Statistics in focus

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Contents

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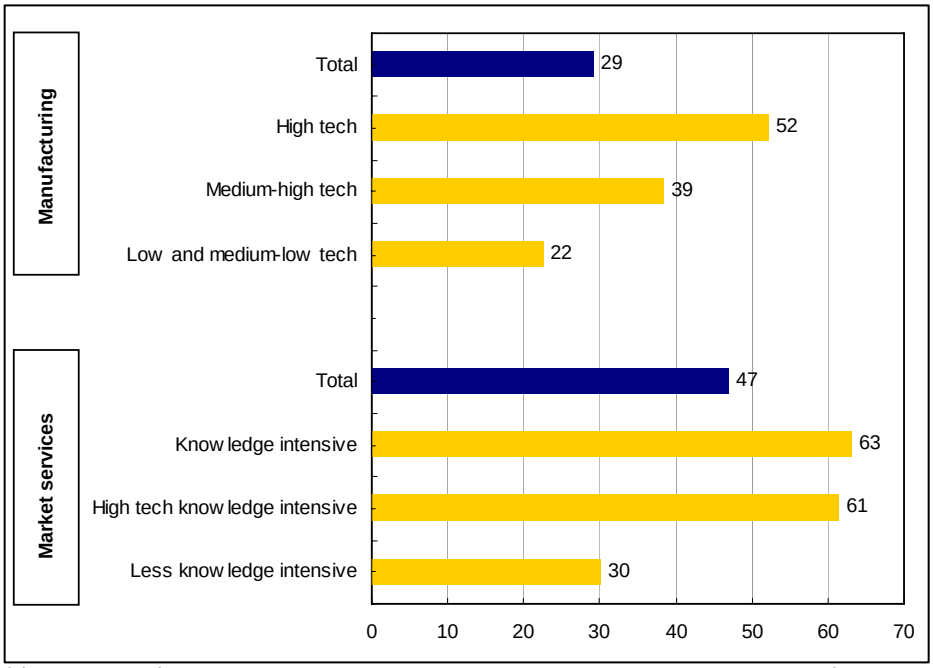
High tech industries and knowledge based services

The importance of R&D and Human Resources in Science and Technology

Figure 1: Proportion of Human Resources in Science and Technology (HRST), as a percentage of employment, in manufacturing and services sectors, EU-25(1) — 2004



(1) Eurostat estimate.

Source: Eurostat/EU-LFS.

Main findings

- Within the EU-25, 53.6 million HRST — *Human Resources in Science and Technology* — were employed in the services sector and 9.4 million in the manufacturing sector in 2004. In relative terms, HRST represented 47% of total employment in services, but only 29% in the manufacturing sector.
- The share of Scientists and Engineers (S&E) among HRST varied markedly across sectors. At the EU-25 level it was highest in the high tech Knowledge Intensive Services sector (KIS) with 35.3%, followed by the high tech manufacturing sector with 27.5%.
- In the total services sector the proportion of women among HRST in the EU-25 (53%) was significantly higher than in the manufacturing sector (28%). The percentage was even higher in the KIS sector (56%).
- Five capital regions — Île de France (FR), Région de Bruxelles-Capitale (BE), Communidad de Madrid (ES), Manner-Suomi (FI) and Berlin (DE) — were among the top 15 regions in terms of proportion of HRST, both in the high and medium-high tech manufacturing sector and in the high tech KIS sector.
- In 2003, the proportion of researchers among business enterprise R&D personnel was generally higher in the high tech manufacturing sector than in the manufacturing sector as a whole.
- Germany, Hungary and the United Kingdom spent more than 90% of their total Business R&D expenditure in the high tech and medium-high tech manufacturing sectors.

Finland had the highest share of Scientists and Engineers in the high tech sectors

Human resources in science and technology (HRST) made up 47% of total employment in the market services sector within the EU-25 in 2004 (Figure 1).

The share was significantly higher when the Knowledge Intensive Services sector (KIS) and the high tech KIS sector are taken into account, giving HRST rates of 63% and 61% respectively of total employment in these sectors.

By comparison, in the total manufacturing sector, only 29% of the total employment was HRST, although in the high tech manufacturing sector this figure reached 52%.

In absolute terms, 53.6 million HRST were employed in the services sector within the EU-25 in 2004. Among these, 36.8 million were employed in KIS and 3.6 million in high tech KIS (see Table 1).

