	11.7	19.3
FR	50.2	35.1	39.8	10.4	15.1	24.6
IT	53.2	40.1	41.2	12.1	13.1	28.1
CY	56.1	43.0	48.0	8.1	13.2	34.9
LV	24.3	20.1	14.9	9.4	4.2	10.7
LT	30.3	23.9	22.6	7.7	6.3	16.3
LU	64.7	46.0	54.6	10.1	18.6	36.0
HU	28.9	20.8	21.9	7.1	8.2	13.7
MT	37.4	29.7	26.9	10.6	7.7	19.2
NL	44.9	35.0	29.9	14.9	9.9	20.1
AT	56.2	42.9	44.3	11.9	13.3	31.0
PL	27.9	19.8	20.1	7.9	8.1	11.9
PT	57.8	50.1	44.5	13.3	7.7	36.8
RO	33.3	19.7	26.8	6.5	13.6	13.2
SI	50.3	34.4	41.2	9.1	15.9	25.2
SK	36.1	21.7	29.7	6.4	14.4	15.3
FI	52.2	46.8	33.0	19.2	5.5	27.5
SE	53.7	44.7	38.0	15.7	9.0	29.0
UK	45.6	:	31.5	:	:	:
IS	74.8	:	54.6	20.2	3.7	50.9
NO	49.2	39.6	31.4	17.8	9.6	21.9
HR	44.2	34.5	33.9	10.3	9.7	24.2

(1) EU-27 excluding EL for enterpises with innovation activity; for all the remaining indicators, EU-27 excluding EL and UK.

Source: Eurostat (online data code: inn_cis6_type and inn_cis6_mo).

Table 5.4: Implementation type of a new organisational method, 2008
(% of all enterprises who introduced organisational innovation)

	New business practices	New methods of organising work responsibilities and decision making	New methods of organising external relations
EU-27	:	:	:
BE	79.1	61.5	28.5
BG	63.7	71.0	41.0
CZ	72.1	79.7	31.4
DK	:	:	:
DE	71.6	64.0	35.8
EE	52.1	73.2	47.0
IE	80.3	82.2	43.1
EL	:	:	:
ES	76.7	80.4	28.2
FR	69.8	80.4	36.6
IT	56.0	76.1	38.9
CY	77.9	86.8	54.8
LV	72.1	76.2	35.5
LT	62.9	65.4	44.5
LU	69.3	83.9	48.4
HU	65.5	66.7	48.1
MT	68.8	82.4	46.4
NL	76.7	63.6	38.3
AT	72.0	73.9	38.5
PL	55.9	72.5	39.1
PT	74.1	80.9	43.7
RO	49.8	86.8	43.4
SI	63.0	78.9	52.5
SK	73.5	69.4	38.1
FI	74.4	73.0	38.7
SE	74.1	68.9	41.9
UK	:	:	:
NO	61.6	81.4	42.1
HR	66.0	77.9	27.7

Source: Eurostat (online data code: inn_cis6_ortype).

Table 5.5: Highly important objectives of organisational innovation, 2008
(% of all enterprises who introduced organisational innovation)

	Improved quality of goods or services	Reduced time to respond to customer or supplier needs	Improved communication or information sharing	Reduced costs per unit output	Improved ability to develop new products or processes
EU-27	:	:	:	:	:
BE	7.7	9.2	16.2	22.7	18.4
BG	54.4	34.3	27.0	29.8	17.3
CZ	53.2	39.2	32.1	36.3	37.3
DK	:	:	:	:	:
DE	35.6	30.4	27.7	14.6	14.0
EE	57.2	60.7	42.2	43.0	36.7
IE	47.3	46.3	32.4	38.5	31.2
EL	:	:	:	:	:
ES	53.4	55.1	39.2	31.1	29.8
FR	59.0	48.1	33.1	36.8	31.0
IT	52.3	48.0	32.3	25.9	41.5
CY	72.6	70.6	59.0	39.8	55.2
LV	38.1	37.6	25.9	24.5	34.4
LT	46.1	27.9	17.1	23.2	21.8
LU	67.1	55.2	40.0	27.8	38.0
HU	78.0	84.7	65.8	65.8	49.0
MT	55.2	67.2	42.4	34.4	32.0
NL	42.5	46.4	32.4	28.4	18.1
AT	64.3	61.1	53.1	38.7	34.7
PL	51.6	48.0	38.8	29.7	28.4
PT	66.0	66.0	45.4	49.5	45.0
RO	58.7	51.7	37.9	32.8	28.9
SI	75.8	76.7	56.5	63.8	46.4
SK	56.9	60.1	37.6	43.8	22.3
FI	44.7	58.8	31.4	37.1	40.1
SE	51.7	32.1	39.3	42.5	34.1
UK	:	:	:	:	:
HR	58.2	48.5	46.7	35.0	35.0

Source: Eurostat (online data code: inn_cis6_orobj).

Table 5.6: Implementation type of a new marketing method, 2008
(% of all enterprises who introduced marketing innovation)

	New media or techniques for product promotion	Significant changes to the aesthetic design or packaging	New methods of pricing goods or services	New methods for product placement
EU-27	:	:	:	:
BE	60.4	50.4	33.2	35.9
BG	40.1	57.7	38.8	48.9
CZ	72.4	37.3	41.8	28.5
DK	:	:	:	:
DE	49.8	48.2	41.7	47.5
EE	45.8	52.5	40.2	48.9
IE	59.2	51.8	41.8	38.3
EL	:	:	:	:
ES	54.9	48.0	44.6	40.0
FR	58.9	50.9	45.5	23.2
IT	58.4	51.3	42.8	29.0
CY	73.5	50.3	37.0	59.7
LV	49.7	57.8	57.3	44.3
LT	37.8	50.6	62.9	41.0
LU	63.7	44.5	49.0	34.0
HU	49.8	37.9	56.9	34.8
MT	64.2	55.8	35.0	41.7
NL	61.0	40.6	35.1	43.3
AT	61.5	52.8	28.7	42.4
PL	53.9	36.4	58.2	35.3
PT	62.8	59.7	43.6	35.4
RO	56.1	51.8	57.9	45.1
SI	60.3	45.4	53.9	48.1
SK	62.0	38.6	50.4	32.0
FI	62.7	39.5	49.6	28.6
SE	62.0	48.7	41.2	35.8
UK	:	:	:	:
NO	53.7	64.7	27.9	37.3
HR	51.1	51.8	55.8	39.1

Source: Eurostat (online data code: inn_cis6_mktype).

Table 5.7: Highly important objectives of marketing innovation, 2008
(% of all enterprises who introduced marketing innovation)

	Increased or maintained market share	Introduce products to new customer groups	Introduce products to new geographic markets
EU-27	:	:	:
BE	56.7	40.6	23.9
BG	38.9	24.3	19.4
CZ	53.1	31.5	14.5
DK	:	:	:
DE	24.2	21.1	10.1
EE	66.4	28.4	32.4
IE	74.2	60.5	35.1
EL	:	:	:
ES	44.5	38.4	29.1
FR	62.6	31.5	29.8
IT	50.6	24.2	18.1
CY	74.3	59.7	27.7
LV	55.9	40.1	25.5
LT	38.0	28.0	15.1
LU	74.0	45.0	35.5
HU	92.7	78.0	33.2
MT	59.2	41.7	20.0
NL	59.7	38.0	17.8
AT	69.5	61.1	32.3
PL	50.5	34.0	20.5
PT	61.8	51.4	35.9
RO	54.1	33.3	18.7
SI	86.0	74.2	41.0
SK	61.7	35.1	16.7
FI	66.3	52.7	23.4
SE	69.8	43.2	28.9
UK	:	:	:
HR	50.2	36.5	20.4

Source: Eurostat (online data code: inn_cis6_mkobj).

6

Patents

In 2009, Germany submitted the largest number of patent applications to the EPO among EU-27 countries (24 152), followed by France (8 645), the United Kingdom (5 138) and Italy (4 921). In terms of patent applications per million inhabitants, Sweden was in the lead (332), closely followed by Germany (295) and Denmark (243).

At world level, the highest numbers of patent applications were recorded in the US (26 158), in Japan (19 291) and in Korea (4 272).

At EU level, the number of patent applications to the EPO increased by an average of 1 % a year between 2004 and 2009. Over the same period, patenting activity rose in every EU Member State except Bulgaria, Luxembourg, Malta, the Netherlands, Finland and the United Kingdom.

In 2007, the majority 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, Greece, Spain, Latvia, Hungary, Poland, Slovenia and the United Kingdom specialised in patenting linked to 'Human necessities' (IPC section A). 'Performing operations; transporting' (section B) was the most prominent section for patenting in Germany, France, Italy, Malta and Austria, whereas 20 % or more of patent applications from Belgium, the Czech Republic, Cyprus and Portugal were on 'Chemistry; metallurgy' (section C). By contrast, patenting was generally less frequent for 'Textiles; paper' (section D), 'Fixed constructions' (section E) and 'Mechanical engineering (section F). The biggest share of patent applications to the EPO concerned 'Physics' (section G) in Bulgaria, Lithuania and the Netherlands. EPO applications related to 'Electricity' (section H) were highly predominant in Estonia, Romania, Slovakia, 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 the countries except Croatia.

High-tech patent applications to the EPO as a percentage of the total varied significantly. Shares of over 50 % were noted for Romania (69.9 %), South Korea (57.1 %), Estonia (55.8 %), China (55.2 %) and Canada (51.2 %).

Biotechnology is another fertile field in terms of patent applications. Overall, however, it is one of the smaller fields. Iceland was in the lead on biotechnology patenting, as 40.8 % of

all patent applications from that country were registered in this field. At EU level, only 4.7 % of all patent applications related to biotechnology inventions.

In 2009, Eurostat published for the first time new indicators on nanotechnology patent applications and on energy technologies patent applications. Nanotechnology is a field of research that is still in its infancy and is small in terms of patenting. Nevertheless, in 2007, the EU-27 accounted for 38 % of all nanotechnology patent applications to the EPO, followed by the United States (29 %), and Japan (19 %).

In 2007, at EU-27 level, 4 391 patent applications on energy technologies were designated to the EPO. Traditional engines represented more than a half of those patents, lighting accounted for 9 %, heat exchange accounted for 8 % and solar energy patents represented 7 % of the total. The shares of patents on geothermal, stirling engines, biofuels, and waste heat recovery of biomass did not exceed 1 %. At country level, most of the patent applications on energy technologies were submitted by Germany (47 %), France (16 %), the United Kingdom and Italy (8 %), and the Netherlands (4 %).

In terms of foreign ownership of domestic inventions in patent applications to the EPO, the EU-27 considered as an entity ranked fifth with 13 % of foreign ownerships behind Japan and South Korea (4 % 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 Estonia, Malta, Hungary, Cyprus, Bulgaria, Slovakia and Romania, and below 20 % in Germany and Finland.

Eurostat also added new datasets on international and European co-patenting and on patent citations. The vast majority of all EU patent applications to the EPO were co-patents involving several applicants from the same country (55.1 % in 2007).

Citations in EU patents refer to EU patent publications more often than to non-EU patent publications.

Analysing patenting behaviour at regional level, it appeared in 2007 that the top thirty NUTS 3 regions in terms of patent applications per million inhabitants consisted of 29 regions in Germany and one region in the Netherlands.

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

	Total		Per million inhabitants		AAGR 2004–2009
	2004	2009 (1)	2004	2009 (1)(2)	
EU-27	54 973	57 864	112	116	1.0
BE	1 511	1 544	145	144	0.4
BG	18	9	2	1	– 12.2
CZ	112	236	11	23	16.1
DK	1 092	1 337	202	243	4.1
DE	22 997	24 152	279	295	1.0
EE	9	44	7	33	37.9
IE	267	345	66	77	5.2
EL	66	119	6	11	12.6
ES	1 209	1 446	29	32	3.7
FR	8 299	8 645	133	134	0.8
IT	4 575	4 921	79	82	1.5
CY	6	8	8	10	6.8
LV	10	20	4	9	15.8
LT	11	14	3	4	4.7
LU	115	76	252	155	– 7.8
HU	153	215	15	21	7.1
MT	6	6	15	14	– 0.9
NL	3 639	2 959	224	180	– 4.0
AT	1 440	1 825	177	218	4.8
PL	124	260	3	7	15.9
PT	58	152	6	14	21.1
RO	23	38	1	2	10.6
SI	113	126	57	62	2.2
SK	21	48	4	9	18.3
FI	1 369	1 149	262	216	– 3.5
SE	2 195	3 073	245	332	7.0
UK	5 535	5 138	93	83	– 1.5
IS	30	14	104	42	– 14.8
LI	25	39	723	1 085	9.2
NO	396	484	87	101	4.1
CH	3 055	3 234	415	420	1.1
HR	32	24	7	5	– 5.7
TR	119	308	2	4	20.9
AU	1 099	737	54	38	– 7.7
CA	2 226	2 120	70	65	– 1.0
CN	980	3 071	:	:	25.7
IL	1 193	1 107	181	167	– 1.5
IN	525	644	0	:	4.2
JP	22 795	19 291	178	155	– 3.3
KR	4 439	4 272	92	92	– 0.8
RU	235	245	2	2	0.9
TW	604	1 384	27	53	18.1
US	34 645	26 158	118	94	– 5.5

(1) 2008 and 2009 estimated.
(2) AU, CA, IL, JP, KR, RU, TW and US, 2008.

