

R&D Expenditure and Personnel

This Statistics in Focus describes the current situation of national expenditure and personnel in R&D.

Europe is still working to achieve the target set by the Lisbon Strategy of devoting 3% of GDP to research and development activities by 2010. With an R&D intensity of 1.84% of GDP in 2006 (exactly the same share as in 2005) the EU-27 is still below the Lisbon target.

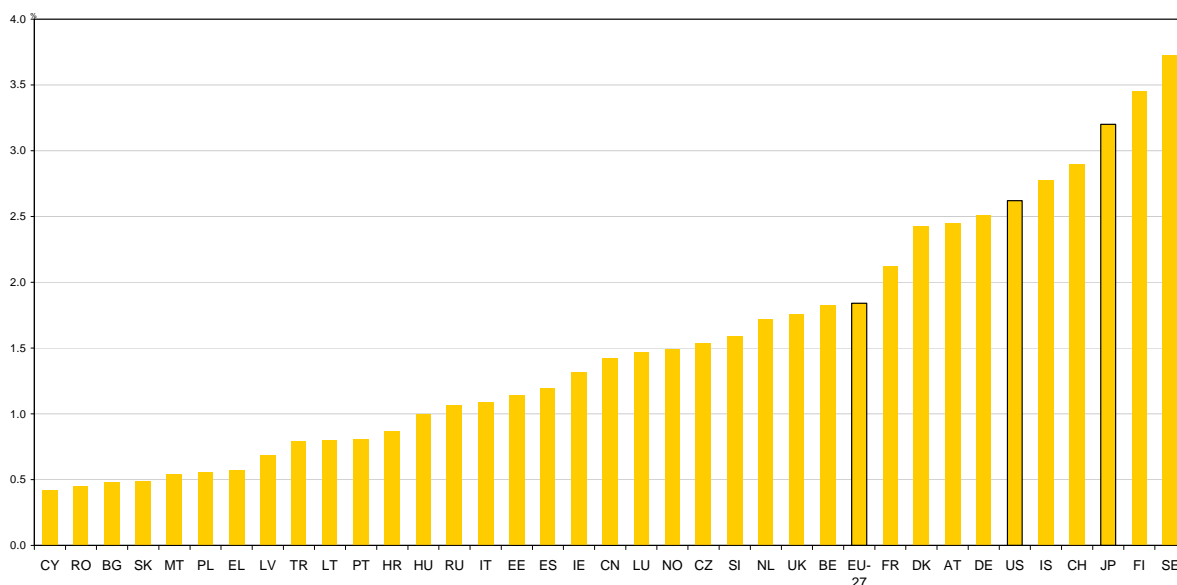
As defined by the new Lisbon Strategy, the business enterprise sector (BES) is expected to finance two thirds of R&D expenditure. Although the target has not been reached

yet, in 2005 54.6% of R&D activities in the EU-27 were financed by the BES.

Looking at R&D personnel, in 2006 the EU-27 counted 2 200 000 persons working in R&D (measured in full-time equivalent FTE). The business enterprise sector employed just over half of them. Between 2001 and 2006, the annual average growth rate (AAGR) for FTE R&D personnel was 2%.

During 2005, people employed on R&D activities in the EU-27 accounted for 1.45% of total employment. 33% of the persons employed in R&D in the EU-27 were women, i.e. an increase of 3% over the previous year.

Figure 1: R&D expenditure as a percentage of GDP (R&D intensity), EU-27 and selected countries — 2006



Exceptions to the reference year: 2005: IT, PT, UK, IS and TR 2004: CH
Eurostat estimate: EU-27. National estimates: BE, DK, EE, ES, FR, CY, MT, SI and NO.

Source: Eurostat - R&D statistics and OCDE-MSTI
Provisional data: DE, EL, LU, AT, NL and US.