In terms of HRST in the services sector, Germany recorded the highest figures with 10.9 million persons employed, followed by the United Kingdom, France, Italy, Spain and Poland with 8.0, 7.1, 5.8, 4.7 and 3.1 million respectively. Of the 10.9 million HRST in German services, 7.0 million were employed in the KIS, of which 659 000 in high tech KIS. Only six other EU-25 Member States totalled more than 100 000 HSRT in the high tech KIS: France (627 000), United Kingdom (618 000), Italy (375 000), Spain (291 000), Poland (147 000) and Sweden (139 000).

In 2004, the manufacturing sector employed 9.4 million HRST in the EU-25, of which 3.8 million were employed in medium-high tech manufacturing and 1.0 million in high tech manufacturing.

Three Member States together accounted for more than half of the HRST employed in EU-25 manufacturing: Germany (2.6 million), well ahead of France (1.3 million) and the United Kingdom (1.1 million). These were also the only three Member States with over 100 000 HRST employed in high tech manufacturing.

Table 1: Total HRST in thousands and percentage of Scientists and Engineers (S&E) in the manufacturing and services sectors, EU-25 and selected countries — 2004

	Manufacturing						Services					
	Total		High tech		Medium-high tech		Total		KIS		High tech KIS	
	HRST	% of S&E	HRST	% of S&E	HRST	% of S&E	HRST	% of S&E	HRST	% of S&E	HRST	% of S&E
EU-25	**9 432 s**	**17.2 s**	**1 030 s**	**27.5 s**	**3 843 s**	**23.8 s**	**53 641 s**	**11.9 s**	**36 754 s**	**14.3 s**	**3 623 s**	**35.3 s**
EU-15	**8 226 s**	**17.8 s**	**946 s**	**28.4 s**	**3 458 s**	**24.1 s**	**46 858 s**	**12.1 s**	**32 364 s**	**14.4 s**	**3 270 s**	**35.1 s**
BE	241	12.5	18	20.8 u	97	14.9	1 440	18.9	1 038	23.5	95	44.3
CZ	263	10.2	17	15.4	100	15.9	1 071	9.5	704	12.8	72	34.1
DK	143	14.9	12	32.2 u	59	22.6	936	12.9	685	14.6	74	43.8
DE	2 562	20.7	304	29.2	1 267	27.5	10 882	11.6	7 027	14.2	659	36.9
EE	39	:	:	:	9 u	:	166	8.3	95	10.0 u	8 u	:
EL	98	13.5	3 u	:	25	25.5	1 051	15.2	724	17.5	36	37.4
ES	868	12.8	49	27.6	322	19.4	4 694	14.2	2 913	19.3	291	31.8
FR	1 256	23.6	179	36.1	521	27.5	7 098	11.2	4 743	13.0	627	34.5
IE	88	21.5	23	26.1	29	28.3	476	20.9	347	25.9	38	44.4
IT	920	8.9	96	10.9	378	13.4	5 765	11.5	4 288	13.1	375	16.8
CY	7	14.1 u	:	:	1 u	:	104	11.1	59	16.5	5	29.5 u
LV	30	21.1	:	:	4 u	:	236	10.4	138	13.5	11	27.4 u
LT	51	:	:	:	:	:	386	14.2	234	18.7	16 u	39.8 u
LU	4	26.9 u	:	:	:	:	69	12.1	44	13.3	3	45.1 u
HU	139	18.0	18	18.8 u	46	30.4	961	12.2	658	14.2	55	38.7
MT	3	:	:	:	:	:	28	9.6 u	21	11.2 u	2 u	:
NL	:	:	:	:	:	:	:	:	:	:	:	:
AT	204 bp	6.1 bp	22 bp	:	68 bp	8.1 up	994 p	8.8 p	597 p	12.4 p	49 p	33.9 p
PL	521	14.0	26	:	176	21.9	3 121	9.7	2 016	12.6	147	43.1
PT	91 b	16.3	8 b	:	31 b	:	804 b	14.7	556 b	17.2	34 b	25.5
SI	57	17.5 u	3 u	:	17	23.5 u	231	11.2	148	12.6	14	30.4 u
SK	96	9.6	9	:	28	16.6	479	8.1	317	10.8	24	26.5
FI	169	24.4	33	50.1	49	30.8	797	14.2	550	18.0	72	51.5
SE	202	17.0	29	29.5	88	21.7	1 546	14.2	1 126	16.9	139	48.3
UK	1 125	20.7	145	28.8	452	28.8	8 022	11.1	5 986	12.3	618	41.5
IS	4	:	:	:	:	:	47	16.1	35	20.3	4	43.7
NO	75	11.4	8	:	27	:	816	11.9	600	14.2	57	39.1
EEA	**9 511 s**	**17.2 s**	**1 039 s**	**27.5 s**	**3 871 s**	**23.7 s**	**54 504 s**	**11.9 s**	**37 388 s**	**14.3 s**	**3 684 s**	**35.4 s**
CH	193	21.5	34	32.2	85	27.9	1 346	14.9	961	16.7	85	53.6
BG	126	10.8	7 u	:	32	20.7 u	702	8.8	413	11.9	42	25.5
RO	297	:	11 u	:	99	:	1 245	:	754	:	50	:

Source: Eurostat/EU-LFS.