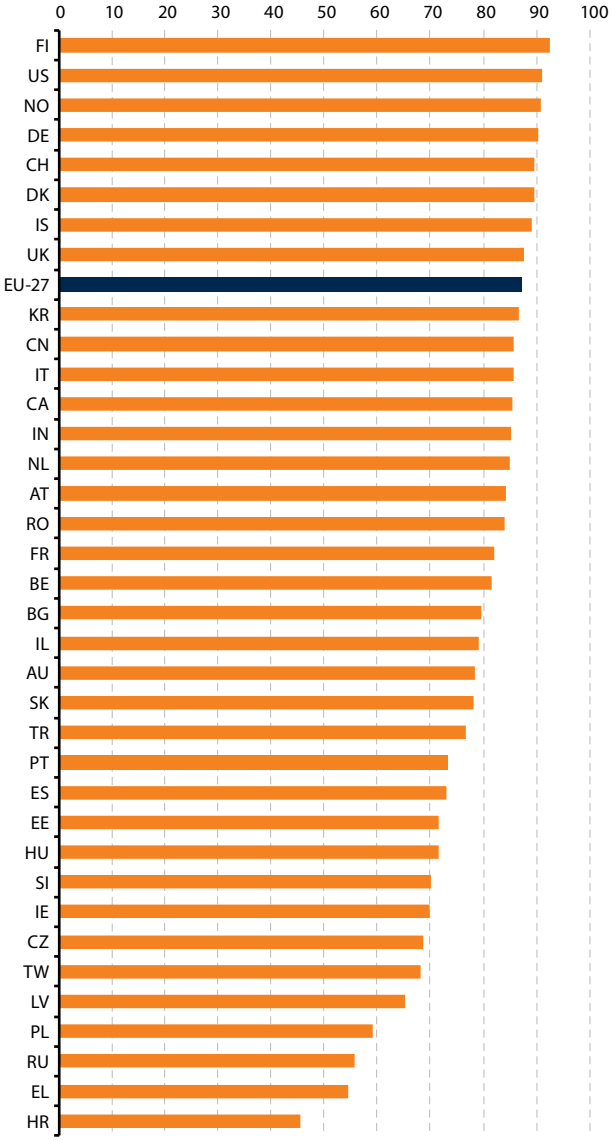
Source: Eurostat (online data code: pat_ep_ntot).

Table 6.2: Breakdown of patent applications to the EPO by IPC section as a percentage of total, 2007
(%)

	IPC section							
	Human necessities	Performing operations; transporting	Chemistry; metallurgy	Textiles; paper	Fixed constructions	Mechanical engineering; lighting;heating; weapons; blasting	Physics	Electricity
EU-27	16.9	20.6	12.0	1.9	4.9	12.4	14.4	16.8
BE	15.2	17.1	24.9	3.1	6.0	7.0	12.3	14.4
BG	10.4	9.7	2.2	0.0	16.6	8.3	31.4	21.5
CZ	16.0	16.7	19.3	6.2	4.3	13.0	10.0	14.6
DK	25.4	12.3	15.0	0.4	7.4	15.4	9.6	14.5
DE	14.5	23.7	11.6	2.1	4.3	14.9	13.6	15.2
EE	13.6	3.5	20.8	0.0	0.0	7.1	27.4	27.6
IE	31.9	8.7	10.8	0.8	5.7	6.5	18.3	17.4
EL	33.5	13.1	15.4	0.0	5.0	12.9	11.7	8.4
ES	23.7	21.9	14.8	2.6	6.9	9.1	9.5	11.5
FR	16.2	20.9	11.8	0.9	4.5	12.1	15.9	17.7
IT	20.3	25.9	8.5	4.0	7.5	13.6	10.0	10.3
CY	15.6	0.0	30.8	0.0	5.4	16.1	17.9	14.3
LV	34.7	0.0	19.4	0.0	0.0	12.2	27.6	6.1
LT	22.4	10.2	20.4	0.0	0.0	0.0	35.0	11.9
LU	6.9	25.7	19.7	0.5	2.3	25.9	10.4	8.6
HU	26.7	12.1	14.3	1.1	3.3	3.9	12.2	26.4
MT	31.8	33.8	9.8	0.0	0.0	0.0	0.0	24.7
NL	19.0	14.5	14.3	1.3	3.8	6.7	21.0	19.3
AT	15.3	21.1	12.5	1.8	6.7	13.0	12.3	17.3
PL	19.5	12.2	12.3	2.5	9.6	11.1	14.7	18.2
PT	19.1	14.8	25.4	1.0	4.7	8.3	8.8	18.1
RO	4.4	8.1	5.3	0.9	0.0	9.8	34.0	37.7
SI	43.7	3.9	15.3	1.4	3.5	9.8	14.5	7.8
SK	8.7	15.9	16.8	0.2	4.3	19.8	3.9	30.3
FI	9.3	12.8	10.1	4.2	4.3	4.4	17.1	37.7
SE	17.1	16.5	7.3	1.3	3.0	9.3	14.8	30.7
UK	21.0	14.2	12.3	0.8	5.3	10.0	18.9	17.5
IS	17.8	6.0	8.5	0.0	11.2	22.8	19.8	13.8
LI	18.8	7.1	3.4	12.0	7.4	24.3	10.2	16.8
NO	25.0	6.4	48.2	0.0	0.0	1.3	10.2	8.9
CH	20.8	29.6	9.7	0.1	2.2	25.4	4.2	8.0
HR	16.0	15.1	13.5	0.4	14.5	10.1	20.3	10.0
TR	25.3	20.8	14.1	1.8	3.2	7.5	15.4	11.7
AU	29.3	16.4	14.0	0.6	5.7	6.7	17.9	9.4
CA	15.2	10.0	11.5	0.8	2.3	4.6	24.6	31.1
CN	10.4	6.8	8.2	1.4	1.2	4.1	12.1	55.9
IL	36.4	9.2	12.0	0.2	1.3	4.5	22.0	14.3
IN	26.7	5.6	33.9	1.0	0.8	2.8	13.8	15.4
JP	9.8	17.7	12.7	1.0	0.6	10.4	21.9	25.9
KR	8.6	6.0	8.4	3.0	1.0	6.8	22.6	43.5
RU	24.3	13.4	17.4	1.6	1.4	13.1	15.6	13.2
TW	14.9	14.3	5.2	1.0	2.2	6.8	22.2	33.3
US	24.3	11.4	15.1	0.9	1.8	6.1	20.4	19.9

Source: Eurostat (online data code: pat_ep_nipc).

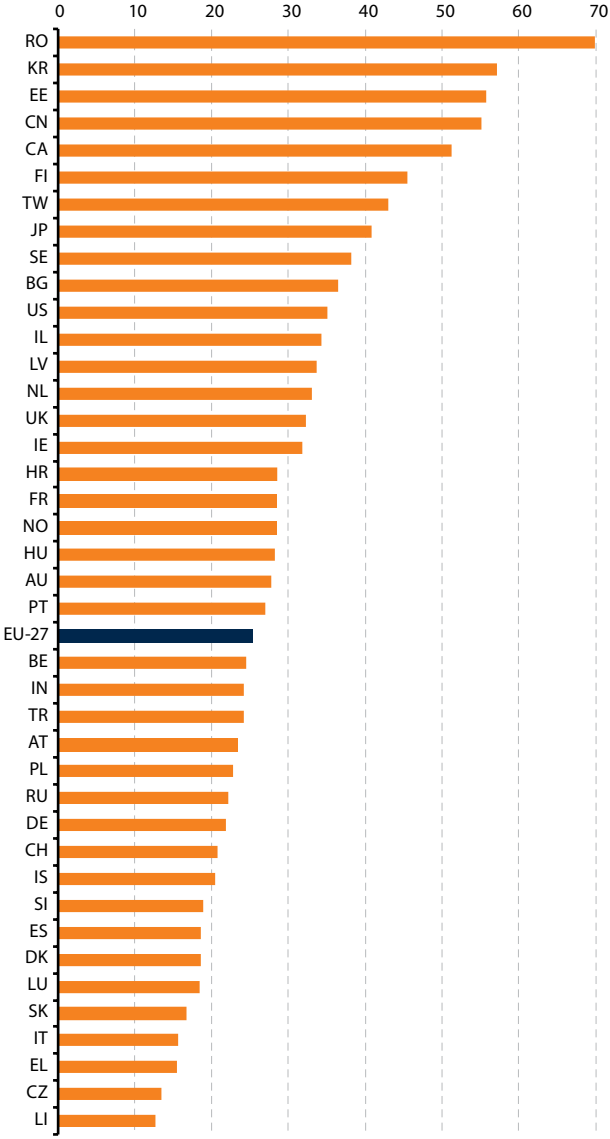
Figure 6.3: Patent applications submitted by business enterprise sector (BE) as a percentage of total, 2007 (1) (%)



(1) Cut-off: at least 10 patent applications.

Source: Eurostat (online data code: pat_ep_nic).

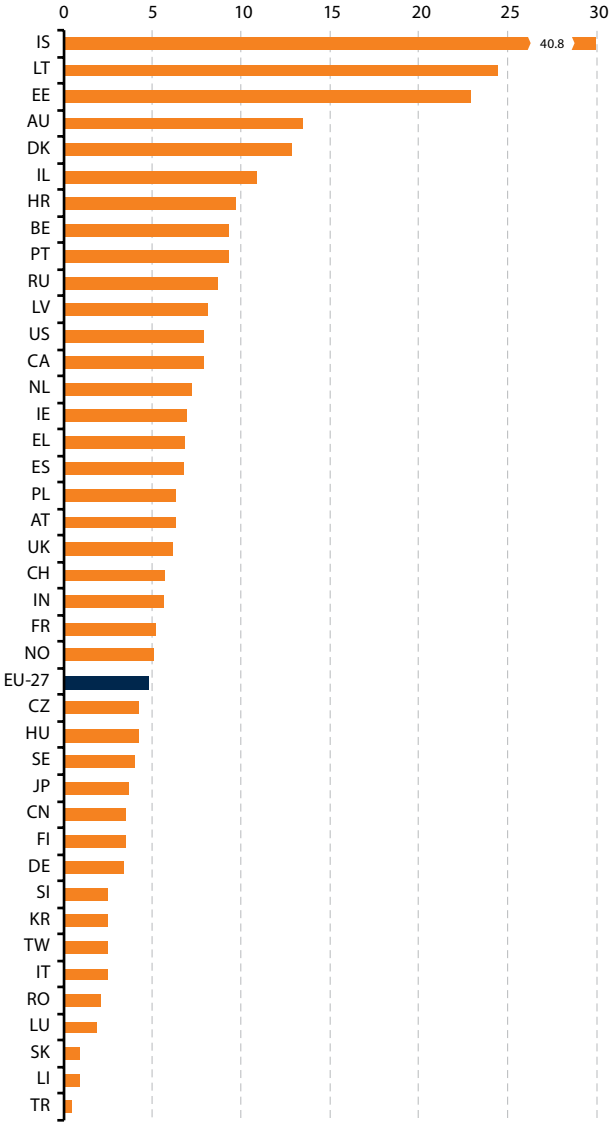
Figure 6.4: ICT patent applications to the EPO as a percentage of total, 2007 (1)
(%)



(1) Cut-off: at least 10 patent applications.

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

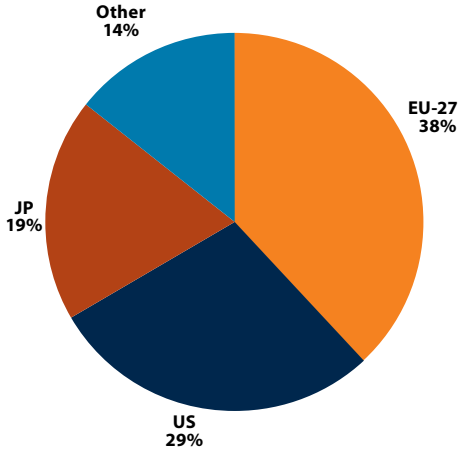
Figure 6.5: Biotechnology patent applications to the EPO as a percentage of total, 2007 (1) (2)
(%)



(1) BG and MT, not available.
(2) Cut-off: at least 10 patent applications.