The highest R&D intensities, above the 3% target, were achieved by Sweden (3.73%) and Finland (3.45%). Germany (2.51%), Austria (2.45%), Denmark (2.43%), and France (2.12%) attained R&D intensities above the EU aggregate, but below the Lisbon Strategy target. This was also the case in Iceland (2.78% in 2005) and Switzerland (2.90%). All other

Member States were below this threshold. R&D investment in Slovenia and the Czech Republic has increased in the past years to 1.59% and 1.54% respectively, close to the EU-27 average, making them the best-performing new Member States in terms of R&D investment.

Cyprus, Romania, Bulgaria and Slovakia spent less than 0.5% of their GDP on R&D, and a further six Member States — Malta, Poland, Greece, Latvia, Lithuania and Portugal — did not reach the 1% mark. The same applies to Croatia and Turkey.

In the global context, the EU's main competitors such as Japan (3.20%) and the United States (2.62%) continued to register higher R&D intensities than the EU-27 average. Chinese investments in R&D were up in relation to previous years but still far from the EU-27 average.

In 2006, R&D spending totalled EUR 213 127 million in the EU-27. Between 2001 and 2006, EU-27 R&D expenditure increased at an annual average growth rate (AAGR) of 3.6%, as shown in Table 2.

Germany, France and the United Kingdom accounted for nearly two thirds of total EU R&D expenditure in absolute terms. However, average annual growth rates for these three countries were around 2%, and their percentage of GDP devoted to R&D did not yet reach the expected 3%.

In many new Member States, such as Estonia, and Romania, expenditure in R&D increased on average by more than 20%, in absolute terms. This increase was also reflected in their percentage of GDP spent on R&D going from 0.71 % (2001) to 1.14 % (2006) in Estonia and from 0.39% (2001) to 0.45% (2006) in Romania showing that these countries are making efforts to reach the Lisbon Strategy target.

For the EU-27, plus Norway and Switzerland, the highest levels of R&D investment were seen in the business enterprise sector (BES).

On the whole, higher education was the second most important sector investing in R&D after business enterprises, except in some countries such as Hungary, Poland, Romania, Slovenia, Slovakia and Russia and China, where government-sector spending was higher, probably as a result of the interventionist tradition of these governments. This tendency also holds true for Luxembourg, although R&D spending in higher education there surged by 54% on average between 2001 and 2006.

Table 2: R&D expenditure in EUR million in 2006 and annual average growth rate 2001-2006 (AAGR), by sector of performance, EU-27 and selected countries

