Statistics in focus

SCIENCE AND TECHNOLOGY

7/2006

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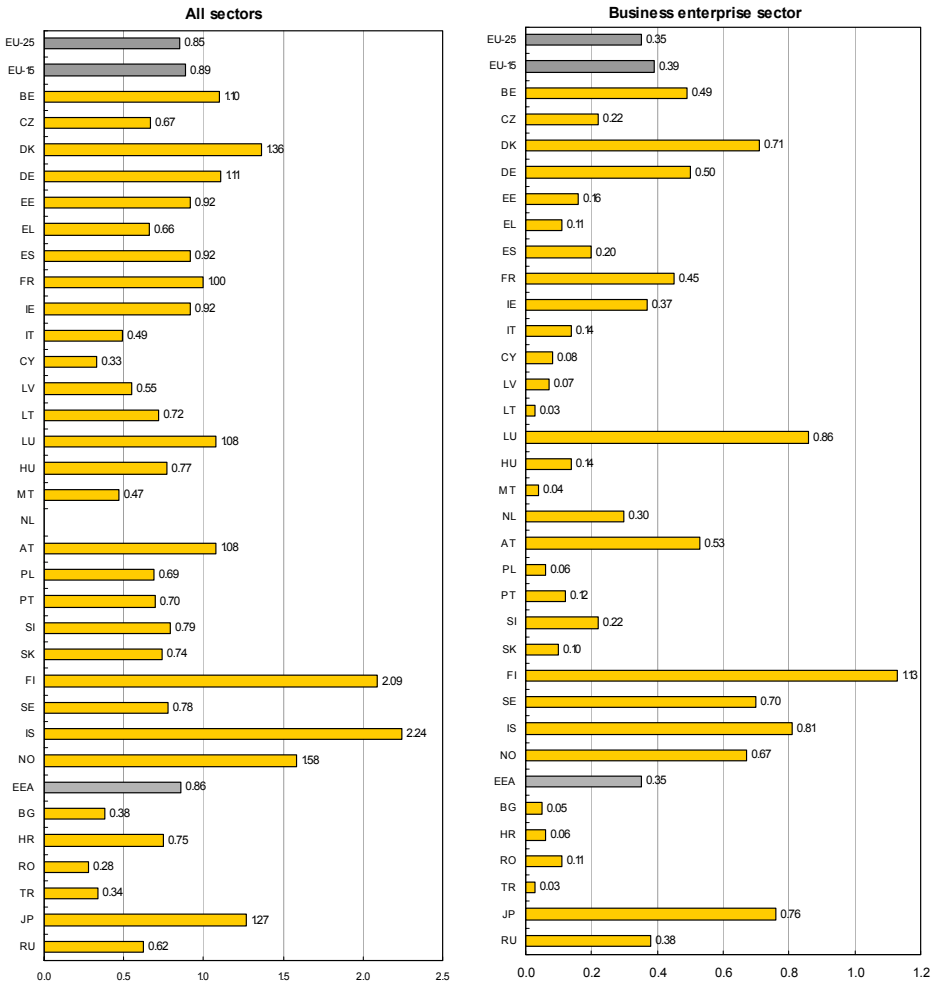
Contents

Manuscript completed on: 27.01.2006
Data extracted on: 8.12.2006
ISSN 1609-5995
Catalogue number: KS-NS-06-007-EN-N

R&D personnel

In the EU Finland employs the most Research & Development personnel and researchers, relative to total employment

Figure 1: R&D researchers as a percentage of total employment — 2003



Source: Eurostat and OECD
Exception to the reference year: 2002: AT, FI and TR
National estimations: SI. Provisional data: IE in All sectors; Eurostat estimations: EU-15, EU-25 and EEA

Main findings

- More than 2% of all persons employed in Iceland and Finland worked as researchers in 2003. Within the business enterprise sector (BES) Finland took the lead, with researchers accounting for 1.13%.
- At EU-25 level, the percentage of R&D personnel reached 1.44% of total employment in 2003, with an annual average growth rate (AAGR) in full time equivalents (FTE) of 1.92% between 1999 and 2003. Japan's rate for this indicator stands at 1.66%, but their AAGR is negative (-1.01%).
- Latvia (53%) and Lithuania (48%) employ the highest proportion of female researchers in 2003, followed by Bulgaria and Portugal.
- In larger EU countries such as Germany, Italy, France and the United Kingdom, more than 60% of the researchers in the business enterprise sector are employed in large enterprises with more than 500 employees. In Germany this ratio exceeds even 80%.