Table 1 also presents the share of Scientists and Engineers (S&E) among HRST. This share is higher in the total manufacturing sector (17.2%) than in the total services sector (11.9%).

Nevertheless, this share varies considerably across sub-sectors. Indeed, in medium-high tech manufacturing, 23.8% of HRST were S&E at the EU-25 level. In high tech manufacturing, the proportion of S&E was still higher (27.5%).

In the services sector, the proportion of S&E in the EU-25 varied even more significantly across sub-sectors. In fact, while 11.9% of HRST employed in total services were S&E, the respective proportions for KIS and high tech KIS were 14.3% and 35.3%.

The share of S&E among HRST also varied across Member States. In high tech and medium-high tech manufacturing, Finland led with 50.1% and 30.8% respectively.

In the total services and in KIS, Ireland led with 20.9% and 25.9% respectively of S&E among HRST. In high tech KIS, Finland was again in the lead with 51.5%.

Higher proportions of women among HRST in the new Member States

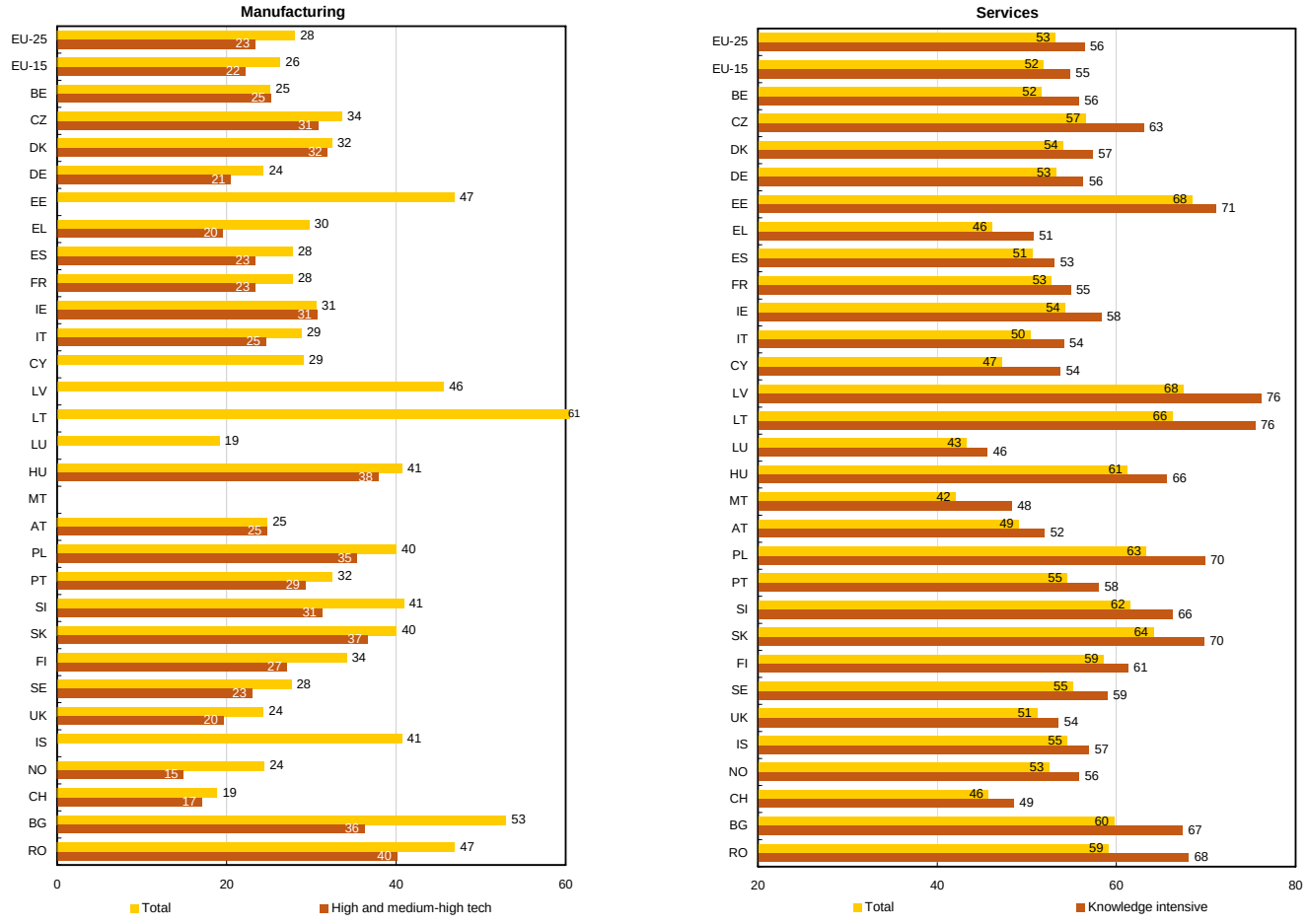
Figure 2 shows the percentage of women in HRST in the manufacturing and services sectors in 2004.