	Total		Business enterprises		Government		Higher education		Private non profit	
	EUR million	AAGR 2001-2006	EUR million	AAGR 2001-2006	EUR million	AAGR 2001-2006	EUR million	AAGR 2001-2006	EUR million	AAGR 2001-2006
EU-27	213 127 s	3.6	135 716	3.2	28 777 s	4.1	46 666 s	4.2	1 968 s	7.4
BE	5 798 p	3.2	3 934	-25.1	500 p	-22.7	1 291 p	5.1	72 p	4.3
BG	121	11.3	31	16.2	78	10.2	12	5.9	1	54.7
CZ	1 761	16.2	1 165	18.4	309	9.4	279	16.5	7	12.8
DK	5 349 p	4.6	3 560 p	3.9	360 p	-6.5	1 396 p	11.5	32 p	0.4
DE	58 231 e	2.3	40 531 e	2.2	8 100 e	2.5	9 600 e	2.4	:	:
EE	151 p	25.3	67 p	32.5	20	23.6	61	20.0	3	26.2
IE	2 306	12.4	1 560 p	11.6	145	6.9	601	16.5	:	:
EL	1 223 e	7.5	367 e	5.7	254 e	6.3	585 e	8.9	16 e	39.5
ES	11 815 p	13.7	6 558 p	15.0	1 971 p	14.8	3 266 p	11.1	21 p	-16.4
FR	37 983 p	2.9	24 081 p	3.0	6 546 p	3.8	6 875 p	2.0	480 p	1.0
IT	15 599	3.5	7 856	4.2	2 701	2.0	4 712 b	1.6	330	:
CY	62 p	17.6	14 p	21.0	18 p	7.0	26 p	29.1	5 p	13.5
LV	112	24.4	57	32.7	17	15.9	39	19.5	0	:
LT	191	15.9	53	14.9	44	3.8	94	26.8	:	:
LU	497 e	5.3	422 e	3.8	63 p	15.8	12 p	54.0	:	:
HU	900	10.4	435	14.6	228	10.0	219	9.2	:	:
MT	28 p	23.5	17 p	55.2	1	-9.3	9	7.2	0	:
NL	9 168 ep	2.6	5 392 ep	2.7	1 261 ep	2.5	:	:	:	:
AT	6 324 e	7.8	4 284 e	8.2	325 e	5.1	1 689 e	7.5	26 e	5.6
PL	1 513	2.7	477	0.1	560	6.2	469	1.6	7	23.3
PT	1 201	3.7	462	8.8	176	-5.0	425	2.8	138	5.4
RO	444	20.2	215	14.6	144	24.6	79	31.5	6	:
SI	486 p	7.3	293 p	8.3	119 p	7.4	73 p	5.7	1 p	-31.8
SK	217	7.7	93	-1.5	71	14.9	52	31.2	0	:
FI	5 761	4.5	4 108	4.6	539	2.7	1 079	5.3	36	3.8
SE	11 691	2.2	8 754	1.5	525	12.1	2 387	2.7	25	20.9
UK	31 828	2.0	19 611	0.5	3 361	3.3	8 144	5.1	712	8.0
IS	364	8.7	187	5.1	86	13.1	80	13.0	11	16.6
NO	3 997 p	5.6	2 130 p	3.3	637	7.5	1 229	9.5	:	:
CH	8 486	5.5	6 257	5.4	91	0.2	1 943	5.5	194	10.2
HR	297	2.4	109	-1.4	79	7.0	109	3.5	0	:
TR	2 287	25.0	774	25.1	264	45.2	1 249	21.9	:	:
CN	30 002	16.4	21 326	20.2	5 910	7.2	2 766	14.9	0	:
JP	118 295	-3.7	91 277	-2.8	9 795	-6.4	15 012	-6.2	2 212	-7.8
RU	8 453	16.0	5 630	14.8	2 285	18.5	517	19.8	21	20.9
US	273 772 p	-2.5	192 571 p	-3.1	30 471 p	-2.7	39 095 p	0.8	11 635 p	-0.6

Exceptions to the reference year:
2005: IT, PT, UK, IS and TR;
2004: CH;

Exceptions to the reference Period:
2000-2004: CH;
2000-2006: LU;

2001-2005: IT, PT, UK and IS;
2002-2005: TR;
2002-2006: MT, AT and HR.

Source: Eurostat - R&D statistics and OCDE-MSTI

Between 2001 and 2006, AAGR for research and development in Japan and the United States was negative in all sectors except for higher education in the US, whereas China and Russia witnessed substantial increases in the same period.

Croatia's annual average growth rate in R&D was low (2.4%).

R&D expenditure financed by the BES

The business enterprise sector (BES) (Table 3), was responsible for more than half (54.6%) of R&D expenditure in the EU-27 in 2005.

As defined in the new Lisbon Strategy, two thirds of R&D expenditure should be financed by the business sector, which implies that fostering business investment in R&D is essential.

Within the EU, Luxembourg registered the highest percentage of R&D expenditure financed by the BES (79.7%) and has already achieved the EU target, together with Germany (67.6%) and Finland (66.9%). Sweden was just under the two-thirds threshold.

Four European countries, Belgium (59.7%), Denmark (59.5%), Ireland (57.4%) and Slovenia (54.8%), were above the EU-27 average.