Iceland and Finland have the highest percentage of researchers & R&D personnel

In Iceland (2.24%) and Finland (2.09%) more than 2% of all persons employed are active as researchers in 2003 (compare Figure 1). Norway and Denmark show respective shares of 1.58% and 1.36% followed by larger countries such as Japan (1.27%) and Germany (1.11%). At the lower end Romania, Cyprus, Turkey and Bulgaria researchers represent from 0.28% to 0.38% of total employment, well below the EU-25 and EU-15 averages of 0.85% and 0.89%.

Within the business sector, Finland took the lead, researchers accounting for 1.13% of total employment, almost three times the EU-25 average of 0.35%. Luxemburg (0.86%), Island (0.81%) and Japan (0.76%) follow in the ranking. For most new EU Member States and Candidate Countries this value is less than one third of the EU-15 average of 0.39%, and in Turkey, Lithuania, Malta and Bulgaria only 0.03% to 0.05%.

Table 1: R&D personnel (HC) as a percentage of total employment and in Full time equivalent (FTE), annual average growth rate (AAGR) — 1999-2003

	R&D personnel (HC) as a % of employment		R&D personnel in FTE			AAGR (in FTE)
	2002	2003	2002	2003	2004	1999-2003
EU-25	1.43 s	1.44 s	1 998 209 s	2 021 395 s	2 047 530 sp	1.92 s
EU-15	1.54 s	1.54 s	1 829 740 s	1 850 998 s	1 872 670 sp	2.16 s
BE	1.81	1.82	52 038	52 240	53 938 f	1.37
CZ	1.13	1.18	26 032	27 957	28 765	3.77
DK	2.27	2.29	42 405 r	41 616 r	44 321 p	3.37 r
DE	:	1.85	480 004	472 533	469 100 e	-0.37
EE	1.19	1.29	4 129	4 144	4 735 p	-2.28
EL	1.36	1.34	30 226	31 822 p	31 843 p	4.80 p
ES	1.40	1.45	134 258	151 487	161 933	10.33
FR	1.71	1.73	343 618	346 078	:	2.42
IE	1.39	1.43 p	13 582	14 450 r	15 713 e	4.13 r
IT	1.16	1.13	164 023	161 828	:	3.23
CY	0.61	0.64	822	922	940 p	7.87
LV	0.93	0.80	5 294	4 858	5 103	3.09
LT	0.95	0.99	9 531	9 648	10 557	-6.81
LU	:	2.20	3 663	4 010	:	3.06
HU	1.26	1.24	23 703	23 311	22 826	2.25
MT	0.06	0.65	475	413	395 u	:
NL	1.52 s	1.50 s	87 415	85 987	89 522 p	-0.23
AT	1.79	:	38 893	:	:	5.57
PL	0.89	0.92	76 214	77 040	78 362	-1.66
PT	0.81 e	0.86	24 250 e	25 529	:	5.25
SI	1.34	1.40 e	8 615	8 731 e	8 830 e	0.69 e
SK	1.00	0.97	13 631	13 354	14 329	-2.62
FI	3.04	3.11	55 044	57 196	58 281	3.11
SE	2.56	2.49	72 087	72 978	72 459	2.28
IS	3.19 f	3.48	:	2 940	3 050	5.31
NO	2.23	2.26	27 333	29 014	:	3.38
EEA	1.44 s	1.45 s	2 028 490 s	2 053 352 s	2 080 407 sp	1.94 s
BG	0.60	0.61	15 029	15 453	15 647	-1.00
HR	1.09	1.12	12 960	9 148	:	:
RO	0.39	0.43	32 799	33 077	33 361	-6.93
TR	0.38	:	28 964	:	:	6.08
CN			1 035 197	1 094 831	:	7.44
JP	1.58	1.66	857 300 b	882 414	:	-1.01
RU	1.32	1.30	986 854	973 382 r	951 569	-0.40 r