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

Figure 6.6: Distribution of nanotechnology patent application to the EPO, EU-27, Japan and United States, 2007 (%)



Source: Eurostat (online data code: pat_ep_nnano).

Table 6.7 (Part I): Patent applications to the EPO on energy technologies, 2007
(Number of patents)

	Energy technologies	Traditional engines	Lighting	Heat exchange	Wind	Fuel cells	Solar	Carbon Capture and Storage	Hydrogen	Storage and transport
EU-27	4 391	2 528	413	341	308	226	184	90	86	77
BE	77	46	6	8	5	1	1	3	1	2
BG	:	:	:	:	:	:	:	:	:	:
CZ	12	3	2	0	:	:	:	1	:	:
DK	183	40	8	7	97	23	2	7	:	1
DE	2 044	1 265	162	149	108	118	100	41	34	32
EE	3	:	:	1	:	1	:	:	:	:
IE	13	1	3	:	:	:	:	:	:	:
EL	10	4	:	:	2	:	:	:	2	:
ES	76	14	5	5	33	3	8	0	2	:
FR	722	499	44	51	10	31	17	13	20	25
IT	345	185	52	41	8	16	15	1	5	2
CY	:	:	:	:	:	:	:	:	:	:
LV	2	1	1	:	:	:	:	:	:	1
LT	:	:	:	:	:	:	:	:	:	:
LU	11	9	:	1	1	:	1	:	:	:
HU	4	1	:	2	1	:	:	:	:	:
MT	:	:	:	:	:	:	:	:	:	:
NL	186	32	69	16	14	6	21	13	10	4
AT	128	61	29	13	2	2	6	2	1	4
PL	14	4	1	7	:	:	:	:	:	2
PT	4	3	:	1	:	:	:	:	:	:
RO	2	2	:	:	0	:	:	:	:	:
SI	5	:	2	1	:	0	:	:	:	:
SK	3	3	:	:	:	:	:	:	:	:
FI	31	14	1	3	2	1	1	:	2	1
SE	160	109	8	15	8	6	4	2	1	2
UK	355	232	20	20	17	17	10	7	8	2
IS	0	0	:	:	:	:	:	:	:	:
LI	2	1	1	:	:	:	1	:	:	:
NO	41	7	1	2	8	1	:	7	1	6
CH	170	104	13	12	8	7	7	6	6	3
HR	6	6	:	:	:	:	:	:	:	:
TR	10	6	:	2	:	1	:	:	:	1
AU	46	15	3	:	2	5	3	8	4	1
CA	113	50	12	3	6	15	7	5	4	2
CN	82	18	30	5	4	3	12	1	2	2
IL	24	11	3	2	1	:	3	:	1	1
IN	13	6	0	:	1	1	0	0	:	1
JP	2 013	1 274	163	71	27	284	159	22	45	9
KR	200	53	24	11	:	49	44	1	13	8
RU	24	15	:	1	6	:	1	:	1	1
TW	70	11	30	2	5	9	9	:	1	:
US	1 491	800	145	66	42	105	133	59	45	38

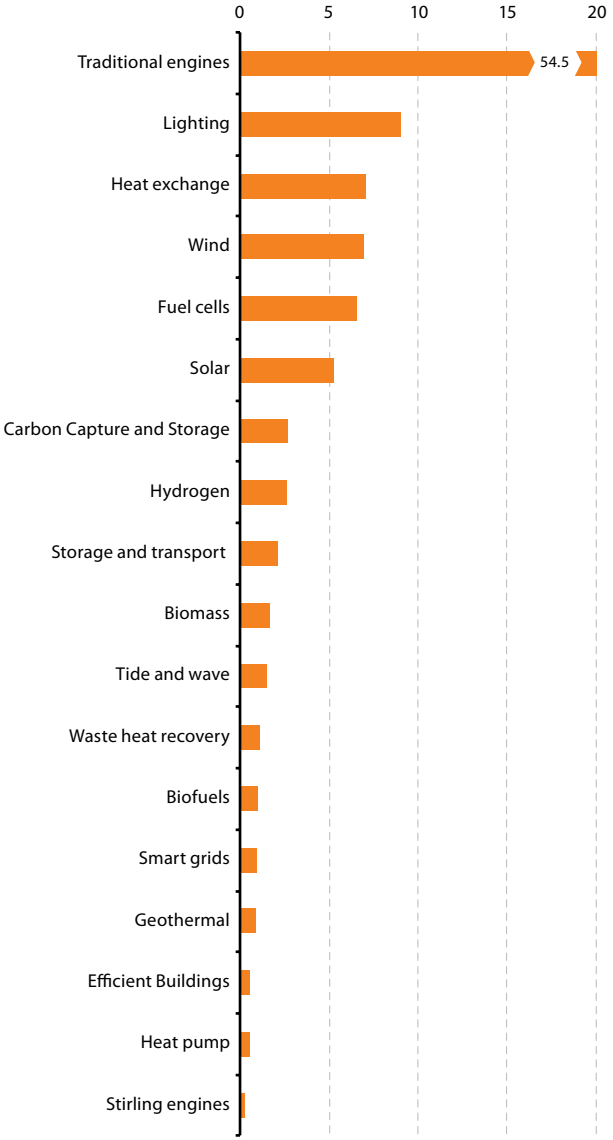
Source: Eurostat (online data code: pat_ep_nrg).

Table 6.7 (Part II): Patent applications to the EPO on energy technologies, 2007
(Number of patents)

	Biomass	Smart grids	Tide and wave	Efficient Buildings	Waste heat recovery	Geothermal	Biofuels	Heat pump	Stirling engines
EU-27	59	49	48	46	42	34	27	23	9
BE	1	1	1	1	:	:	0	:	:
BG	:	:	:	:	:	:	:	:	:
CZ	2	2	:	:	1	1	1	1	:
DK	:	:	2	:	1	:	3	:	:
DE	17	21	10	13	24	16	4	11	1
EE	:	:	1	:	:	1	:	:	:
IE	1	1	7	1	:	:	:	:	:
EL	2	:	:	:	:	:	1	:	:
ES	1	3	3	1	:	1	1	1	:
FR	4	2	5	18	3	2	6	2	5
IT	1	6	2	9	8	2	:	:	1
CY	:	:	:	:	:	:	:	:	:
LV	:	:	:	:	:	:	:	:	:
LT	:	:	:	:	:	:	:	:	:
LU	:	:	:	:	:	:	:	:	:
HU	:	:	:	:	:	:	:	:	:
MT	:	:	:	:	:	:	:	:	:
NL	7	1	2	1	:	2	2	1	:
AT	4	4	3	:	1	6	1	2	:
PL	:	:	:	:	:	:	:	:	:
PT	1	:	:	:	0	:	:	:	:
RO	:	:	:	:	:	:	:	:	:
SI	1	1	:	:	:	:	:	:	:
SK	:	:	:	:	:	:	:	:	:
FI	5	:	1	1	1	:	4	1	:
SE	:	1	2	:	1	2	1	1	1
UK	11	6	10	1	2	1	3	3	1
IS	:	:	:	:	:	:	:	:	:
LI	0	:	:	:	:	:	:	:	:
NO	2	:	6	1	:	0	1	0	:
CH	1	2	:	2	5	2	3	:	:
HR	:	:	:	:	:	:	:	:	:
TR	:	:	:	:	:	:	:	:	:
AU	:	2	5	2	1	:	:	:	:
CA	2	3	1	3	:	:	6	:	:
CN	3	3	1	:	:	1	:	:	:
IL	:	1	:	:	:	:	1	:	:
IN	:	2	:	:	:	:	1	:	:
JP	3	15	2	4	14	:	:	5	:
KR	:	1	:	:	2	:	1	2	:
RU	:	:	:	:	:	:	:	:	:
TW	:	1	1	:	:	1	:	:	:
US	18	40	5	11	11	1	14	5	8

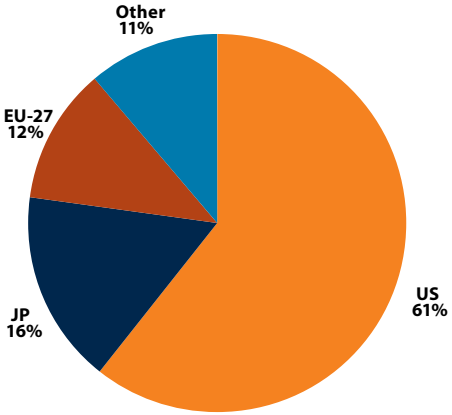
Source: Eurostat (online data code: pat_ep_nrg).

Figure 6.8: Distribution of energy technologies PCT applications designated to the EPO at EU-27 level, 2007
(%)



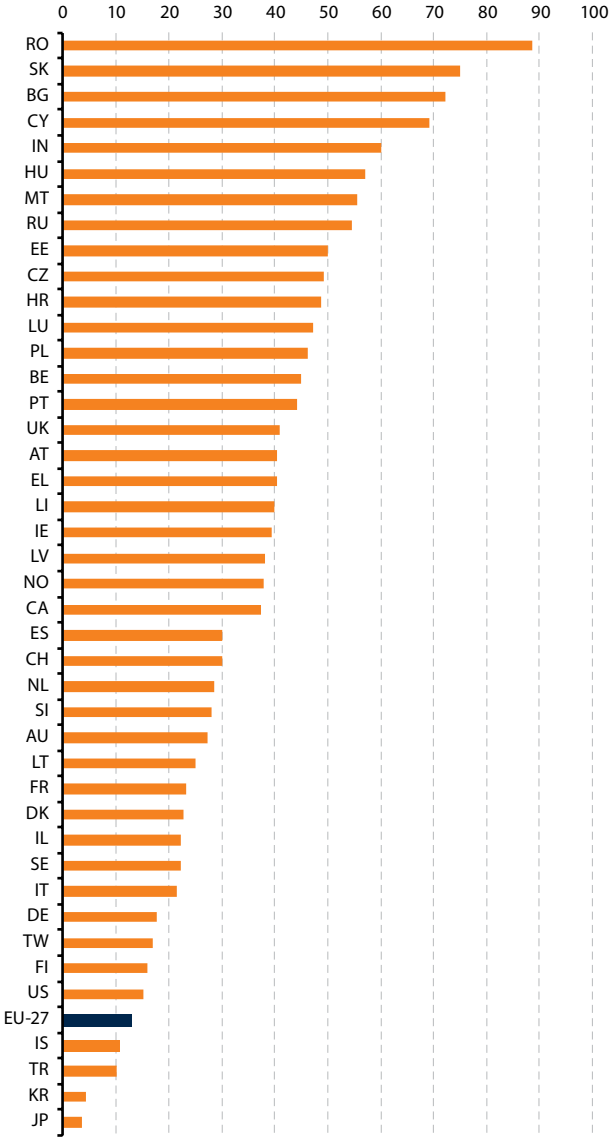
Source: Eurostat (online data code: pat_ep_nrgpct).

Figure 6.9: Distribution of patent applications to the EPO on radio navigation by satellite, EU-27, Japan and United States, 2007
(%)



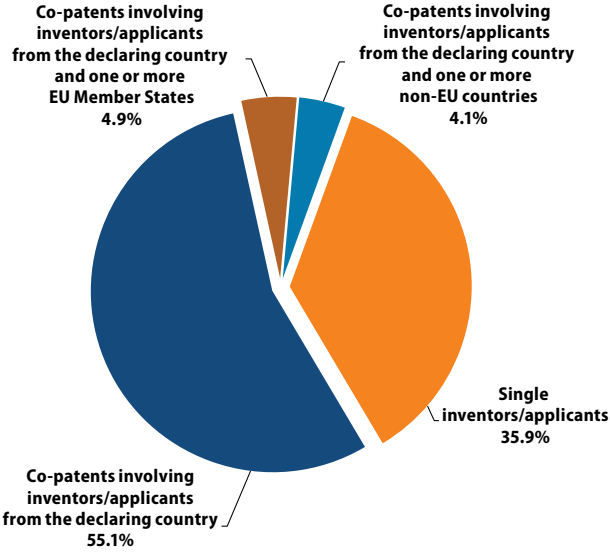
Source: Eurostat (online data code: pat_ep_nrns).

Figure 6.10: Foreign ownership of domestic inventions in patent applications to the EPO as a percentage of total, 2007 (%)



Source: Eurostat (online data code: pat_ep_nfgn).