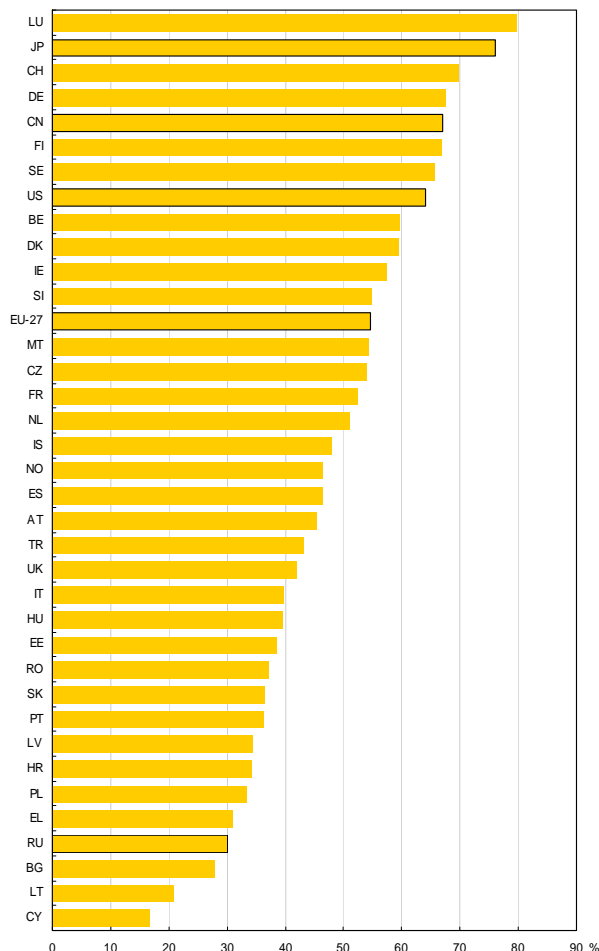
Although the level of business investment in R&D exceeded 50% in Malta, the Czech Republic, France and the Netherlands, it nonetheless remained below the EU-27 average.

On the other hand, Cyprus (16.8%), Latvia (20.8%), Bulgaria (27.8%) and Greece (31.0%) had relatively low involvement of the business sector in R&D.

BES is also the biggest source of R&D financing outside the EU. In Japan, 76% of R&D activities were financed by the business sector, against 64% in the United States. China is following the trend of the developed world economies, as 67% of R&D investment is funded by businesses.

Conversely, the Russian Federation still relies on the government as a main source of R&D financing, and in 2005 business accounted for only 30% of total R&D investment.

Figure 3: Percentage of R&D expenditure financed by the business enterprise sector (BES), EU-27 and selected countries — 2005



Exceptions to the reference year:
 2004: CH;
 2003: NL.
 Break in series: SE.
 Eurostat estimate: EU-27.
 National estimate: AT.
 Provisional data: MT and US.

Source: Eurostat - R&D statistics and OCDE-MSTI

The Fifth European Freedom: Freedom of Knowledge

R&D collaboration and knowledge transfer between Public Research Organisations (PROs) and industry represent one of the weaknesses of the European research and innovation system.

In order to **create a level playing field for trans-national university-industry R&D cooperation**, there is a need to promote consistency in the rules and practices applied across Europe.

To this end, the Commission adopted, in April 2007, a Communication on "Improving knowledge transfer between research institutions and industry across Europe: embracing open innovation", accompanied by "Voluntary guidelines for universities and other research institutions to improve their links with industry across Europe". They aim to improve research collaboration and knowledge transfer between PROs and industry. Member States and stakeholders will be encouraged to implement them on a voluntary basis.

Source: European Commission, Investing in European Research — 2007

R&D personnel

In 2006, the EU-27 counted 2 200 000 persons working in R&D (measured in full-time equivalent). The business enterprise sector employed just over half of them, followed by higher education with 30%, and governments with 15%.

All sectors under scrutiny have witnessed positive annual average growth rate between 2001 and 2006.

Germany, France, Spain and the Netherlands together made up more than half of the EU's R&D personnel, while Malta employed less than 1 000. Compared to other sectors, the BES was, as a rule, the largest employer in R&D, except for Bulgaria, where the government was the leading employer in R&D, and Latvia, Poland, Slovakia and Croatia,

where the higher education sector was the leading employer in R&D. This is especially remarkable in Bulgaria's case, where government-sector staff working in R&D outnumbered the business sector by four to one. Aside from Slovakia, the United Kingdom, Poland and Romania, most countries displayed positive annual average growth rates within the business enterprise sector. The biggest increases were registered in Malta (52.2%) and Estonia (21.1%).