Source: Eurostat and OECD

Annual average growth rate: (AAGR)

Exceptions to the reference period 1999-2003: LU: 2000-2003; AT: 1998-2002; TR: 1999-2002

Exceptions to the reference year 2002: EL, SE: 2001; LU, MT: 2000

A similar picture emerges for R&D personnel as a percentage of total employment (Table 1). Iceland and Finland are again in the lead for both 2002 and 2003, with values above 3%. Sweden, Denmark, Luxemburg and Norway follow with values above 2% and Germany, Belgium and France all exceeded the EU-25 average in 2003.
At EU-25 level, R&D personnel represented 1.44% of total employed persons in 2003 with an AAGR in full time equivalents (FTE) of 1.92% between 1999 and 2003. The rate for Japan (1.66%) is higher, but like Russia, Germany, the Netherlands, some new EU Member States and Candidate Countries, their AAGR is negative.

Based on Full time equivalents (FTE), researchers represent a remarkably high percentage of total R&D personnel (Table 2) in Portugal (79%), Poland (77.8%) and Slovakia (74.8%), compared with an EU-25 average for 2004 of 59%. The equivalent figure for Japan reached 77% in 2003, whereas in Russia it stood at only 50%. Within the BES, the highest contingent of researchers among R&D staff are found in Japan (79%) and the Nordic countries Finland (72%) and Norway (71%).

Table 2: Researchers as a % of total personnel (in FTE) — 2004

	Researchers as a % of total R&D personnel in 2004 - FTE			
	TOTAL	BES	GOV	HES
EU-25	59.0 sp	54.6 sp	54.6 sp	68.4 sp
EU-15	57.9 sp	54.6 sp	53.0 sp	66.2 sp
BE	59.1 f	51.9 f	52.8 f	74.4 f
CZ	56.7	48.4	62.8	70.0
DK	61.3 p	56.9 p	71.6 p	70.1 p
DE	57.5 e	54.3	55.6 e	68.2 e
EE	71.2 p	61.0 p	60.0	78.6
EL	49.2 p	37.5 p	41.9 p	59.8 p
ES	62.9 e	45.3 e	63.1 e	81.5 e
FR	55.7	52.1	47.8	67.6
IE	69.4 e	64.2 e	45.7	85.7
IT	43.5	39.5	44.4	46.8
CY	55.3 p	50.0 p	28.6 p	94.9 p
LV	65.1	50.9	48.4	74.3
LT	69.7	49.3	55.1	79.5
LU	48.6	45.5	68.3	88.3 u
HU	65.3	64.3	61.8	69.2
MT	68.9 u	54.3 u	23.1	76.6
NL	45.0 e	43.5 e	57.1 e	41.7 e
AT	62.0	59.9	48.5	70.6
PL	77.8	64.2	65.0	87.2
PT	79.3	62.0	70.0	90.3
SI	56.7 e	38.4 e	73.1 e	87.8 e
SK	74.8	52.3	67.1	89.3
FI	70.4	71.7	57.2	73.1
SE	67.3	60.0	76.7	81.2
UK	:	63.0	44.0 e	:
IS	65.2	61.8	60.3	77.3
NO	:	71.2	66.2	80.0
EEA	59.2 sp	54.9 sp	54.8 sp	68.5 sp
BG	62.8	57.4	59.4	77.8
HR	64.1	42.2	65.9	75.2
RO	63.7	55.5	64.2	81.7
TR	82.8	62.5	50.1	100.0 u
JP	76.5	79.0	54.5	76.9
RU	50.2	45.3	52.4	71.3

Source: Eurostat and OECD

Exceptions to the reference year:

FR, IT, LU, UK and NO (BES only), HR and JP 2003
AT and TR 2002

In Latvia, female researchers are in the majority

The percentage of female researchers (Table 3) is particularly high in the Baltic countries, Bulgaria and Portugal (all well above 40%). Low representation of women as researchers is reported for Luxembourg (17%), Germany (19.2%) and for Japan (only 11.6%). In the BES Japan, Netherlands, Austria and Germany display the lowest level of female researchers, where in Latvia (54%) women researchers are in the majority in all sectors observed.
For almost two-thirds of countries, the largest proportion of female researchers is found in the Government (GOV) sector, with Estonia (60%), Portugal (58%) and Latvia (56%) scoring the top values. Roughly one third have reported their highest share for the Higher Education sector, but in no country is highest proportion of female researchers found in the BES.