Figure 6.11: Breakdown of EU co-patenting at the EPO according to inventors' country of residence, 2007
(%)



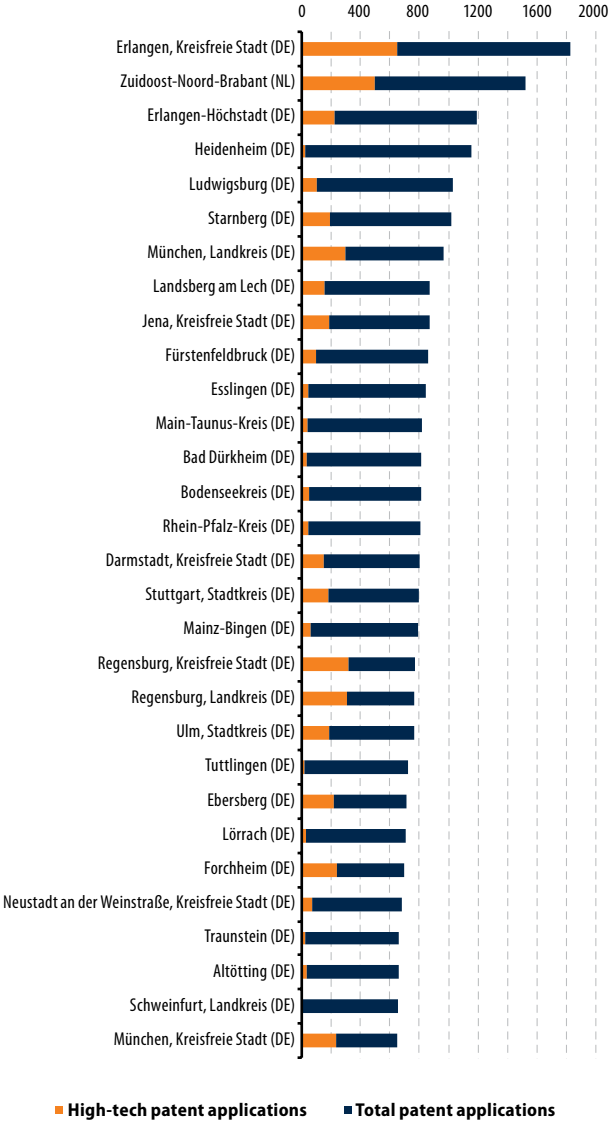
Source: Eurostat (online data code: pat_ep_cpi).

Table 6.12: EU patent citations referring to non-EU and EU patent publications (EPO) according to applicants' country of residence, 1991–2007
(Number of citations)

	Number of EU patent citations referring to non-EU patent publications		Number of EU patent citations referring to EU patent publications	
1991	5 720		7 647	
1992	5 145		6 722	
1993	4 615		6 380	
1994	4 497		5 948	
1995	4 303		5 618	
1996	4 552		5 889	
1997	4 356		5 992	
1998	4 255		5 890	
1999	4 244		5 809	
2000	3 711		5 082	
2001	3 015		4 696	
2002	2 403		3 995	
2003	2 097		3 570	
2004	1 495		3 003	
2005	898		2 160	
2006	323	p	1 199	p
2007	52	p	192	p

Source: Eurostat (online data code: pat_ep_cta).

Figure 6.13: Top 30 regions at NUTS 3 level in terms of total patent applications to the EPO and share of high-tech patent applications, 2007
(Per million inhabitants)



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

7

High technology

In 2008, the European Union had almost 50 000 enterprises in high-tech manufacturing and 756 000 in knowledge-intensive services. High-tech manufacturers were most numerous in Germany, the United Kingdom, Italy and France, together accounting for around 55 % of the high-tech sector in the EU.

In terms of turnover in high-tech manufacturing, the turnover generated by German enterprises represented almost one fourth of the EU total and rounded to EUR 128 billion, way ahead of France (EUR 76 billion) and Italy (EUR 50 billion). The value added was distributed in a similar way with the highest contribution, that of Germany, close to EUR 41 billion, followed by the United Kingdom (EUR 21 billion) and France (EUR 20 billion).

The United Kingdom was the leading EU Member State in the high-tech KIS sector with 144 006 enterprises, and also ranked first in terms of turnover, production value, value added and gross investment in tangible goods in the high-tech KIS sector.

Within the EU-27, Germany was the leading exporter of high-tech products in 2009, followed by France, the Netherlands, the United Kingdom and Belgium. For the aforementioned countries excepting the United Kingdom a positive trade balance was noted as well.

In 2009, China led the world market in terms of value of high-tech exports (EUR 251 billion), followed by the EU-27 (EUR 185 billion). The EU-27 and China were also in the lead in terms of high-tech imports, with respectively EUR 208 billion and EUR 205 billion. The United States ranked third in both exports and imports when taking into account its estimated value for 2009.

At EU level, the high-tech trade balance was negative in 2009, with imports approximately EUR 22.7 billion higher than exports. Among eighteen of the EU's main economic partners observed, however, nine countries registered a positive trade balance with the greatest export/import ratio recorded in Other Asian countries (193 %), South Korea (180 %) and Israel (178 %). In terms of the share of high-tech exports in total exports in 2009, the EU average stood at 16.9 % but wide disparities were observed across countries, ranging from more than 40 % in Malta and Luxembourg to less than 5 % in Spain, Bulgaria and Portugal. At the same time, in 2009 the majority of observed countries with small exceptions recorded an increase of high-tech exports compared to 2007.

In a majority of EU Member States, the share of intra-EU exports of high-tech products was higher than the share of extra-EU exports. Nevertheless, Malta, Sweden, the United Kingdom and Italy exported more to countries outside the EU.

When considering exports by group of products at global level, the 'Electronics — Telecommunication' group came first, followed by the 'Computer — Office Machines', 'Scientific instruments', 'Pharmacy', 'Aerospace' and 'Other' groups. At country level, significant variations could be observed in terms of the share of each group of products but still 'Electronics — Telecommunication' maintained the foremost position.

In 2010, around 75 million people were employed in Knowledge Intensive Activities (KIA) in the EU-27, which represented 35.3 % of the total employment. Luxembourg, Iceland, Sweden, Ireland, the United Kingdom and Belgium ranked first with over 40 % of employment in KIA sectors. On the other side of the scale, Romania and Turkey did not reach 20 %.

In terms of growth of employment in KIA sectors, Luxembourg, Turkey and Switzerland experienced an increase of more than 5 % yearly between 2008 and 2010. The biggest falls of more than 3 % in absolute values yearly were noted in Iceland, Bulgaria and Latvia.

In the EU-27, women accounted for 56 % of KIA sectors compared to only 46 % in total employment. In KIA sectors, women outnumbered men in all the observed countries excepting Greece, Switzerland, Malta, Luxembourg and Turkey. By contrast in total employment, gender parity was achieved only in Balkan countries.

Employment in high-tech sectors at regional level in 2010 varied significantly from one country to another and big discrepancies could be observed between highest and lowest shares. Capital regions and the surrounding areas were often ranked the highest, like Berkshire, Buckinghamshire and Oxfordshire (UK) in the close proximity of London with 9.7 %, Hovedstaden (DK) with 9.5 %, Province Brabant Wallon (BE) with 8.9 %, Stockholm (SE) with 8.7 % and Praha (CZ) with 8.0 %. By contrast, the lowest shares of less than 1 % were registered in Samsun (TR), region Nord-Est (RO), Dytiki Ellada (EL) and Región de Murcia (ES).

Table 7.1: Economic statistics on high-technology manufacturing sector, 2008

	Number of enterprises		Turnover (EUR million)		Production value (EUR million)		Value added (EUR million)		Gross investment in tangible goods (EUR million)	
EU-27	49 621	s	545 722	s	484 389	s	159 674	s	16 238	s
BE	:	c	:	c	:	c	:	c	:	c
BG	448	c	:	c	:	c	:	c	:	c
CZ	3 737	p	12 511	p	12 223	p	1 437	p	535	p
DK	641		9 934		10 289		4 354		390	
DE	7 790		128 409		113 566		40 599		4 987	
EE	126		468		441		113		12	
IE	186		49 472		46 911		14 079		957	
EL	:		:		:		:		:	
ES	3 219		24 202		21 235		6 683		992	
FR	4 538		76 202		61 281		20 344			
IT	7 379		50 120		49 101		14 029		1 715	
CY	14		188		187		56		10	
LV	110		225		229		112		25	
LT	162		305		273		85		23	
LU	11		:	c	:	c	:	c	:	c
HU	2 684		19 961		18 417		2 717		526	
MT	:		:		:		:		:	
NL	1 348		:	c	:	c	:	c	:	c
AT	672		8 477		7 570		3 052		450	
PL	2 382		11 527		10 613		2 889		494	
PT	546		:	c	:	c	:	c	:	c
RO	1 309		2 343		2 058		618		270	
SI	326		2 077		1 955		890		206	
SK	268		6 297		6 029		648		280	
FI	627		:	c	:	c	:	c	:	c
SE	1 975		:	c	:	c	:	c	:	c
UK	7 479		46 204		43 274		21 270		1 465	
NO	343		:	c	:	c	:	c	:	c
HR	845		:	c	:	c	:	c	:	c

Source: Eurostat (online data code: htec_eco_sbs2).

Table 7.2: Economic statistics on high-technology knowledge intensive services (KIS), 2008

	Number of enterprises		Turnover (EUR million)		Production value (EUR million)		Value added (EUR million)		Gross investment in tangible goods (EUR million)	
EU-27	755 531	s	1 032 324	s	925 009	s	467 483	s	58 745	s
BE	:		:	c	:	c	:	c	:	c
BG	5 509		3 129		2 968		1 506		393	
CZ	29 334	p	12 806	p	12 158	p	6 021	p	689	p
DK	11 299		20 510		18 180		8 945		1 592	
DE	81 747		190 154		149 721		89 802		10 713	
EE	1 841		1 210		1 138		549		117	
IE	:	c	:	c	:	c	:	c	:	c
EL	:		:		:		:		:	
ES	41 936		77 177		60 565		35 020		5 417	
FR	:	c	:	c	:	c	:	c	:	
IT	104 424		106 730		104 570		48 021		7 602	
CY	493		988		980		566		120	
LV	2 287		1 377		1 313		650		184	
LT	1 796		1 561		1 438		580		156	
LU	1 454		:	c	:	c	:	c	:	c
HU	33 134		10 788		6 800		3 725		817	
MT	:		:		:		:		:	
NL	28 305		49 756		47 299		22 858		2 938	
AT	15 338		16 711		12 226		7 358		1 326	
PL	40 568		:	c	:	c	:	c	:	c
PT	16 843		12 695		11 828		5 073		1 604	
RO	16 199	p	9 231	p	8 626	p	4 278	p	1 669	p
SI	4 939		2 933		2 536		1 108		436	
SK	2 648		4 247		3 885		2 004		521	
FI	7 828		:	c	:	c	:	c	:	c
SE	44 168		:	c	:	c	:	c	:	c
UK	144 006		219 133		206 286		102 297		13 435	
NO	13 393		17 835		17 306		7 750		1 274	
HR	4 527		:	c	:	c	:	c	:	c

Source: Eurostat (online data code: htec_emp_sbs2).

Table 7.3: Turnover and value added in high-tech manufacturing and KIS as a % of manufacturing and services (respectively), 2008
(%)

	High-tech manufacturing as a % of total manufacturing				High-tech KIS as a % of services (1)			
	Turnover		Value added		Turnover		Value added	
EU-27	7.6		9.6		7.1	e	13.3	e
BE	:	c	:	c	:	c	:	c
BG	:	c	:	c	5.1		16.0	
CZ	8.7	p	4.5	p	6.0	p	14.8	p
DK	10.6		15.2		7.2		13.1	
DE	6.9		8.9		7.8		13.2	
EE	5.5		5.2		4.3		11.8	
IE	46.6		46.1		:	c	:	c
EL	:		:		:		:	
ES	4.5		5.3		6.6		11.5	
FR	8.1		10.0		:	c	:	c
IT	5.1		6.6		6.9		13.9	
CY	4.7		4.6		5.1		10.3	
LV	3.2		6.0		4.1		9.6	
LT	1.8		3.1		3.9		7.8	
LU	:	c	:	c	:	c	:	c
HU	20.6		14.1		7.0		14.8	
MT	:		:		:		:	
NL	:	c	:	c	5.9		12.0	
AT	5.2		6.5		4.7		8.8	
PL	4.6		5.0		:	c	:	c
PT	:	c	:	c	6.0		11.5	
RO	3.7		4.0		6.4	p	15.1	p
SI	8.0		13.2		6.2		11.7	
SK	11.7		8.1		7.0		17.0	
FI	:	c	:	c	:	c	:	c
SE	:	c	:	c	:	c	:	c
UK	7.3		11.5		8.7		15.4	
NO	:	c	:	c	:		:	
HR	:	c	:	c	:	c	:	c

(1) Services cover NACE Rev.2 sections G to J, L to M and S95.

Source: Eurostat (online data codes: htec_eco_sbs2, sbs_na_dt_r2 and sbs_na_1a_se_r2).