In contrast, AAGR for the government sector was negative in just under half of the Member States.

The private non-profit sector is still small in absolute terms, but substantial growth has been recorded in countries such as Sweden and Poland.

Table 4: R&D personnel in full-time equivalent (FTE) in 2006 and annual average growth rate 2001-2006, EU-27 and selected countries

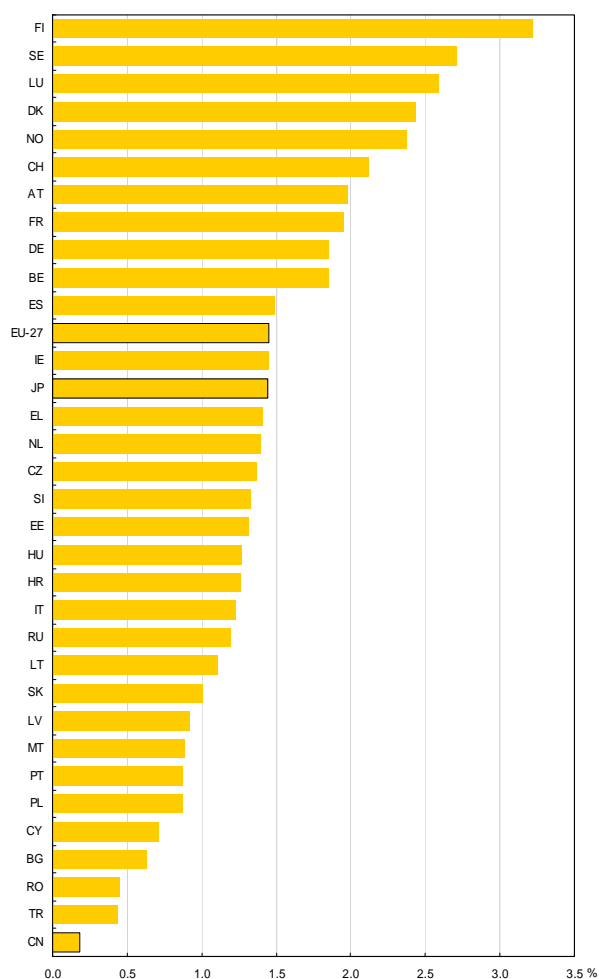
	Total		Business enterprises		Government		Higher education		Private non profit	
	FTE	AAGR 2001-2006	FTE	AAGR 2001-2006	FTE	AAGR 2001-2006	FTE	AAGR 2001-2006	FTE	AAGR 2001-2006
EU-27	2 167 381	2	1 155 669	2.0	330 452	1.0	654 955	2.0	26 305	5.0
BE	55 161 p	1.5	32 206 p	0.4	3 861 p	1.2	18 540 p	3.6	553 p	-0.9
BG	16 321	1.8	2 463	5.5	10 255	-0.3	3 464	6.2	139	12.5
CZ	47 729	12.8	24 101	14.9	10 698	6.6	12 776	16.1	154	-9.1
DK	45 182 p	2.5	29 268 p	2.5	3 305 p	-9.6	12 322 p	8.3	286 p	0.2
DE	485 000 e	0.2	308 000 e	0.0	77 000 e	1.4	100 000 e	-0.3	:	:
EE	4 740 p	4.8	1 630 p	21.1	714	-1.0	2 290	-0.3	106	16.2
IE	17 647 p	5.8	10 800 p	3.4	1 248	-0.8	5 599	14.1	:	:
EL	35 140 e	3.1	11 402 e	0.4	4 578 e	-0.6	18 952 e	5.9	207 e	15.9
ES	182 810 p	7.8	76 800 p	10.6	34 458 p	8.0	70 948 p	5.4	605 p	-12.7
FR	357 327	1.7	198 864	1.8	53 418	2.0	98 743	1.8	6 302	-1.6