Within EU-25 the proportion of women was 28% in the total manufacturing sector and only 23% in the high and medium-high tech manufacturing sector. The percentage of women in total manufacturing was particularly high in Lithuania (61%), Bulgaria (53%), Romania (47%), Estonia (47%) and Latvia (46%).

In the total services sector the proportion of women in the EU-25 (53%) was generally higher than in the manufacturing sector (28%). The percentage of women in total services was particularly high in Latvia (68%), Estonia (68%), Lithuania (66%), Slovakia (64%) and Poland (63%).

Regarding the KIS sector, the proportion of women in the whole EU-25 (56%) was even higher than for the total services sector (53%). The percentage of women in the KIS sector was also significant in Latvia (76%), Lithuania (76%), Estonia (71%), Poland (70%) and Slovakia (70%).

Figure 2: Percentage of women in HRST in the manufacturing and in the services sectors EU-25 and selected countries — 2004



EU-25 and EU-15: Eurostat estimates.
Unreliable data: LU in total manufacturing
Data is not available for the Netherlands

Break in series: AT in manufacturing, PT
Provisional data: AT

Source: Eurostat/EU-LFS.

Capitals lead the way in terms of the proportion of HRST in high tech sectors

Figure 3 shows the leading regions (at NUTS level 1) in terms of the proportion of HRST in the high and medium-high tech manufacturing sector and in the high tech KIS sector in 2004.

The leading region for the high and medium-high tech manufacturing sector was Île de France (FR) with 73.9%. It was followed by Region de Bruxelles-Capitale (BE) and Canarias (ES), with shares of 67.7% and 55.9% respectively.

Five out of the top 15 regions were capital regions: Île de France (FR), Region de Bruxelles-Capitale (BE), Communidad de Madrid (ES), Manner-Suomi (FI) and Berlin (DE).

Moreover, Ireland — which is classified at NUTS level 1 — was among the top 15 regions in terms of proportion of HRST in high and medium-high tech manufacturing.

Of the fifteen leading regions, four were French, three Spanish, two Belgian and two German. Among the Spanish regions, Canarias (ES) ranked first with 55.9% and among the German regions it was Mecklenburg-Vorpommern (DE) with 50.5%. This is explained by the fact that, although those two regions had a rather low employment in high and medium-high tech manufacturing in 2004, their proportion of HRST in this sector was however significant.