Table 7.4 (Part I): High-technology trade
(million EUR)

	Imports			Exports		
	2007	2008	2009	2007	2008	2009
EU-27 (1)	239 677	230 192	208 153	199 835	200 922	185 460
BE	21 568	21 533	22 320	20 839	21 801	23 231
BG	1 446	1 572	1 219	472	543	534
CZ	13 348	14 600	13 068	12 628	14 115	12 330
DK	8 317	7 506	6 911	8 786	8 515	8 262
DE	108 277	107 370	99 149	125 210	122 304	112 631
EE	929	869	621	628	638	450
IE	15 363	13 236	11 719	22 820	20 756	18 351
EL	4 562	5 166	4 597	819	1 041	967
ES	26 820	28 491	19 888	7 832	7 966	7 609
FR	61 864	61 633	59 429	68 061	73 621	68 515
IT	32 412	31 428	29 008	21 890	21 936	19 788
CY	448	482	405	149	212	181
LV	791	774	501	280	319	294
LT	1 201	1 064	720	918	1 048	689
LU	5 558	5 944	5 199	5 299	6 141	6 358
HU	13 283	12 705	11 060	14 867	14 930	13 243
MT	935	873	761	1 074	906	703
NL	66 431	64 794	58 606	73 455	70 089	65 559
AT	12 832	13 263	11 828	13 267	13 358	11 504
PL	11 234	14 041	12 613	3 108	4 950	5 584
PT	6 253	6 428	4 949	2 595	2 454	1 158
RO	4 332	4 956	4 190	1 035	1 819	2 389
SI	1 628	1 790	1 425	1 015	1 205	1 033
SK	4 567	4 943	4 220	2 133	2 516	2 355
FI	8 968	8 420	6 114	11 508	11 366	6 250
SE	14 590	14 493	12 778	16 769	16 655	13 897
UK	72 749	58 018	52 302	53 448	47 231	46 003
IS	368	255	167	57	59	46
NO	6 404	6 440	5 977	3 259	3 666	3 466
CH	17 223	17 975	16 418	25 298	28 325	27 854
HR	1 554	1 650	1 353	575	630	565
MK	232	275	283	17	25	30
TR	10 647	10 585	9 837	1 356	1 306	1 123

(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 7.4 (Part II): High-technology trade, EU-27 and leading economies
(million EUR)

	Imports			Exports		
	2007	2008	2009	2007	2008	2009
EU-27 (1)	239 677	230 192	208 153	199 835	200 922	185 460
ASI_OTH	21 204	17 809	31 886	43 002	40 919	61 606
AU	15 686	15 648	15 420	2 701	2 960	2 633
BR	15 047	17 918	15 644	6 933	3 599	3 295
CA	31 801	32 089	30 368	22 803	20 414	18 175
CN (2)	216 860	213 310	204 855	242 887	258 513	251 334
HK	101 604	100 443	104 108	89 953	92 999	94 378
ID	3 432	7 405	6 053	3 627	3 700	4 122
IL	5 163	4 577	4 194	2 278	6 510	7 445
IN	15 726	12 420	16 794	4 374	5 201	7 891
JP	70 252	65 152	59 273	93 626	86 360	72 551
KR	44 864	44 408	40 478	76 302	73 752	72 643
MX	28 294	35 468	31 342	24 121	29 308	27 802
MY	25 752	23 915	28 101	33 613	28 923	39 282
PH	14 693	10 807	8383	18 911	16 416	13366
RU	16 342	19 608	13 678	3 152	3 718	3 408
SG	62 884	64 418	53 950	80 507	83 854	71 707
TH	18 896	18 679	17 830	22 807	22 081	20 882
US	221 973	209 951	:	208 847	200 149	:

(1) Extra EU-27 trade.
(2) CN excluding HK.

Source: Eurostat (online data code: htec_trd_tot4).

Table 7.5 (Part I): High-technology products — trade balance and trade ratio

	Balance (million EUR)			Export/import ratio (%)		
	2007	2008	2009	2007	2008	2009
EU-27 (1)	– 39 842	– 29 270	– 22 693	83.4	87.3	89.1
BE	– 729	268	911	96.6	101.2	104.1
BG	– 974	– 1 029	– 685	32.6	34.5	43.8
CZ	– 720	– 485	– 738	94.6	96.7	94.4
DK	469	1 009	1 351	105.6	113.4	119.5
DE	16 933	14 934	13 482	115.6	113.9	113.6
EE	– 301	– 231	– 171	67.6	73.4	72.5
IE	7 457	7 520	6 632	148.5	156.8	156.6
EL	– 3 743	– 4 125	– 3 630	18.0	20.2	21.0
ES	– 18 988	– 20 525	– 12 279	29.2	28.0	38.3
FR	6 197	11 988	9 086	110.0	119.5	115.3
IT	– 10 522	– 9 492	– 9 220	67.5	69.8	68.2
CY	– 299	– 270	– 224	33.3	44.0	44.7
LV	– 511	– 455	– 207	35.4	41.2	58.7
LT	– 283	– 16	– 31	76.4	98.5	95.7
LU	– 259	197	1 159	95.3	103.3	122.3
HU	1 584	2 225	2 183	111.9	117.5	119.7
MT	139	33	– 58	114.9	103.8	92.4
NL	7 024	5 295	6 953	110.6	108.2	111.9
AT	435	95	– 324	103.4	100.7	97.3
PL	– 8 126	– 9 091	– 7 029	27.7	35.3	44.3
PT	– 3 658	– 3 974	– 3 791	41.5	38.2	23.4
RO	– 3 297	– 3 137	– 1 801	23.9	36.7	57.0
SI	– 613	– 585	– 392	62.3	67.3	72.5
SK	– 2 434	– 2 427	– 1 865	46.7	50.9	55.8
FI	2 540	2 946	136	128.3	135.0	102.2
SE	2 179	2 162	1 119	114.9	114.9	108.8
UK	– 19 301	– 10 787	– 6 299	73.5	81.4	88.0
IS	– 311	– 196	– 121	15.5	23.1	27.5
NO	– 3 145	– 2 774	– 2 511	50.9	56.9	58.0
CH	8 075	10 350	11 436	146.9	157.6	169.7
HR	– 979	– 1 020	– 788	37.0	38.2	41.8
MK	– 215	– 250	– 253	7.3	9.1	10.6
TR	– 9 291	– 9 279	– 8 714	12.7	12.3	11.4

(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).

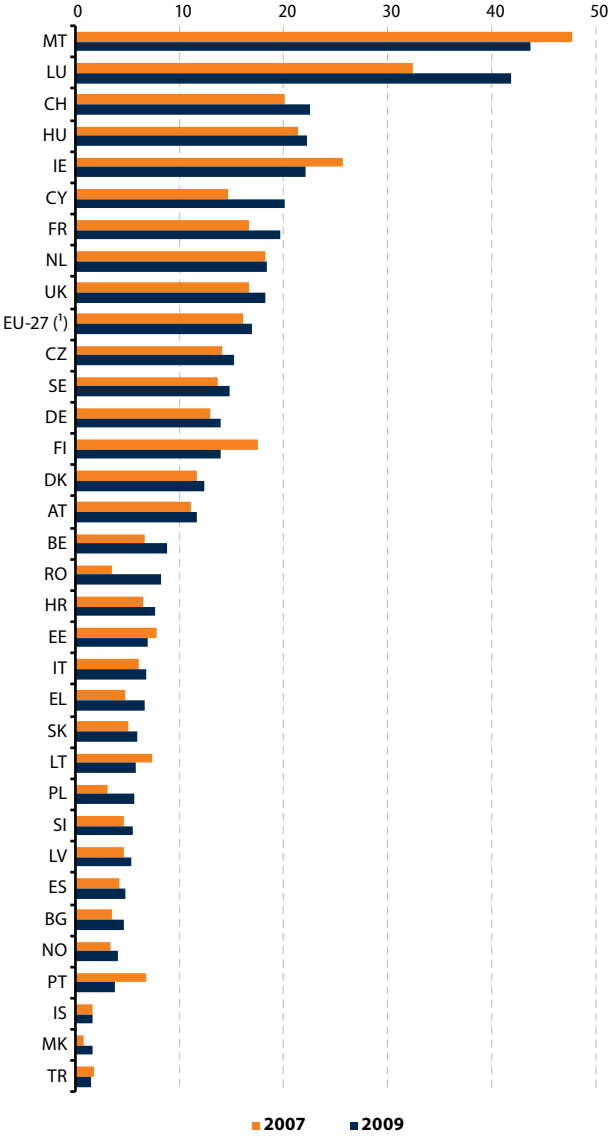
Table 7.5 (Part II): High-technology products — trade balance and trade ratio, EU-27 and leading economies

	Balance (million EUR)			Export/import ratio (%)		
	2007	2008	2009	2007	2008	2009
EU-27 (1)	– 39 842	– 29 270	– 22 693	83.4	87.3	89.1
ASI_OTH	21 798	23 110	29 720	202.8	229.8	193.2
AU	– 12 985	– 12 688	– 12 787	17.2	18.9	17.1
BR	– 8 114	– 14 319	– 12 349	46.1	20.1	21.1
CA	– 8 998	– 11 675	– 12 193	71.7	63.6	59.8
CN (2)	26 027	45 203	46 479	112.0	121.2	122.7
HK	– 11 651	– 7 444	– 9 730	88.5	92.6	90.7
ID	195	– 3 705	– 1 931	105.7	50.0	68.1
IL	– 2 885	1 933	3 251	44.1	142.2	177.5
IN	– 11 352	– 7 219	– 8 903	27.8	41.9	47.0
JP	23 374	21 208	13 278	133.3	132.6	122.4
KR	31 438	29 344	32 165	170.1	166.1	179.5
MX	– 4 173	– 6 160	– 3 540	85.3	82.6	88.7
MY	7 861	5 008	11 181	130.5	120.9	139.8
PH	4 218	5 609	4 983	128.7	151.9	159.4
RU	– 13 190	– 15 890	– 10 270	19.3	19.0	24.9
SG	17 623	19 436	17 757	128.0	130.2	132.9
TH	3 911	3 402	3 052	120.7	118.2	117.1
US	– 13 126	– 9 802	:	94.1	95.3	:

(1) Extra EU-27 trade.
(2) CN excluding HK.

Source: Eurostat (online data code: htec_trd_tot4).

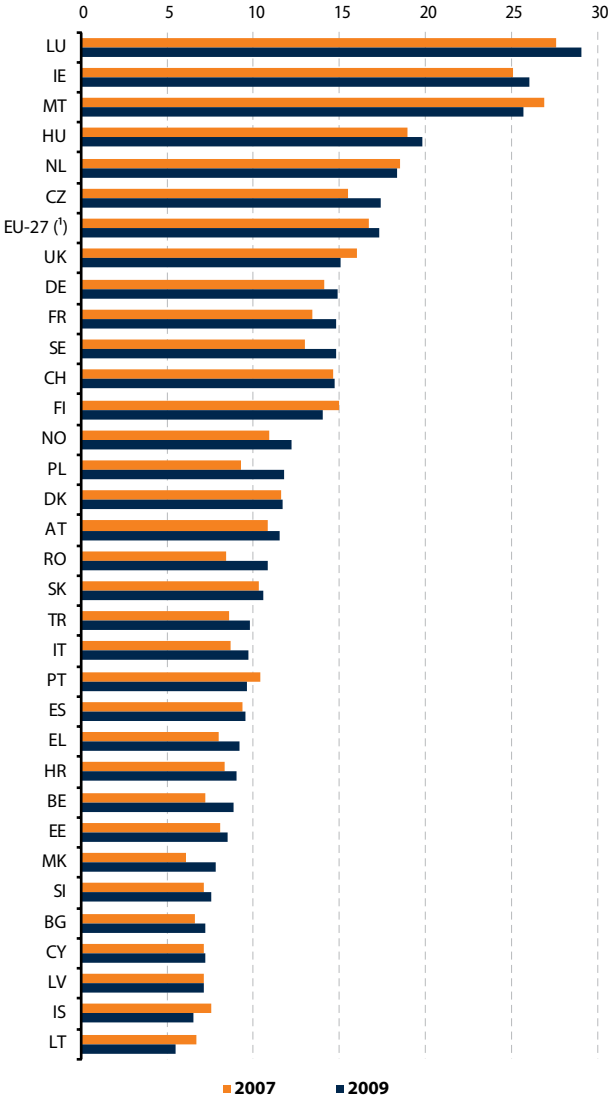
Figure 7.6: High-tech exports as a percentage of total
(%)



(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).