IT	:	:	71 487 p	1.8	33 567 p	2.4	:	:	5 860 p	:
CY	1 220	12.1	310	16.6	355	0.1	465	24.7	90	13.4
LV	6 520	3.6	1 873	6.7	1 164	1.3	3 482	2.8	1	0.0
LT	11 443	-0.9	1 276	14.6	2 930	-9.0	7 237	1.8	:	:
LU	4 586 e	:	3 746 e	:	592 p	9.0	248 p	47.9	:	:
HU	25 971	2.5	9 279	6.5	8 169	1.0	8 523	0.3	:	:
MT	752 p	12.2	402 p	52.2	43	-24.9	307	3.7	0	:
NL	91 618 ep	0.5	49 856 ep	0.6	12 635 ep	-0.4	:	:	:	:
AT	50 322 e	6.7	34 192 e	6.4	2 388 e	3.8	13 494 e	8.1	249 e	2.3
PL	73 554	-1.0	14 166	-3.9	17 668	0.2	41 535	-0.4	185	24.4
PT	25 728	2.9	6 133	12.2	4 533	-6.7	11 680	3.5	3 381	3.5
RO	30 802	-1.2	13 761	-7.1	8 381	-0.1	8 563	14.8	97	:
SI	9 789 p	2.6	4 830 p	2.6	2 843 p	3.5	2 088 p	3.2	28 p	-31.6
SK	15 028	0.8	3 144	-7.9	3 732	-1.3	8 138	7.5	15	:
FI	58 257	1.7	32 993	1.9	7 408	0.3	17 362	2.2	493	1.8
SE	78 715	1.7	57 641	3.1	3 618	5.1	17 137	-2.9	319	25.4
UK	:	:	147 356	-1.1	20 415	-3.4	:	:	6 273	-0.2
IS	3 226	2.7	1 530	3.5	849	4.0	742	0.0	106	1.7
NO	31 720 p	3.2	16 520 p	2.2	5 330	2.3	9 870	5.7	:	:
CH	52 250	:	33 085	:	810	0.3	18 355 e	4.2	:	:
HR	8 543	-9.9	2 228	-2.7	2 722	-2.6	3 579	-16.7	14	:
TR	49 251	15.5	14 993	27.9	8 825	13.6	25 434	10.9	:	:
CN	1502472	9.4	987834	13.0	272133	1.4	242505	7.2	:	:
JP	935182	0.9	619184	2.0	63196	0.1	238813	-0.9	:	:
RU	928 320	-1.6	527 130	-3.3	297 880	1.4	100 990	-0.4	2 320	-5.2