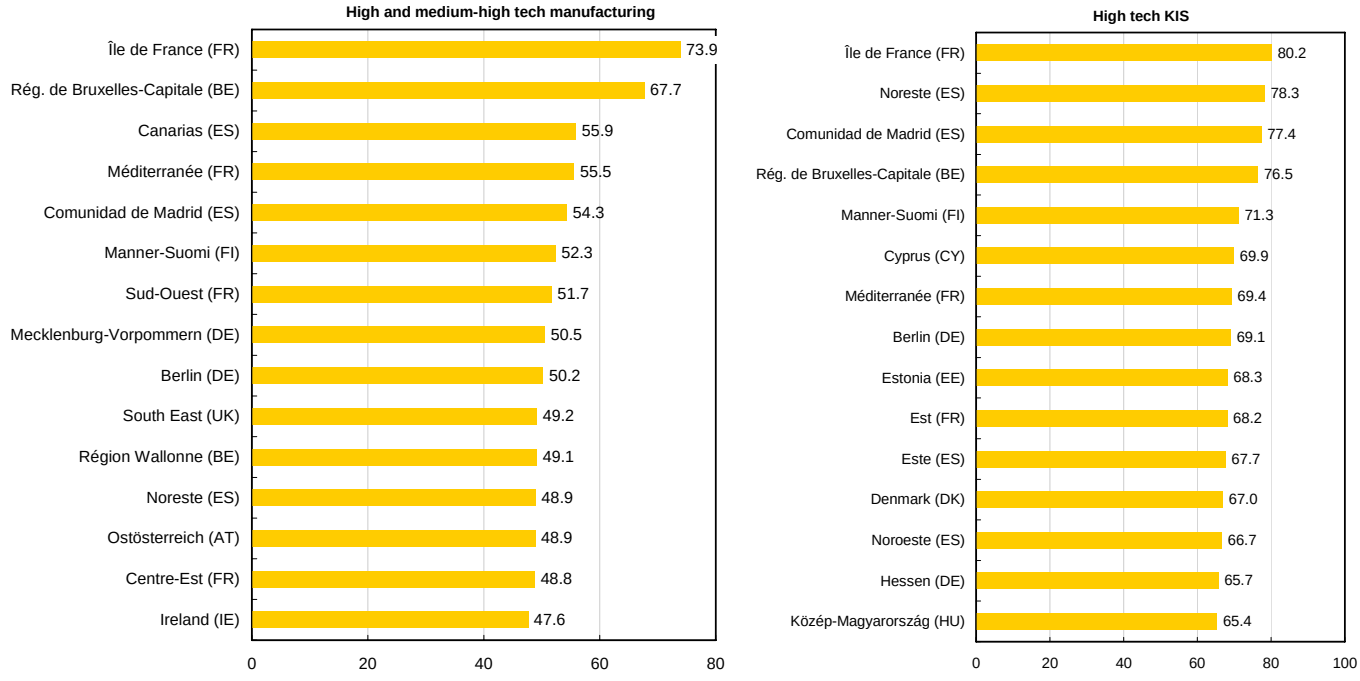
Looking at the proportion of HRST in the high tech KIS sector, Île de France was once again the leading region with 80.2%. It was followed by two Spanish regions, Noreste (ES) with 78.3% and Communidad de Madrid (ES) with 77.4%.

The five capital regions which are among the top 15 leading regions in terms of proportion of HRST in high and medium-high tech manufacturing in 2004, are also in the top 15 regions in terms of proportion of HRST in the high tech KIS sector for the same reference year. These are: Île de France (FR), Communidad de Madrid (ES), Region de Bruxelles-Capitale (BE), Manner-Suomi (FI) and Berlin (DE). The Hungarian capital region — Közép-Magyarország (HU) — is also ranked among the top 15 regions.

Of the fifteen leading regions, four were Spanish, three French and two German. As mentioned above, the first Spanish region was Noreste (ES) with 78.3%, the first French and German ones being the capital regions.

Moreover, three countries that are classified at NUTS level 1 were among the top 15 regions in terms of proportion of HRST in the high tech KIS sector: Cyprus, Estonia and Denmark.

Figure 3: Top 15 regions (at NUTS 1 level) with the highest proportion of HRST (as % of employment) in high and medium-high tech manufacturing sector and in high tech KIS sector — 2004



Unreliable data: Canarias (ES) in manufacturing and Estonia (EE) in services
Provisional data and break in series: Ostösterreich (AT)

Source: Eurostat/EU-LFS.

Highest proportion of researchers in high tech manufacturing

In the EU-25, the R&D personnel of business enterprises in the manufacturing sectors amounted to more than 800 000 Full Time Equivalents (FTE) in 2003.

Three countries were responsible for over 65% of the R&D personnel in the total manufacturing sector of the EU-25: Germany, France and the United Kingdom with 267 000, 135 000 and 119 000 persons respectively employed in FTE.

Germany also had the highest figure in the high tech manufacturing sector (58 000), followed by France, United Kingdom, Italy and the Netherlands with 36 000, 18 000, 12 000 and 11 000 respectively.

When taking into account the proportion of R&D personnel in high tech manufacturing compared to total manufacturing, Ireland, the Netherlands and Austria had a high proportion of R&D personnel employed in the high tech manufacturing sector.

In the medium-high tech manufacturing sector, the same countries, namely Germany, the United Kingdom and France again led in absolute terms with 184 000, 85 000 and 78 000 persons employed respectively.

In Cyprus, Hungary, Poland and the United Kingdom, approximately 70% of R&D personnel were employed in medium-high tech manufacturing.

In the EU-25 in 2003, more than half (51.5%) of total R&D personnel in the manufacturing sector as a whole were in fact researchers. This share varied considerably from country to country, exceeding 60% in Estonia, Ireland, Lithuania, Malta and the United Kingdom, but barely rising above 30% in Greece, Italy and Slovenia.