Table 3: Percentage of women researchers (in HC) — 2003

	% of women on researchers in 2003 - HC			
	TOTAL	BES	GOV	HES
EU-25	:	:	:	:
EU-15	:	:	:	:
BE	28.3	19.6	29.8	35.6
CZ	28.3	19.5	32.6	32.9
DK	28.4	25.1	34.9	31.3
DE	19.2	11.6	27.1	25.0
EE	43.1	23.7	59.5	45.1
EL	36.8	34.7	38.9	36.9
ES	36.3	26.6	44.5	37.7
FR	27.8	20.3	32.0	34.1
IE	31.0 p	20.3	30.6	38.8 p
IT	29.3	19.3	38.7	30.8
CY	30.9	22.3	40.1	31.0
LV	53.1	54.0	55.5	52.5
LT	48.3	36.5	50.3	48.7
LU	17.4 i	14.2 e	28.5	42.9 u
HU	35.1	24.5	39.9	36.8
MT	:	:	22.2	24.3
NL	:	8.7	20.0	:
AT	20.7	10.4	34.6	30.0
PL	39.3	25.2	41.1	40.5
PT	44.3	29.7	57.9	45.9
SI	34.4 e	28.3 e	43.3 e	33.0 e
SK	40.6	30.9	45.2	41.4
FI	29.9 i	18.4 i	40.7 i	52.7 i
SE	36.1	25.2	36.4	43.7
UK	:	:	32.2	:
IS	39.4	33.0	42.1	43.1
NO	29.4	18.9	35.6	37.6
EEA	:	:	:	:
BG	46.6	47.5	50.7	37.8
HR	42.2	40.1	45.9	40.4
RO	43.0	41.8	49.2	40.3
TR	35.6	25.0	27.5	37.0
JP	11.6	6.6	11.7	20.4
RU	43.3	42.6	45.9	38.2

Source: Eurostat and OECD

Exceptions to the reference year:

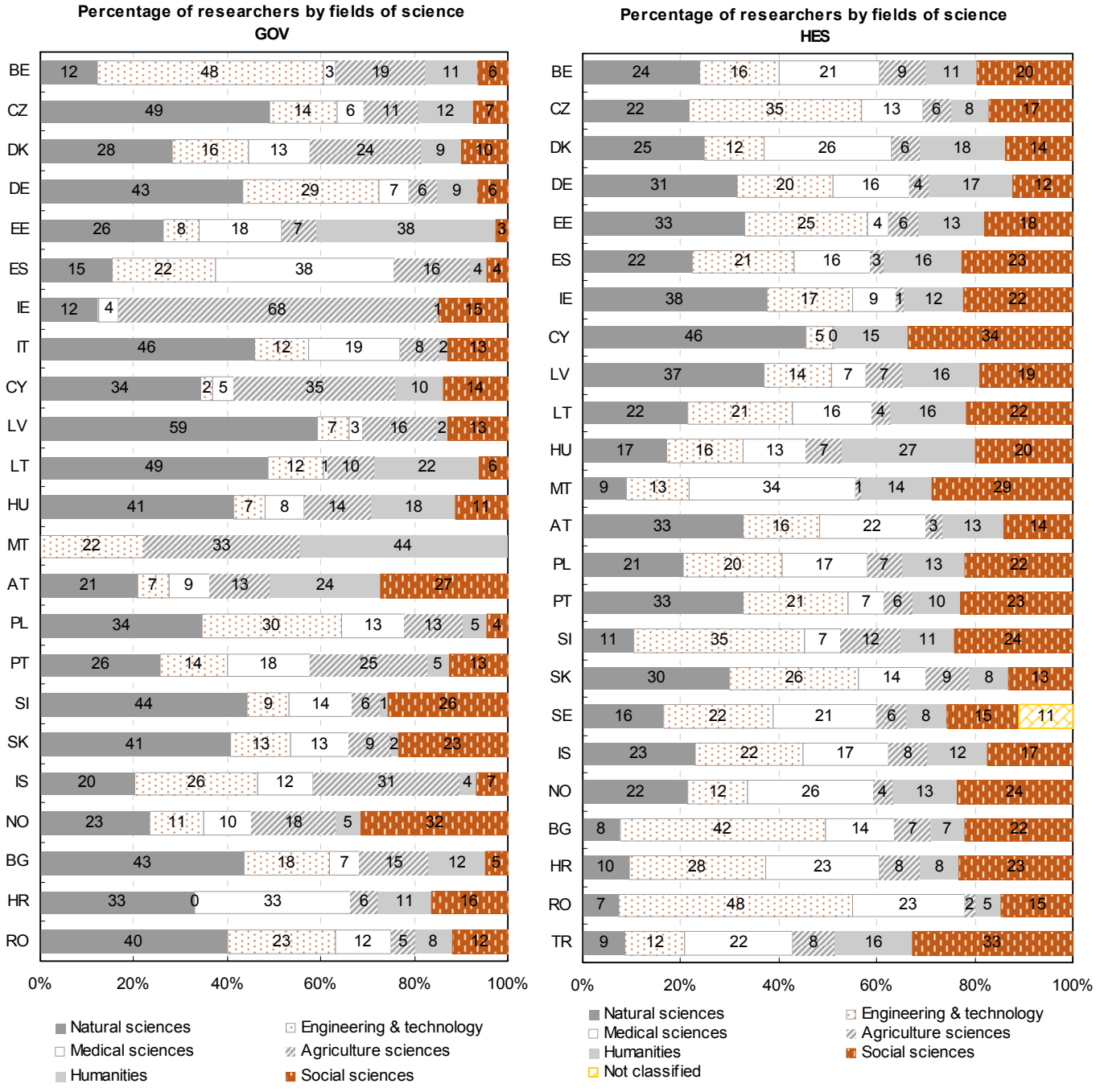
TOTAL: 2002: AT, FI and TR
BES: 2002: AT, FI and TR; 2000: CH
GOV: 2002: AT, FI, CH and TR; 2001: NL
HES: 2002: AT, FI, CH and TR

FI: University graduates instead of researchers
LU: Data in the Total sectors with reference to the HES correspond to 2001

Natural sciences are the most important field of Governmental research

Natural sciences are the most important field of science in which Government and Higher Education researchers are active in 2003 (Figure 2). This is notably observed in the GOV sector, where almost half of the countries display more than 40% of the government researchers classified in the *Natural Sciences* with Latvia (59%), Czech Republic (49%) and Lithuania (49%) heading the list. However, remarkably high shares of researchers in other GOV sector fields of sciences are found in Ireland (68% in *Agriculture*), Belgium (48% in *Engineering & Technology*), Spain (38% in *Medical Sciences*). *Social Sciences* is most frequented domain in Norway and Austria, *Humanities* are of particular importance in Malta and Estonia.

Figure 2: Total researchers in full time equivalent (in FTE) by fields of science as a percentage of total Government and Higher education sector — 2003



Source: Eurostat

Exceptions to the reference year 2003:
GOV: AT and SI: 2002; IS: 2001 HES: AT, SI and TR: 2002; SE and IS: 2001