Exceptions to the reference year:
2005: FR, PT, UK, IS and TR;
2004: CH;

Exceptions to the reference Period:
2001-2005: FR, PT, UK, IS and TR;
2002-2004: CH;
2002-2006: BE, MT, AT and HR.

Source: Eurostat - R&D statistics and OCDE-MSTI

Figure 5: R&D personnel as a percentage of total employment, EU-27 and selected countries — 2005



Exceptions to the reference year:
2004: EU-25, AT, CH and HR;
Eurostat estimate: EU-27.
Provisional data: MT and NL.

Source: Eurostat - R&D statistics and OCDE-MSTI

In 2005, R&D activities accounted for 1.45% of total employment in the EU-27. However, R&D personnel intensity varied significantly across countries, with Nordic countries at the top of the ranking. With a share of 3.58%, Iceland registered the highest proportion of persons employed in R&D, followed by four Member States, Finland (3.22%), Sweden (2.71%), Luxembourg (2.59%) and Denmark (2.44%). R&D personnel intensity was also above 2% in Norway and Switzerland.

In Japan, 1.44% of total employment was related to R&D activities in 2005. This figure shows a decrease from previous years, being below the EU average (1.45%).

Ireland, Greece and the Netherlands remained very close to the EU-27 aggregate value.

All new Member States were below the EU average regarding R&D intensity, but these figures have increased in relation to previous years. Among them, the Czech Republic came in first with 1.37% of the population employed in R&D, followed by Slovenia (1.33%), Estonia (1.31%) and Hungary (1.27%). The rest of the new Member States together with Italy (1.23%) and Portugal (0.87%) were below 1.25%. Romania (with 0.45%) devoted the least human resources to R&D.

R&D personnel intensity in Croatia amounted to 1.26%, which is very close to the EU-27 average. Turkey, however, ranked last in the chart with only 0.44% of persons employed in R&D.

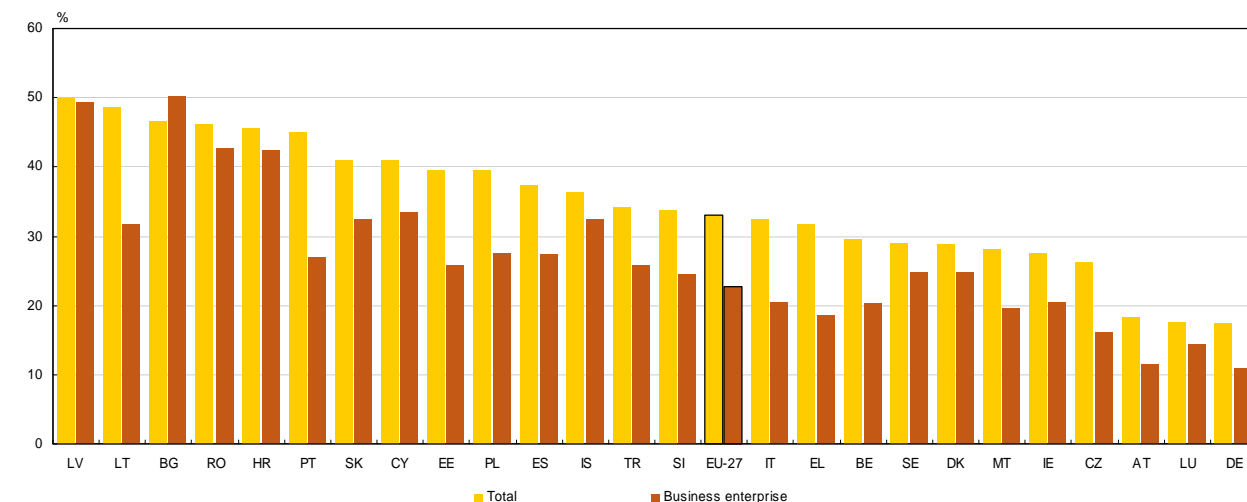
China is still at the bottom of the table with 0.18% of employment devoted to R&D activities.

Realising a single labour market for researchers

A key challenge for Europe is to train, retain and attract more competent researchers. Moreover, the seamless mobility of researchers across institutions, sectors and countries is even more important than for other professions: it is essential to better balance researcher supply and demand, particularly given their high specialisation and relatively low numbers; it constitutes one of the most efficient vehicles for the transmission of knowledge; and it is an increasingly important requirement for the development of skills and careers in science. Today, most researchers in Europe still find their opportunities curtailed by institutional and national boundaries, poor working conditions and narrow career prospects. In practice, academic positions still remain largely reserved for national or even internal staff. Transparent competition for recruitment is the exception rather than the rule. Mobility across borders or between academia and industry tends to be penalised rather than rewarded. Administrations do not usually allow researchers to receive or carry research grants across borders.

Source: Green Paper on the European Research Area: New Perspectives — 2007

Figure 6: Share of women (FTE) among R&D personnel, total and business enterprise sector, EU-27 and selected countries — 2005



Exceptions to the reference year:
2004: ES (Total), AT and HR.
Provisional data: EL (total) and MT.
Break in series: CZ.

Source: Eurostat - R&D statistics

R&D is employing more women in Europe

Figure 6 shows the share of women in full-time equivalent (FTE) among R&D personnel as a total and within the BES.