With the exception of Malta, the Netherlands, Slovenia and Slovakia, the proportion of researchers among R&D personnel was higher in the high tech manufacturing sector than in the total manufacturing sector. Hungary had the highest proportion, with 85.8% of researchers.

In medium-high tech manufacturing, Malta had the highest proportion of researchers, with 73.1%.

Table 2: Business enterprises R&D personnel in FTE and percentage of researchers, in the manufacturing sectors, EU-25 and selected countries — 2003

	Manufacturing									
	Total		High tech		Medium-high tech		Medium-low tech		Low tech	
	R&D personnel	% of researchers	R&D personnel	% of researchers	R&D personnel	% of researchers	R&D personnel	% of researchers	R&D personnel	% of researchers
EU-25	**801 361 s**	**51.5 s**	**:**	**:**	**:**	**:**	**:**	**:**	**:**	**:**
EU-15	**773 639 s**	**51.6 s**	**:**	**:**	**:**	**:**	**:**	**:**	**:**	**:**
BE	22 659	46.9	4 563	51.8	12 440	46.8	3 549	41.8	2 107	46.2
CZ	7 756	44.4	1 008	45.7	5 214	46.6	1 059	39.9	475	26.7
DK	16 071	52.1	:	:	:	:	:	:	:	:
DE	267 404	53.3	57 820	65.8	184 138	50.7	17 540	44.2	7 907	42.9
EE	298	64.8	86	70.9	:	:	:	:	:	:
EL	5 543	30.5	:	:	2 273	44.6	407	30.9	:	:
ES	34 357	38.4	3 997	49.3	19 912	38.5	4 901	34.1	5 547	:
FR	135 378	47.5	36 280	66.8	77 524	41.7	12 651	35.0	8 924	36.3
IE	5 057	62.0	2 065	76.8	2 070	59.7	369	31.4	553	35.6
IT	50 174	34.0	12 380	41.1	30 561	34.9	4 040	19.6	3 194	16.2
CY	89	59.7	0	:	64	63.8	3	36.0	22	50.4
LV	299	49.8	:	:	:	:	:	:	:	:
LT	459	65.1	:	:	:	:	:	:	:	:
LU	1 511	50.0	:	:	:	:	:	:	:	:
HU	4 922	59.6	772	85.8	3 441	58.3	274	49.3	435	29.7
MT	46	65.2	12	58.3	26	73.1	2	0.0	6	66.7
NL	32 080	40.5	10 843	34.7	15 404	44.8	2 281	41.6	3 553	38.7
AT	19 137	56.1	6 408	70.5	8 996	47.6	:	:	:	:
PL	8 191	57.6	833	66.9	5 764	56.8	947	58.5	647	51.2
PT	2 673	52.9	709	79.9	:	:	:	:	:	:
SI	3 762	32.2	966	25.3	2 120	32.6	377	44.6	299	35.8
SK	1 900	47.9	395	34.4	:	:	:	:	:	:
FI	24 312	:	:	:	:	:	:	:	:	:
SE	38 748	55.7	:	:	:	:	:	:	:	:
UK	118 535	62.1	18 044	76.5	85 427	60.5	6 363	57.9	8 701	50.7
NO	7 071	68.2	1 762	80.3	3 285	70.9	721	62.6	1 303	48.3
BG	940	52.9	:	:	623	50.1	:	:	67	:
RO	10 844	62.8	588	76.7	7 509	64.5	1 832	61.4	914	42.3
TR	4 588	59.2	845	84.1	2 422	57.9	:	:	:	:

Exceptions to the reference year:
2002: FR, MT, AT, SI, SK, TR

Source: Eurostat

Germany and the United Kingdom posted the highest Business R&D expenditure in the high tech and medium-high tech manufacturing sectors

Figure 4 shows the absolute and relative business enterprises R&D expenditure in the manufacturing sectors in 2003, expressed in million euro.

The share of R&D expenditure in high tech manufacturing was over 40% in Greece and in the Netherlands. In absolute terms, however, R&D expenditure in high tech manufacturing in these two countries amounted to EUR 86 million and EUR 1 530 million respectively.

The proportion of R&D expenditure in high tech manufacturing was also high in Austria and in Ireland.