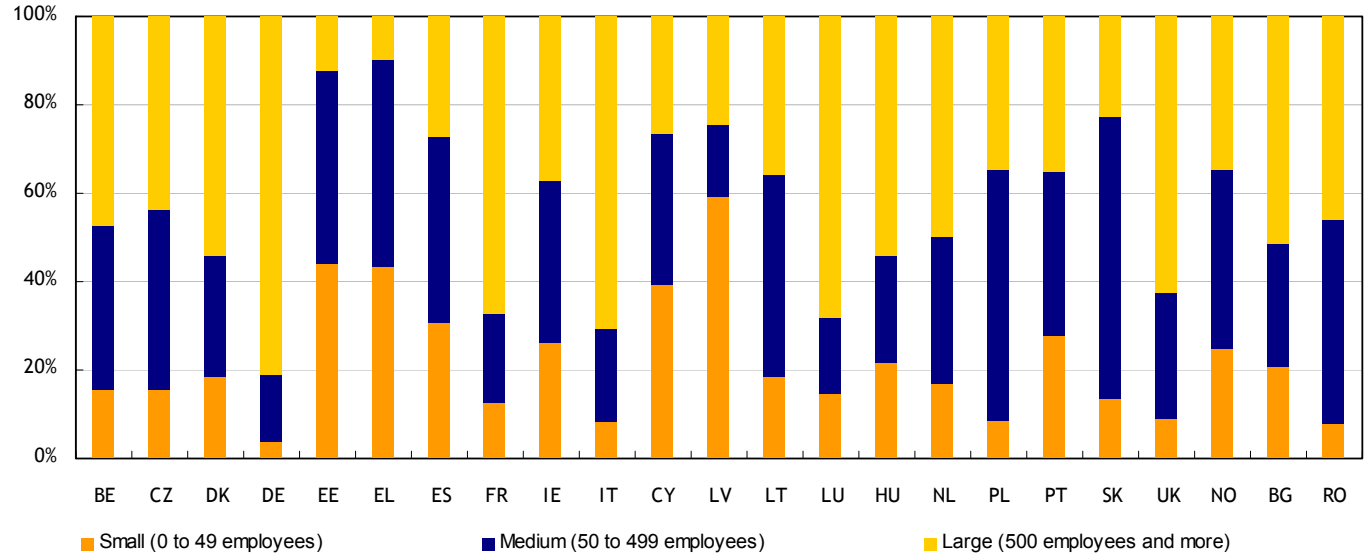
For the Higher Education sector (HES) the *Engineering & Technology* domain shows about the same FTEs of active researchers as the *Natural Sciences*,, whereas *Agricultural research* is much less present than in the GOV sector.

In Romania, Bulgaria, Czech Republic, Slovenia and Croatia, *Engineering* is the biggest field employing researchers. *Natural Sciences* is especially popular in Cyprus (46%), Ireland (38%), Latvia (37%), Estonia, Portugal, Austria, Germany and Slovakia (all above 30%). *Social Sciences* is the most prominent area in Turkey, Spain and Poland. In the HES the field of *Social Sciences* shows in average significantly higher engagement of researchers than in the Government sector. The range of researchers' shares in *Social Sciences* for all countries is much smaller than in the other areas of the HES, since there are no remarkable high or low percentages found for individual countries.

Interestingly, *Humanities* has the highest share of researchers in the HES in Hungary (27%) and the lowest for the EU Candidate Countries Romania, Bulgaria and Croatia.

In larger countries, researchers are mainly employed by large companies

Figure 3: Business Enterprise Sector researchers in FTE broken down by size — 2003



Source: Eurostat

In the larger EU countries, Germany, Italy, France and the United Kingdom, more than 60% of the researchers in the Business Enterprise Sector are employed in enterprises with more than 500 employees. In Germany, this ratio even reaches 81%, and in Italy, 71%. Particularly in smaller countries such as Greece, Estonia, Slovakia, Latvia or Cyprus this proportion is well below 30%, with Greece and Estonia marking the lower end at 10% and 12% respectively. Exceptions to this general observation are noted for Spain with a share of the researches at large firms of only 27% and in the other direction for Luxemburg, where 68% of the researchers are employed by large companies.

Slovakia (64%) and Poland (57%) display very high shares of staff conducting research for medium sized firms (50 to 499 employees), but the trend is towards an engagement of researchers with large sized enterprises than with small sized ones, since e.g. for Poland the respective ratios for medium sized and large companies together add up to 91%.

This proportion is even exceeded for Romania (92%), with an equal share of researchers in the two size classes (46%).

In Latvia almost 60% of the Business Enterprise Sector researchers are active in small companies (0 to 49) employees, showing by far the highest proportion for this company size class. In Estonia, Greece and Cyprus, small enterprises accounted for a share of 40% to 45%. The share of researchers employed by medium sized companies of the BES is however roughly at the same level for these counties.