In 2005, 33% of persons employed in R&D in the EU-27 were women, up by 3% in relation to the previous year.

Regarding data on total R&D personnel, in five Member States the female presence represented more than 45% of the total: Latvia (49.8%), Lithuania (48.5%), Bulgaria (46.5%), Romania (46.2%) and Portugal (45.1%). This tendency was also observed in Croatia, with a share of 45.6% of women.

Aside from Portugal (45.1%) and Spain (37%), the tendency in old Member States was below average with respect to the integration of women among R&D personnel.

Women made up less than 20% of R&D staff in Austria, Luxembourg and Germany.

The business enterprise sector follows the same pattern as the total figures. The BES in Bulgaria employed over 50% of women in R&D activities, followed closely by Latvia (49.4%), Romania (42.7%) and Croatia (42.5%). Female staff employed in the business sector in Lithuania (31.7%) and Portugal (26.9%) were far fewer than the total average for these countries, which indicates that women working in R&D were mainly employed either by the government, by higher education institutions or by non-profit organisations.

In the EU-27, The business sector employed 23% of women in R&D. Nordic countries such as Sweden and Denmark were very close to this average, while Austria (11.5%) and Germany (11.0%) lagged behind.

The percentage of women employed in R&D in Turkey was higher than in the EU-27, both in the total (34.2%) and in the BES (25.9%), and has increased in comparison with the previous year.

➤ ESSENTIAL INFORMATION — METHODOLOGICAL NOTES

Research and experimental development

Research and experimental development activities (R&D) 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.

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.

For the computation of R&D intensity at national level, GDP from national accounts is used as reference data.

R&D personnel

Data on R&D personnel measure the resources going directly to R&D activities. The 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, § 294–296).

Full-time equivalent — FTE

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

Institutional classifications

R&D expenditure and personnel are broken down with reference to the four institutional sectors in which the R&D takes place.

The business enterprise sector (BES)

With regard to R&D, the business enterprise sector includes: all firms, organisations and institutions whose primary activity is the market production of goods or services (other than higher education) for sale to the general public at an economically significant price and the private non-profit institutions mainly serving them (Frascati Manual, § 163).

The government sector (GOV)

In the field of R&D, the government sector includes: all departments, offices and other bodies which furnish but normally do not sell to the community those common services, other than higher education, which cannot otherwise be

conveniently and economically provided, and administer the state and the economic and social policy of the community (public enterprises are included in the business enterprise sector) as well as PNPs controlled and mainly financed by government (Frascati Manual, § 184).

The higher education sector (HES)

This sector comprises: all universities, colleges of technology and other institutes of post-secondary education, whatever their source of finance or legal status. It also includes all research institutes, experimental stations and clinics operating under the direct control of or administered by or associated with higher education establishments (Frascati Manual, § 206).

The private non-profit sector (PNP)

This sector covers: non-market, private non-profit institutions serving households (i.e. the general public) and private individuals or households (Frascati Manual, § 194).

European aggregates

For R&D expenditure and personnel, EU totals are calculated as the sum of the national data by sector. If data are missing, estimates are first made for the country in question, reference period, institutional sector or relevant R&D variable, as appropriate.

Reference Year:

The reference year used for figure 1, table 2 and table 4 is 2006 while for figure 3, figure 5 and figure 6 2005 is used as reference year due to data availability.

Sources

Eurostat — R&D statistics (data for US and JP through OECD Main Science and Technology Indicators).

General abbreviations

e	estimated value
p	provisional value
s	Eurostat estimate
b	break in series
i	more information in metadata
:	not available

Reference manual

Standard method proposed for research and experimental development surveys — Frascati Manual, OECD, 2002.

Data presented in this Statistics in Focus reflect the data availability in Eurostat's reference database and OECD Main Science and Technology Indicators (MSTI) 2008/1.




Further information

Data: [Eurostat Website: http://ec.europa.eu/eurostat](http://ec.europa.eu/eurostat)

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