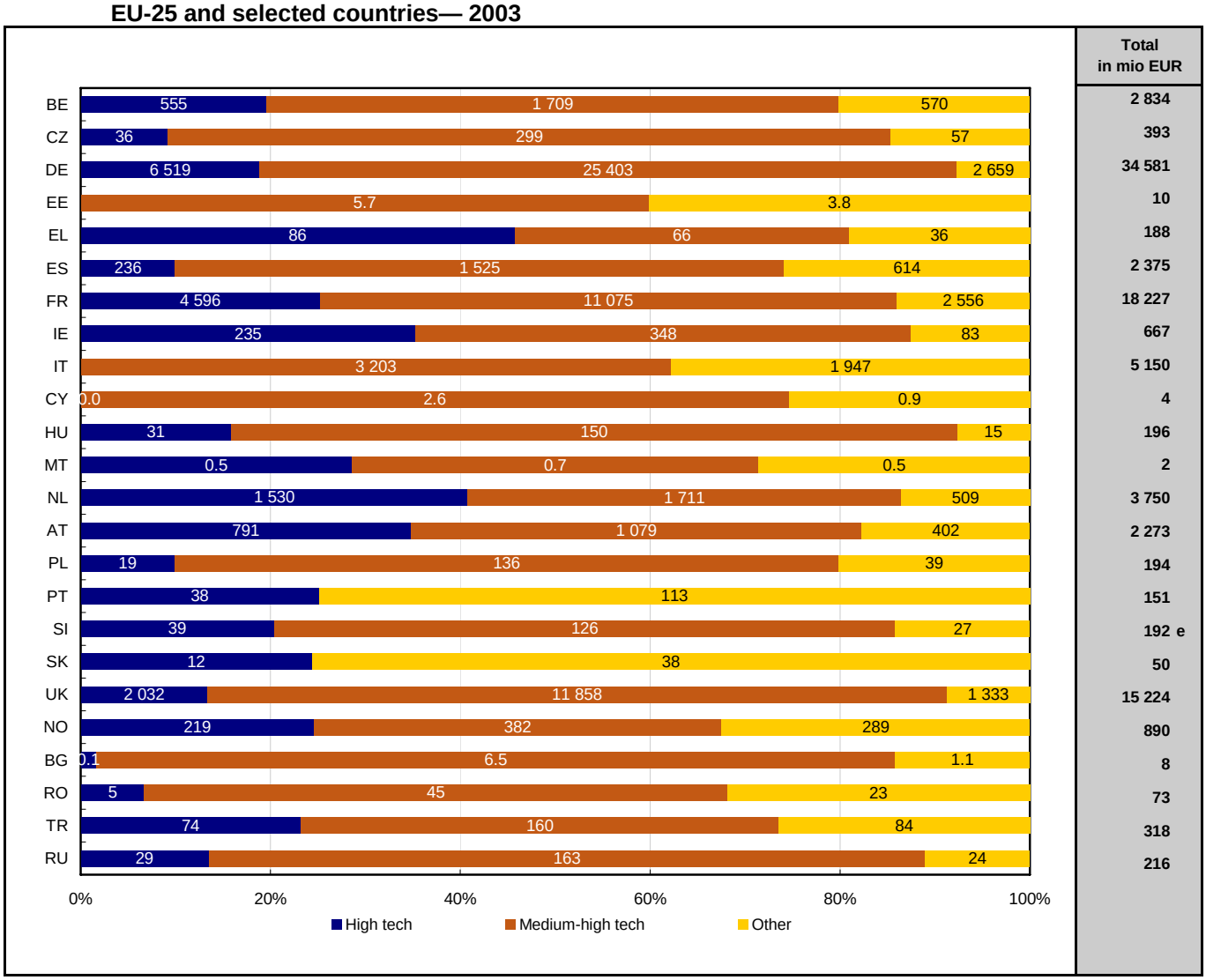
The countries where R&D expenditure in medium-high tech manufacturing was most significant as a proportion of R&D expenditure in total manufacturing were Germany, the United Kingdom, Italy and Cyprus.

In absolute terms, Germany and the United Kingdom were also the leading countries in terms of Business R&D expenditure in medium-high tech manufacturing, with EUR 25 billion and EUR 12 billion respectively. They were followed by France, with EUR 11 billion.

Among the EU-25 Member States for which data are available, more than 90% of total Business R&D expenditure was in the high and medium-high tech manufacturing sectors in Germany, Hungary and the United Kingdom.

The threshold of 80% was surpassed by the Czech Republic, Greece, France, Ireland, the Netherlands, Austria and Slovenia. This was also the case in Bulgaria and the Russian Federation.