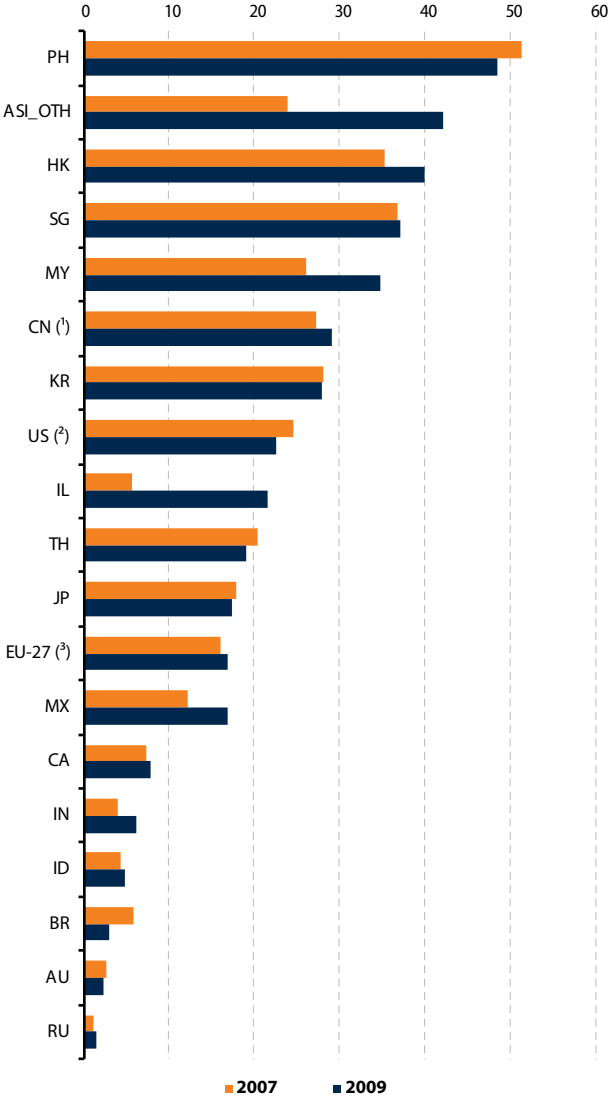
Figure 7.7: High-tech imports as a percentage of total
(%)



(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).

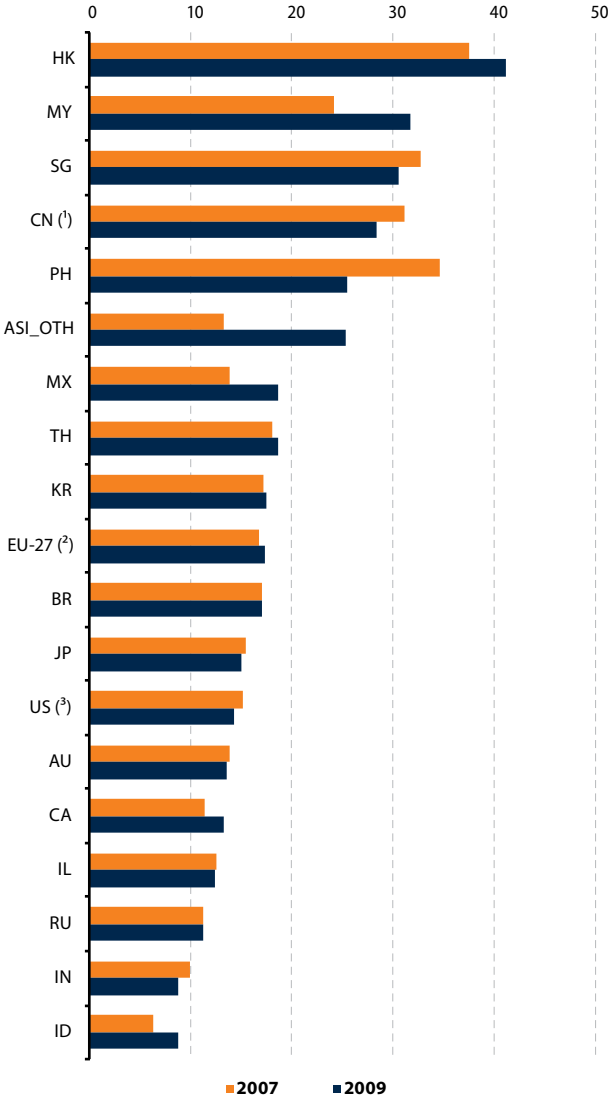
Figure 7.8: High-tech exports as a percentage of total, EU-27 and leading economies
(%)



(1) CN excluding HK.
(2) US, 2008.
(3) Extra EU-27 trade.

Source: Eurostat (online data code: htec_trd_tot4)

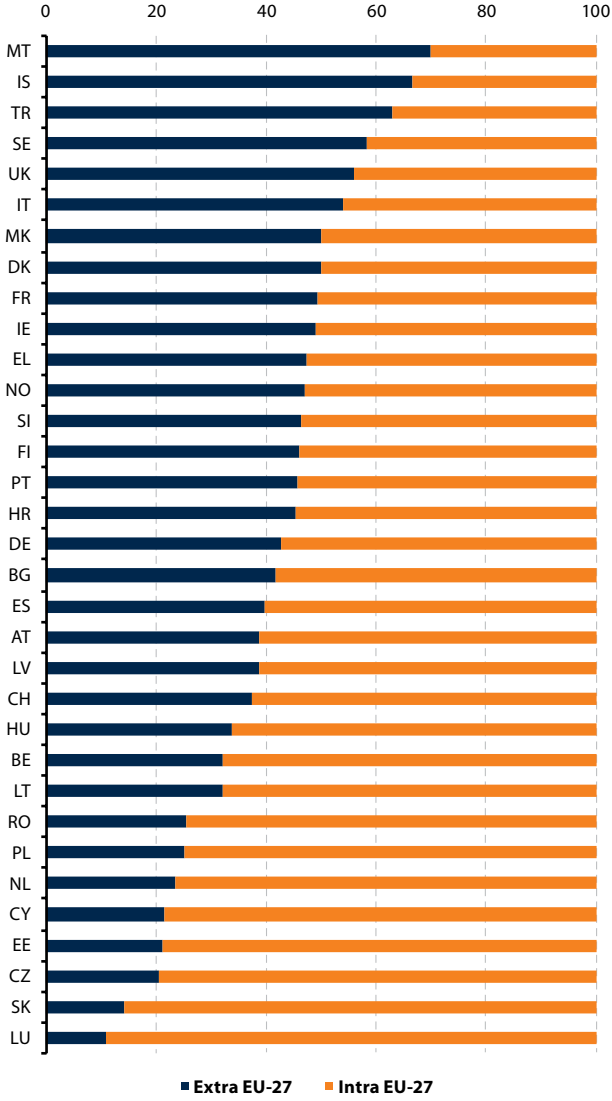
Figure 7.9: High-tech imports as a percentage of total, EU-27 and leading economies
(%)



(1) CN excluding HK.
(2) Extra EU-27 trade.
(3) US, 2008.

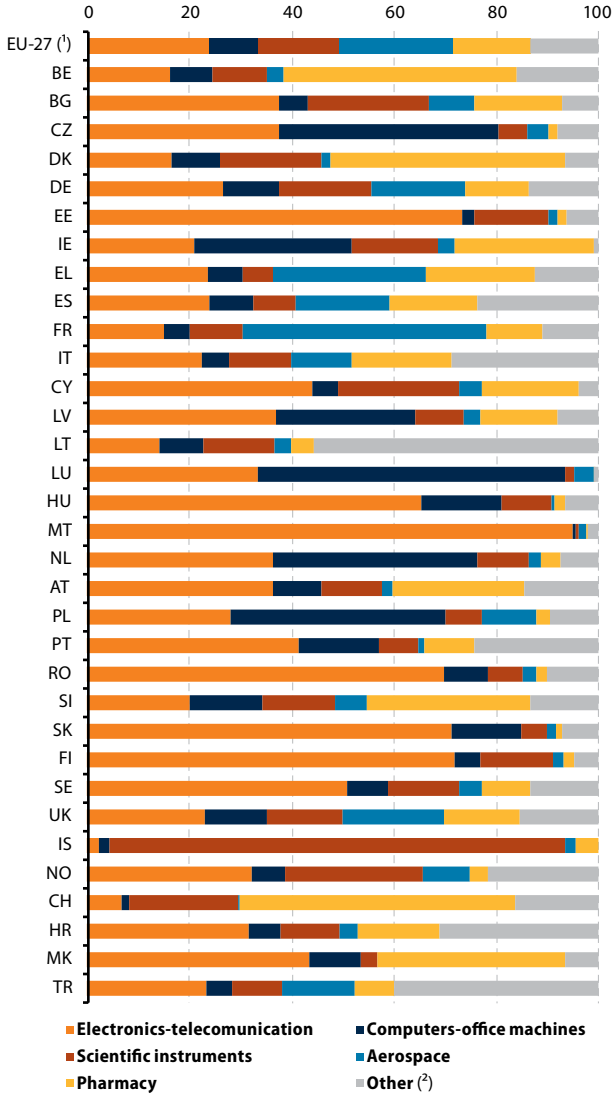
Source: Eurostat (online data code: htec_trd_tot4).

Figure 7.10: Intra and extra EU exports of high-tech products, 2009
(%)



Source: Eurostat (online data code: htec_trd_tot4).

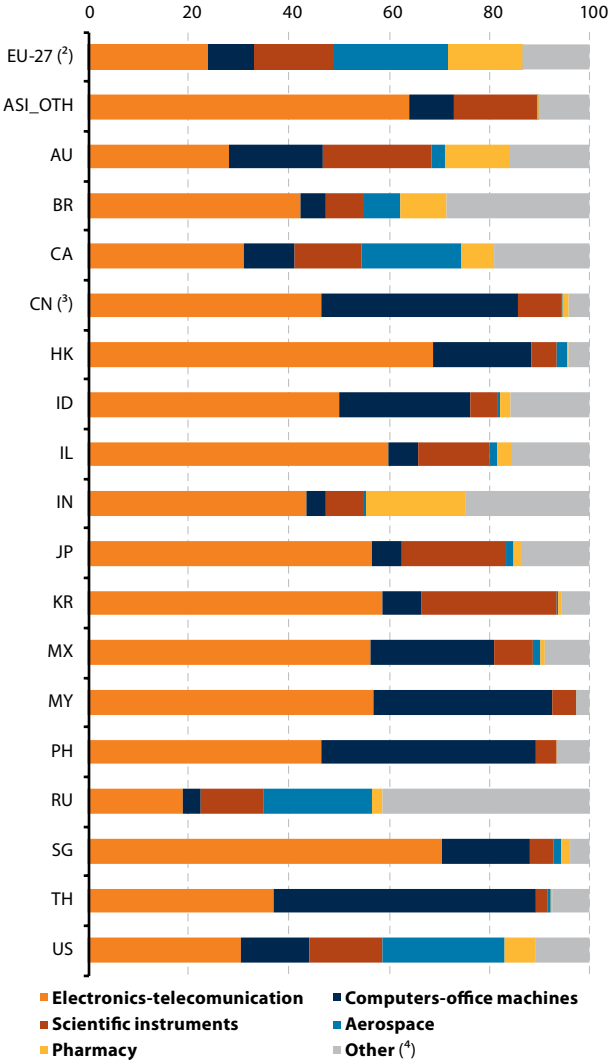
Figure 7.11 (Part I): High-tech exports by high-technology group of products, 2009
(%)



(1) Extra-EU trade.
(2) 'Other' includes 'Electrical machinery', 'Chemistry', 'Non-electrical machinery' and 'Armament'.

Source: Eurostat (online data code: htec_trd_group4).

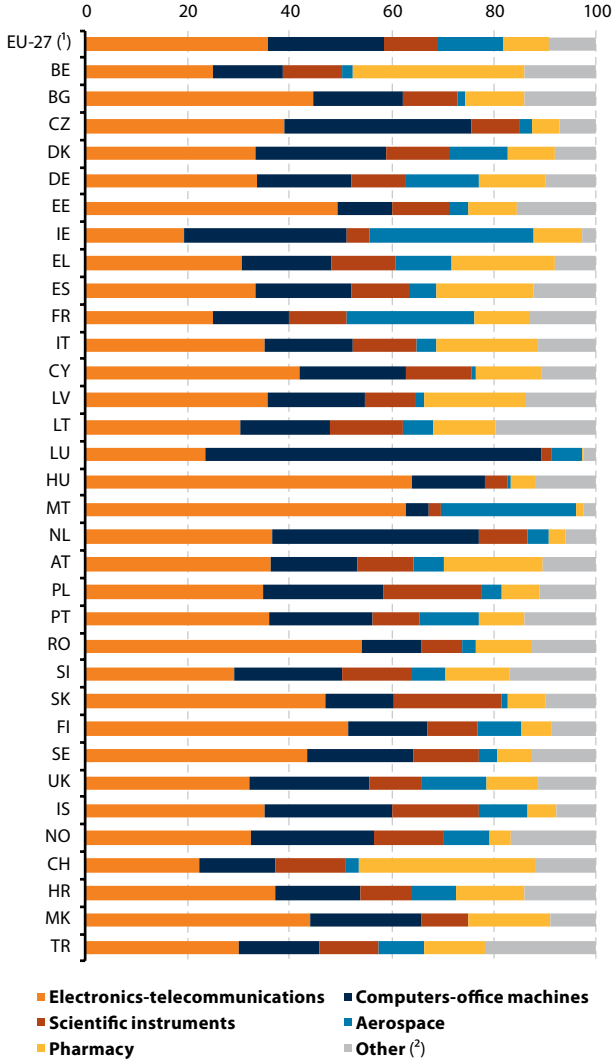
Figure 7.11 (Part II): High-tech exports by high-technology group of products, EU-27 and leading economies, 2009 (1) (%)



(1) US, 2008.
(2) Extra-EU trade.
(3) CN excluding HK.
(4) 'Other' includes 'Electrical machinery', 'Chemistry', 'Non-electrical machinery' and 'Armament'.