Percentage of R&D personnel in top regions three times higher than the EU-25 average

Figure 4.1: Regional disparities for R&D personnel as a percentage of the employment, All sectors, EU25 — 2003

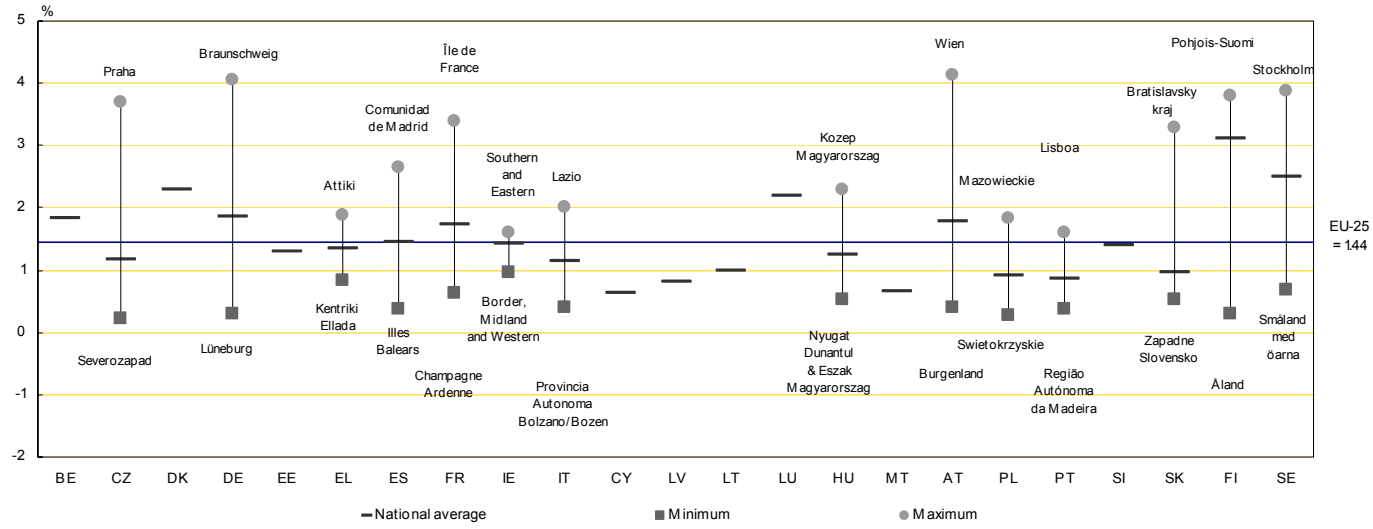
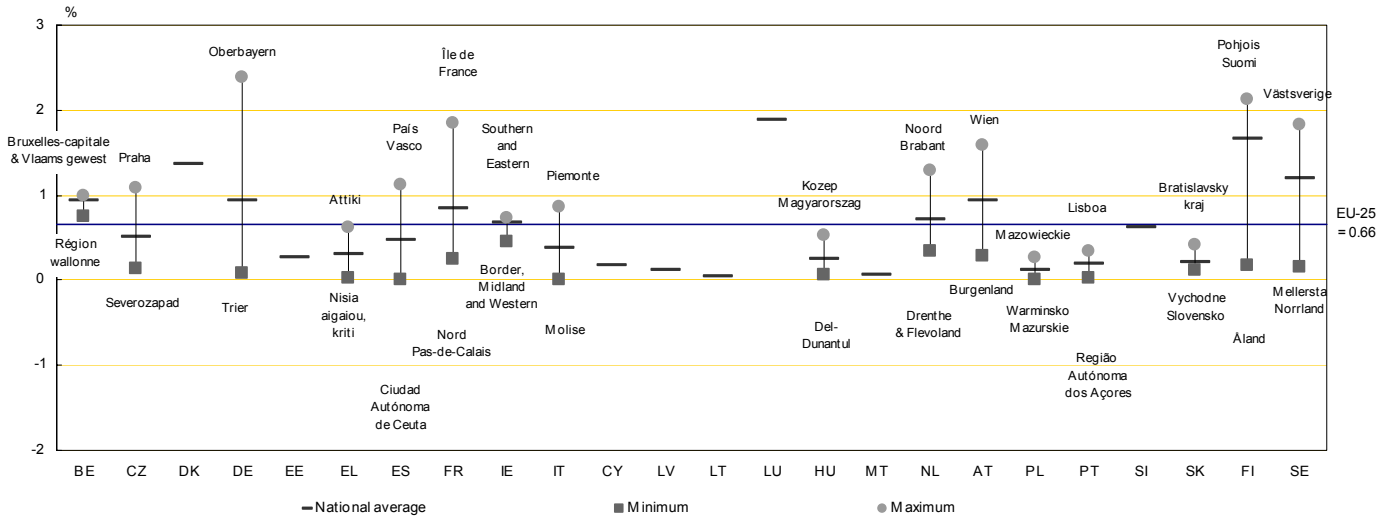