Figure 4: Business enterprises R&D expenditure in the manufacturing sectors in million euro EU-25 and selected countries— 2003



Exceptions to the reference year:
2002: FR, MT, AT, SK, BG, RO TR and RU
Data are not available (and therefore included in "other") for:
High tech manufacturing in EE and IT, medium-high tech manufacturing in PT and SK

Source: Eurostat

➢ ESSENTIAL INFORMATION – METHODOLOGICAL NOTES

Sources and definitions

HRST

A human resource in science and technology (HRST) is defined according to the *Canberra Manual* as a person fulfilling one of the following conditions:

- Successfully completed education at third level in S&T field of study;
- Not formally qualified as above, but employed in S&T occupation where the above qualification is normally required.

The Eurostat's database on statistics in high-tech industries and knowledge-intensive services under "Science and Technology" includes data on HRST. The indicators presented in this publication are extracted and built up using data from the European Union Labour Force Survey — EU-LFS.

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.

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.

For more methodological information on R&D statistics, please refer to *Standard method proposed for research and experimental development surveys — Frascati Manual*, OECD, 2002.

NUTS

Regional data are presented in this publication according to the *Nomenclature of Territorial Units for Statistics (NUTS 2003),* at level 1. More information on the NUTS classification can be found on the Internet site: http://europa.eu.int/comm/eurostat/ramon/nuts/home_regions_en.html

Abbreviations and symbols

b	Break in series	FTE	Full time equivalent
p	Provisional	HRST	Human resources in Science and Technology
s	Eurostat estimation	KIS	Knowledge intensive sector
u	Unreliable	LKIS	Less knowledge intensive sector
:	Not available	S&E	Scientists and Engineers

Classification of high tech and knowledge intensive sectors

High tech and medium-high tech manufacturing sectors

The classification of high and medium-high technology manufacturing sectors is based on the Eurostat/OECD's classification — itself based on the ratio of R&D expenditure to GDP or R&D intensity. Since the EU LFS only allows reporting of NACE at the 2 digit level, the aggregations are made as follows:

High technology manufacturing	NACE Rev. 1.1 codes: 30 Manufacture of office machinery and computers 32 Manufacture of radio, television and communication equipment and apparatus 33 Manufacture of medical, precision and optical instruments, watches and clocks
Medium-high-technology manufacturing	NACE Rev. 1.1 codes: 24 Manufacture of chemicals and chemical products 29 Manufacture of machinery and equipment n.e.c. 31 Manufacture of electrical machinery and apparatus n.e.c. 34 and 35 Manufacture of transport equipment
High and medium-high technology manufacturing	NACE Rev. 1.1 codes: 24 Manufacture of chemicals and chemical products 29 to 35 Manufacture of machinery and equipment n.e.c.; man. of electrical and optical equipment; man. of motor vehicles, trailers and semi-trailers; man. of other transport equipment
Low and medium low-technology manufacturing	NACE Rev. 1.1 codes: 15 to 22 Manufacture of food products, beverages and tobacco; textiles and textile products; leather and leather products; wood and wood products; pulp, paper and paper products, publishing and printing; 23 Manufacture of coke, refined petroleum products and nuclear fuel 25 to 28 Manufacture of rubber and plastic products; basic metals and fabricated metal products; other non-metallic mineral products; 36 to 37 Manufacturing n.e.c.

Knowledge-intensive and less knowledge-intensive services

The knowledge intensity reflects the integration with a generic or service specific science and technology base, it can be seen as a combination of knowledge embedded in new equipment, personnel, and R&D intensity.

Service sectors are defined according to their knowledge-intensity. The two main groups are:

- Knowledge-intensive services — KIS, and
- Less Knowledge-intensive services — LKIS.

Each of these can be further broken into sub-groups.

Knowledge Intensive Services (KIS)	NACE Rev. 1.1 codes: 61 Water transport 62 Air transport 64 Post and telecommunications 65 to 67 Financial intermediation 70 to 74 Real estate, renting and business activities 80 Education 85 Health and social work 92 Recreational, cultural and sporting activities
High-technology KIS	NACE Rev. 1.1 codes: 64 Post and telecommunications; 72 Computer and related activities; 73 Research and development
Less KIS	NACE Rev. 1.1 codes: 50 to 52 Motor trade 55 Hotels and restaurants 60 Land transport; transport via pipelines 63 Supporting and auxiliary transport activities; activities of travel agencies 75 Public administration and defence; compulsory social security 90 Sewage and refuse disposal, sanitation and similar activities 91 Activities of membership organization n.e.c. 93 Other service activities 95 Activities of households as employers of domestic staff 99 Extra-territorial organizations and bodies

Data presented in this Statistics in Focus shows the data availability in Eurostat's reference database as of 20 February 2006.

Further information:

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

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