Source: Eurostat (online data code: htec_trd_group4).

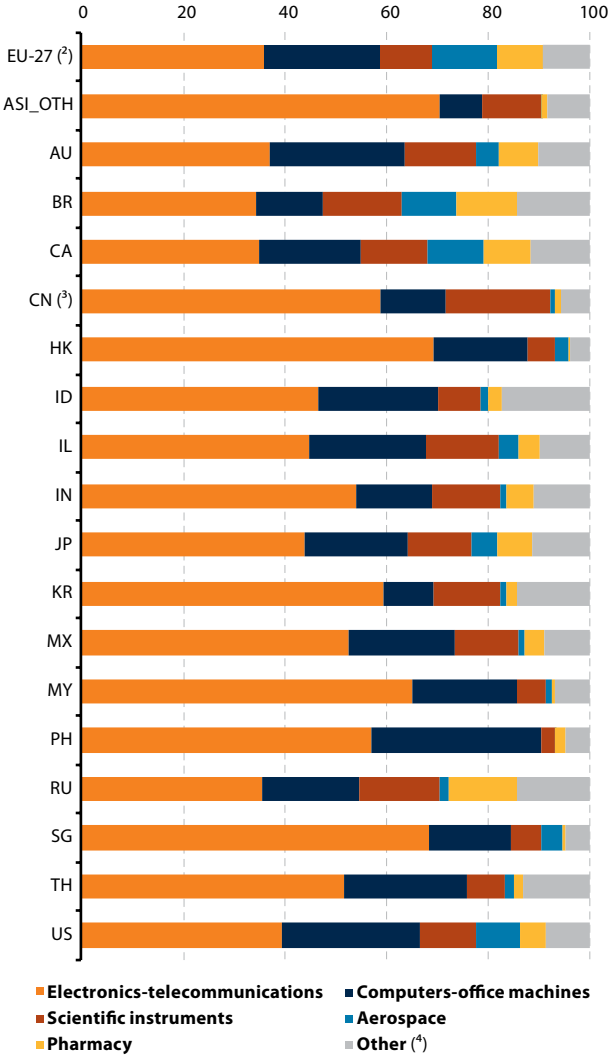
Figure 7.12 (Part I): High-tech imports by high-technology group of products, 2009
(%)



(1) Extra-EU trade.
(2) 'Other' includes 'Electrical machinery', 'Chemistry', 'Non-electrical machinery' and 'Armament'.

Source: Eurostat (online data code: htec_trd_group4).

Figure 7.12 (Part II): High-tech imports by high-technology group of products, EU-27 and leading economies, 2009 (1)
(%)



(1) US, 2008.
(2) Extra-EU trade.
(3) CN excluding HK.
(4) 'Other' includes 'Electrical machinery', 'Chemistry', 'Non-electrical machinery' and 'Armament'.

Source: Eurostat (online data code: htec_trd_group4).

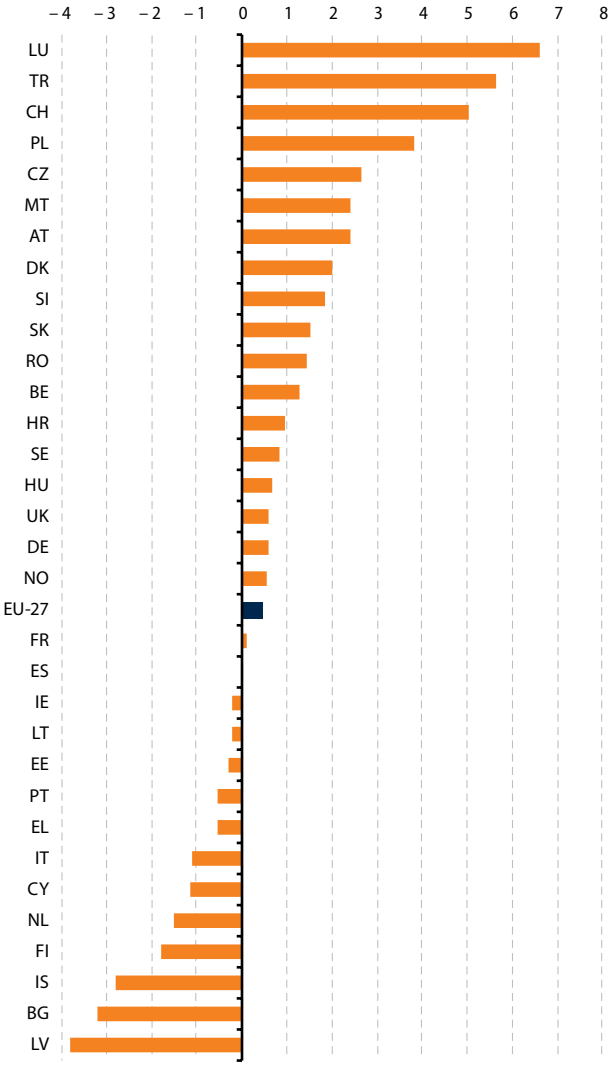
Table 7.13: Employment in knowledge-intensive activities (KIA)

	2008		2009		2010	
	1 000	% of total	1 000	% of total	1 000	% of total
EU-27	74 358	34.2	74 974	35.1	74 992	35.3
BE	1 819	41.2	1 818	41.4	1 866	41.9
BG	840	25.4	831	25.9	787	26.2
CZ	1 384	28.1	1 416	29.2	1 459	30.3
DK	1 016	36.3	1 066	39.2	1 057	39.8
DE	14 017	36.6	14 297	37.6	14 185	37.2
EE	180	28.5	183	31.8	179	32.4
IE	774	37.5	769	41.1	771	42.8
EL	1 407	31.5	1 399	31.6	1 392	32.3
ES	5 758	28.6	5 674	30.3	5 760	31.4
FR	9 998	38.7	9 996	39.2	10 023	39.1
IT	7 583	33.0	7 481	33.0	7 419	33.0
CY	130	35.1	125	33.8	127	34.2
LV	308	28.6	286	30.1	285	31.0
LT	434	29.1	433	31.2	432	32.7
LU	110	54.7	122	56.5	125	56.3
HU	1 275	33.1	1 255	33.5	1 292	34.4
MT	61	38.5	62	38.9	64	39.2
NL	3 138	37.3	3 092	37.0	3 045	37.0
AT	1 370	34.1	1 415	35.4	1 437	35.7
PL	4 185	26.9	4 380	28.0	4 512	28.7
PT	1 320	27.1	1 321	27.9	1 306	28.0
RO	1 707	19.2	1 744	19.8	1 756	19.9
SI	298	30.6	305	31.9	309	32.9
SK	677	28.0	686	29.1	698	30.3
FI	905	36.3	893	36.9	873	36.2
SE	1 871	41.6	1 856	42.3	1 902	42.9
UK	11 791	41.1	12 069	42.9	11 933	42.5
IS	73	42.8	70	43.6	69	43.5
NO	918	37.4	944	38.7	928	38.2
CH	1 652	40.2	1 735	41.9	:	:
HR	418	26.4	425	27.4	426	28.6
MK	97	16.1	:	:	:	:
TR	:	:	3 815	18.4	4 031	18.3

Source: Eurostat (online data code: htec_kia_emp2).

Figure 7.14: Annual average growth rate (AAGR) of employment in knowledge-intensive activities (KIA), 2008–2010 (1)

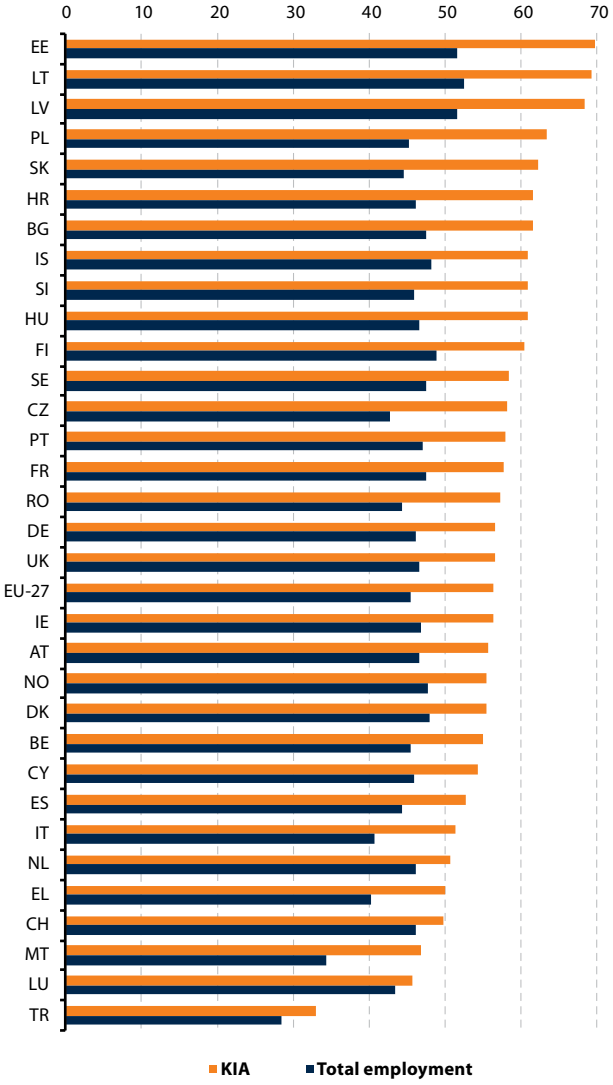
(%)



(1) TR, between 2009 and 2010; CH, between 2008 and 2009.

Source: Eurostat (online data code: htec_kia_emp2).

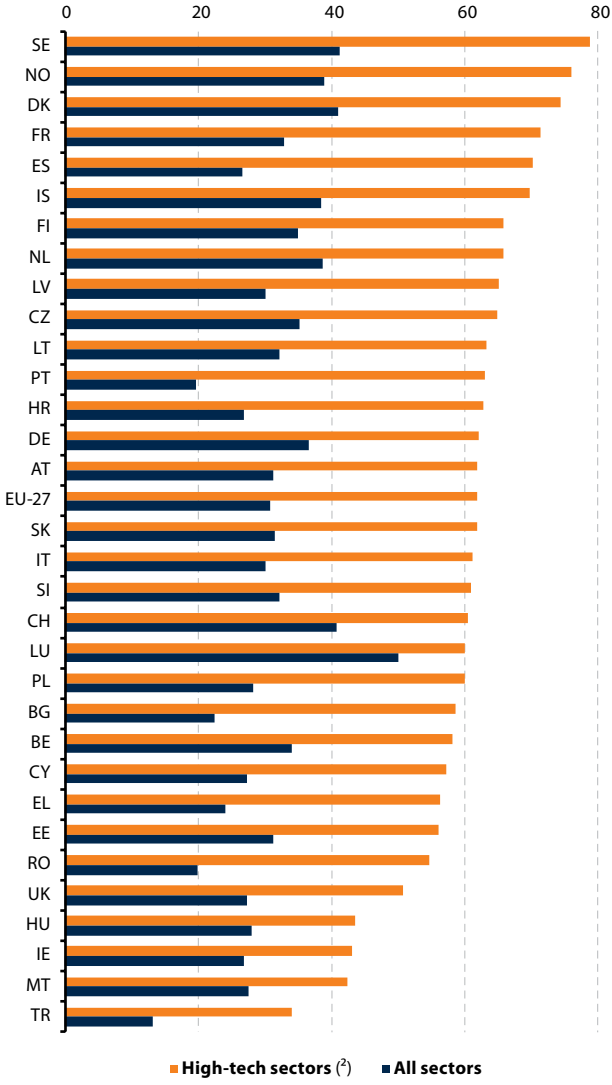
Figure 7.15: Share of women in knowledge-intensive activities (KIA) and in total employment, 2010 (1)
(%)



(1) CH, 2009.