Figure 4.2: Regional disparities for R&D personnel as a percentage of the employment, Business enterprises sector (BES), EU25 — 2003



Source: Eurostat

All sectors
Exceptions to the reference year:
2002: AT; 2001: FR; 1999: SE
Data at NUTS 1 level: EL

BES
Exceptions to the reference year:
2002: AT; 2001: FR
NUTS1: BE, EL

Investigating regional disparities, in the top regions for all sectors (*Wien* 4.14%) and for the BES (*Oberbayern* 2.38%) the number of R&D personnel as a percentage total employment is about three times higher than the EU-25 average.

Looking at the national differences for all sectors, the spread between regions with the lowest and highest proportions of R&D personnel are particularly large in Austria (*Wien* to *Burgenland,* with a difference of 3.75 % points), Germany (*Braunschweig* to *Lüneburg*, 3.75), Finland (*Pohjois-Suomi* to *Åland*, 3.49) and Czech Republic (*Praha* to *Severozapad*, 3.47). An especially small range (0.63, 1.06 and 1.21 percentage points) is recorded for Ireland, Greece and Portugal.

The regional differences in the BES show again Germany (*Oberbayern* to *Trier*) and Finland (*Pohjois-Suomi* to *Åland*) (2.3 and 1.95 percentage points of difference respectively), whilst Belgium (*Région de Bruxelles-capitale & Vlaams gewest* to *Région wallonne,* 0.24) and Poland (*Mazowieckie* to *Warminsko-Mazurskie*, 0.25) have the smallest differences.

➢ ESSENTIAL INFORMATION – METHODOLOGICAL NOTES

Research and experimental development — R&D

Research and experimental development — 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.

Institutional classifications

Internal expenditure and R&D 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, organizations 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 Manua*l, § 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.

R&D indicators:

- R&D personnel

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 Manua*l, § 294-296.

- Researchers

Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, and in the management of the projects concerned — *Frascati Manua*l, § 301.

- Full-time equivalent — FTE

One FTE may be thought of as one person-year. For instance, a person who normally spends 40 % of his time on R&D and the rest of it on other work (e.g. lecturing, university administration, guidance) should be counted as only 0.4 FTE — *Frascati Manua*l, section 5.3.3.

- Personnel by number of individuals — HC

The number of individuals who are employed mainly or partly on R&D — *Frascati Manua*l, section 5.3.2.

- R&D personnel and researchers as a percentage of employment

The source for the employment statistics is the European Labour Force Survey (EU LFS).

Fields of science

The classification by fields of science is based on the nomenclature suggested by Unesco: *Recommendation concerning the International Standardisation of Statistics on Science and Technology* — see the *Frascati Manual* sections 4.4, 3.6.2 and 3.7.2.

European aggregates

For R&D 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. This method is not identically applied to the calculation of R&D personnel in head count (HC). The estimates for R&D personnel in full-time equivalent (FTE) serve as a basis for the HC calculation. An FTE/HC ratio based on available FTE and HC personnel data at the 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.

Sources

United States, Japan and China: OECD, *Main Science and Technology indicators* – MSTI 2005/1.

General abbreviations

AAGR	annual average growth rate
p	provisional value
e	estimated value
s	Eurostat estimate
r	revised value
f	forecast
b	break in series
i	more information in metadata
:	not available

Reference manual

*Standard method proposed for research and experimental development surveys — Frascati Manua*l, OECD, 2002.

Data presented in this Statistics in Focus shows the data availability in Eurostat's reference database as of 8 December 2005.

Further information:

Data:EUROSTAT Website/Home page/Science and technology/Data

- **Science and technology**
  - Research and development
    - Statistics on research and development
      - R&D expenditure
      - ***R&D personnel***
        - National R&D personnel
        - Regional R&D personnel

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