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

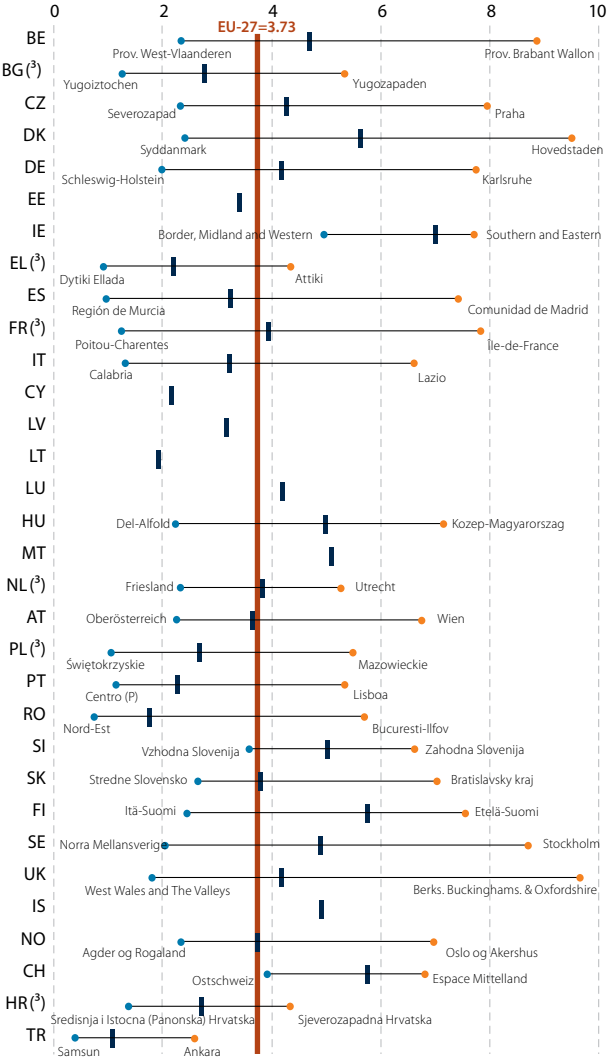
Figure 7.16: Technicians and professionals in high-tech sectors and in all sectors, 2010 (1)
(%)



(1) CH, 2009.
(2) High-tech sectors = High-tech manufacturing and high-tech KIS.

Source: Eurostat (online data code: htec_emp_nisco2).

Figure 7.17: Regional disparities in employment in high-tech sectors as a percentage of total employment (NUTS 2 level), 2010 (1) (2)
(%)



(1) CH, 2009.
(2) High-tech sectors = high-tech manufacturing and high-tech KIS.
(3) Data lack reliability due to small sample size but are publishable in region with the smallest share.

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 appropriations allocated to R&D in central government or federal budgets and therefore refer to budget provisions, not to actual expenditure. Provincial or state governments should be included where the contribution is significant. Unless otherwise stated, the data include both current and capital expenditure and cover not only 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 not available in their final form until some time after the end of the budget year concerned and 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 assembled by national authorities from data on public budgets. These measure government support for R&D activities or, in other words, how much priority governments give to the public funding of R&D.

Eurostat collects aggregated data which are checked and processed, and compared with other data sources such as the OECD. Then, all the necessary aggregates are calculated (or estimated).

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 gentlemen's agreement. From the reference year 2004 on, 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 applicable since reference year 2007. Before that its earlier version (NABS 1992) was used.

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 2004 to 2010.

R&D expenditure and personnel

1. Concepts and definitions

The basic concepts, guidelines for collecting data and 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 given in chapters 6 and 5 respectively. Regional data are collected according to the standards defined by the *Regional Manual*, Eurostat, 1996.

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 expenditures are 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. At regional level, GDP data are taken from the regional accounts. Both data series were extracted from Eurostat's reference database.

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. Total R&D personnel is 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 on R&D. For 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 gentlemen's agreement. From the reference year 2003 on, 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 EU-27 Member States, Croatia, Turkey, Iceland, Norway, Switzerland, China, South Korea, Russia, Japan, and the United States at national level and for European countries 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, reference period, institutional sector or relevant R&D variable, as appropriate. The method for calculating R&D personnel in head count (HC) is somewhat different. The estimates for R&D personnel in full-time equivalents (FTE) 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 2000-2010. However, data series in Eurostat's reference database are available from 1981 onwards, although availability differs depending on the variables and institutional sectors. Not all years are complete. For that 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.

Human resources in science and technology

1. Concepts and definitions

Statistics on human resources in science and technology — HRST — can 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 serves to show the needs and the current situation of the highly skilled labour force and the latter indicates 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 education at the third level in an S&T field of 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).

The conditions of the above educational or occupational requirements are considered according to internationally harmonised standards:

- the International Standard Classification of Education — ISCED — giving the level of formal education achievement;

- the International Standard Classification of Occupation — ISCO — detailing the type of occupation.

Stocks and inflows

HRST stocks provide information on the level of human resources in science and technology 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 conform to Eurostat guidelines on sample-size limitations and are therefore not published if the degree of sampling error is likely to be high and are flagged as unreliable if the degree of reliability is too small.

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

The operational definitions of main HRST categories are as follows:

HRST — Human Resources in Science and Technology

- successfully completed education at the third 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 or 3).

HRSTO — Human Resources in Science and Technology — Occupation

- employed in an S&T occupation (ISCO '88 COM codes 2 or 3).

HRSTE — Human Resources in Science and Technology — Education

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

HRSTC — Human Resources in Science and Technology — Core

- successfully completed education at the third level (ISCED '97 version levels 5a, 5b or 6); and

- employed in an S&T occupation (ISCO '88 COM codes 2 or 3).

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).

HRSTU — Human Resources in Science and Technology — Unemployed

- successfully completed education at the third level (ISCED '97 version levels 5a, 5b or 6) and are unemployed.

NHRSTU — Unemployed non-HRST

- no education at the third level and are unemployed.

HRST inflows are the number of people who do not fulfil any of the conditions for inclusion in HRST at the beginning of a time period but gain at least one of them 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 between 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, Computing (codes 42, 44, 46, 48).

Engineering groups the fields of education in Engineering and engineering trades, Manufacturing and processing, 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 in turn obtained 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 data source. For HRST stocks these data are available for EU-27 Member States, candidate countries and EFTA countries. HRST inflows from education are available for EU-27 Member States, candidate countries, EFTA countries, 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, breakdowns for which quality levels are considered insufficient are either flagged as 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.

The CIS is a survey of innovation activity in enterprises covering EU Member States, candidate countries, Iceland and Norway.

The data have been collected on a two-yearly basis from 2004 onwards. The last survey, CIS 2008, was carried out in 27 Member States, candidate countries, Norway and Iceland. It was launched in 2009, based on the reference period 2008,

with the observation period from 2006 to 2008. This survey introduced a new, extended definition of innovation including not only the technological product and process innovations but also non-technological organisational and marketing innovations.

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 changes to the CIS 2008 survey questionnaire were based on the requirement to meet 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

Innovation: an innovation is the implementation of a new or significantly improved product (good 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. However, purely selling innovations wholly produced and developed by other enterprises is not included as an innovation activity. Innovations should be new to the enterprise concerned. For product innovations they do not necessarily have to be new to the market and for process innovations the enterprise does not necessarily have to be the first one to have introduced the process.

A product innovation is the introduction of a good or service that is new or significantly improved with respect to its 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 been previously 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 for CIS 2008 is the **enterprise.**

The target population for CIS 2008 was 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 05-09), manufacturing (NACE 10-33), electricity, gas steam and air conditioning supply (NACE 35), water supply; sewerage, waste management and remediation activities (NACE 36-39), wholesale trade, except of motor vehicles and motorcycles (NACE 46), transportation and storage (NACE 49-53), publishing activities (NACE 58), telecommunications (NACE 61), computer programming, consultancy and related activities (NACE 62), information services activities (NACE 63), financial and insurance activities (NACE 64-66), and architectural and engineering activities; technical testing and analysis (NACE 71).

3. Type of Survey

Most of the countries carried out CIS 2008 by means of a stratified sample survey over the frame population, while a number used a census or a combination of the two.

4. Reference period

CIS 2008 covered the observation period 2006-2008 inclusive, i.e. the three-year period from the beginning of 2006 to the end of 2008. The reference period for CIS 2008 was the year 2008.

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 they can indicate the level of innovative activity in a particular market, region or country.

2. Sources

Following changes in the production of patent statistics at Eurostat in 2007, data shown on the Eurostat webpage are no longer fully comparable with data previously disseminated. From 2007 onwards Eurostat's production of EPO and USPTO data has been based almost exclusively on the **EPO Worldwide Statistical Patent Database**. This database, also known as 'PATSTAT', was developed by the EPO in 2005, using their collection and knowledge of patent data.

EPO patent applications by priority year

The new methodology for EPO data used for the calculation of indicators is very similar to the methodology of the OECD. For patent applications to the EPO all direct applications (EPO-direct) are taken into account, but among the PCT applications (applications following the procedure laid down by the Patent Cooperation Treaty — PCT) made to the EPO only those that have entered into the regional phase are counted. As PCT patent applications in the international phase designating the EPO will no longer be included in the calculation of patent applications to the EPO, the data shown are lower. Nevertheless, patent data produced by Eurostat and the OECD may still not be exactly the same. Differences may be explained by the fact that the data sources used and the date of extraction of the data could differ.

USPTO patents granted by priority year

Eurostat uses also the same methodology as the OECD for patents granted by the USPTO. Differences may be explained by the fact that the data sources are not exactly the same and by the date of data extraction.

Triadic patent families by earliest priority year

A patent family is defined as a set of patents taken in various countries for protecting the same invention, i.e. related patents 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; the values of the patents are more homogeneous).

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 therefore the latest available data refer to 2006 only, while still being provisional.

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 date is the earliest and it is chosen in order to be the closest to the date of the invention as patent procedures always take several years. The drawback of this choice is that data on USPTO patents granted have declined in recent years, due to administrative delays between the priority date and the grant date. 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

Patent 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 code, not only the main (first) IPC code

is taken into account but all of them. The application is divided equally among all IPC codes (fractional counting), thus avoiding double counting. Only after the fractional counting are the IPC codes 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 Organization (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 only one IPC code or more than one.

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 the 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, due to the interdisciplinary nature of the field, it was too difficult to retrieve these specific patent data from the available databases. 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 inventor's and also 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
- 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 corresponds the identified citation in patents to the EPO.

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 technology-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 related to total employment, this classification covers both manufacturing and services.

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

High-tech manufacturing

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

High-tech Knowledge Intensive Services

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

High-tech sectors total

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 to compare economies in regard to their knowledge intensity. An activity is classified as knowledge intensive if tertiary-educated persons employed (according to ISCED97, levels 5+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, 64 to 66, 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, 90

The product approach

The product approach was devised to complement the sectoral approach. It opens the way to 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 products group in this publication are according SITC Rev.4.

For further details please see also the Eurostat metadata on high-technology statistics disseminated on Eurostat's reference webpage.

High-tech economic statistics

Data on high-tech enterprises are extracted and built up using data from the Structural Business Statistics — SBS. This publication presents for the first time the SBS results by NACE Rev.2 for the 2008 reference year. Because it was the first year of implementation of the revised NACE classification the data may change due to revisions and updates arising from subsequent surveys.

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 adjusting 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 see also the Eurostat metadata on high-technology statistics disseminated on Eurostat's reference webpage.

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. Trade data reported by other countries are extracted from the UN Statistical Office's COMTRADE database and included in the COMEXT database as a separate dataset. For more details, please refer to methodologies of the specific data sources.

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

Science, technology and innovation in Europe — 2012 edition

Luxembourg: Publications Office of the European Union

2012 — 138 pp. — 10.5 x 21 cm

Theme: Science and technology
Collection: Pocketbooks

ISBN 978-92-79-21874-3
ISSN 1830-754X
doi:10.2785/19722
Cat. No KS-GN-12-001-EN-C

How to obtain EU publications

Free publications:

- via EU Bookshop (http://bookshop.europa.eu);
- at the European Commission's representations or delegations. You can obtain their contact details on the Internet (http://ec.europa.eu) or by sending a fax to +352 2929-42758.

Priced publications:

- via EU Bookshop (http://bookshop.europa.eu).

Priced subscriptions (e.g. annual series of the *Official Journal of the European Union* and reports of cases before the Court of Justice of the European Union):

- via one of the sales agents of the Publications Office of the European Union (http://publications.europa.eu/others/agents/index_en.htm).

KS-GN-12-001-EN-C

Science, technology and innovation in Europe

2012 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

ISBN 978-92-79-21874-3

Publications Office