Statistics in focus

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R&D expenditure and personnel in the candidate countries in 2000

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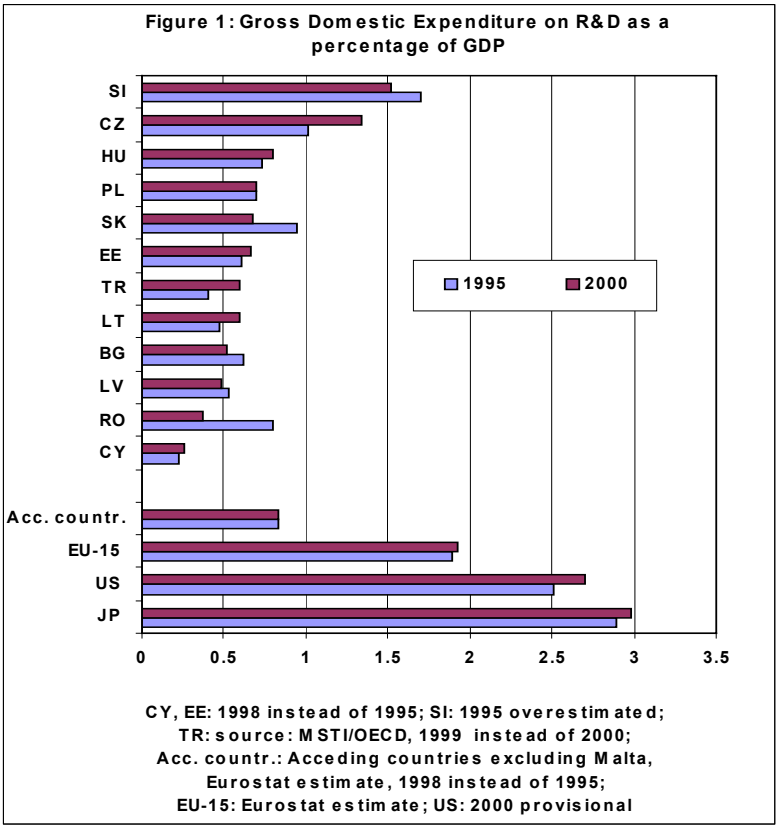
Figure 1: Gross Domestic Expenditure on R&D as a percentage of GDP



CY, EE: 1998 instead of 1995; SI: 1995 overestimated;
TR: source: MSTI/OECD, 1999 instead of 2000;
Acc. countr.: Acceding countries excluding Malta,
Eurostat estimate, 1998 instead of 1995;
EU-15: Eurostat estimate; US: 2000 provisional

- The Czech Republic and Slovenia have the highest Gross domestic Expenditure on R&D (GERD) as a percentage of GDP (1.33% and 1.52%, respectively) among the candidate countries. Nevertheless, the same ratio for the whole of the acceding countries (0.84%) was less than half the EU-15's (at 1.93%) in 2000.
- Poland was by far the biggest R&D spending candidate country in 2000, with over 1 billion EUR. Other big R&D performing candidate countries are Turkey, the Czech Republic, Slovenia and Hungary.
- The government remains the largest provider of R&D funding in the candidate countries, despite the fact that the business enterprise sector is the main R&D performer on average.
- Overall, the acceding countries have experienced increases in R&D personnel between 1998 and 2000.
- The number of R&D personnel (head counts) as a percentage of the active labour force in the candidate countries still remained below the EU average, although Slovenia almost reached the same level as the EU in 2000.
- The Baltic countries, Bulgaria and Romania have the highest proportions of female workers among their R&D personnel.

R&D expenditure remains lower in the candidate countries than in the EU

Gross domestic Expenditure on R&D (GERD) varies widely between the candidate countries, as it also does across the EU Member States. In 2000, Cyprus, Latvia and Romania showed GERD/GDP ratios lower than 0.50% while the Czech Republic and Slovenia's GERD amounted to more than 1.30% of their respective GDP figures (see figure 1). Indeed, Slovenia and the Czech Republic both attained higher proportional levels of GERD than some EU Member States in 2000 (namely Greece, Spain, Italy and Portugal, see table 1). Nevertheless, the acceding countries' aggregate GERD/GDP ratio of 0.84% was less than half the EU average in 2000, and much lower than the US and Japan's levels.

In absolute terms, Poland had the highest R&D expenditure of all candidate countries in 2000, with over 1 billion EUR of GERD. The Czech Republic and Hungary also showed substantial absolute expenditure in R&D in 2000, compared to their geographical and population sizes. Turkey spent over 850 million EUR on R&D in 1999, making it the second biggest R&D spending candidate country after Poland. This allowed Poland and Turkey to show higher absolute levels of GERD than small EU Member States such as Greece, Ireland and Portugal. When GERD is expressed in EUR purchasing power standards (PPS) at 1995 prices, the Czech Republic also achieved higher figures than the three aforementioned EU Member States.

Whereas Japan, the US and the EU as a whole have reported an increase of their GERD/GDP ratio from 1995 to 2000, the situation is less clear-cut for the candidate countries. Bulgaria, Latvia, Lithuania, Romania and the Slovak Republic experienced a drop in their GERD/GDP ratio during the same period, while the acceding countries' aggregate GERD/GDP ratio marginally progressed between 1998 and 2000.

Table 1. Gross domestic expenditure on R&D (GERD) in the candidate countries and the EU Member States

	Mio ECU/EUR		Mio ECU/EUR PPS at 1995 prices		% of GDP	
	1995	2000	1995	2000	1995	2000
BG	62.0	71.5	:	:	0.62	0.52
CY (1)	18.2	24.5	:	:	0.23	0.26
CZ	403.0	744.0	988.8	1384.7	1.01	1.33
EE (1)	30.1	37.0	:	:	0.61	0.66
HU	250.4	405.3	520.2	691.7	0.73	0.80
LV	17.8	37.5	:	:	0.53	0.48
LT	22.0	73.1	:	:	0.48	0.60
PL	672.7	1196.6	1433.9	1863.5	0.69	0.70
RO	216.8	148.7	770.9	333.5	0.80	0.37
SK	138.3	142.9	345.4	294.7	0.94	0.67
SI (2)	243.1	297.3	322.5	358.2	1.69	1.52
TR (3) (4)	492.5	851.0	1010.1	1266.1	0.40	0.60
BE (3)	3628.7	4618.1	3454.1	4362.0	1.71	1.96
DK	2530.6	3604.2	1999.6	2573.0	1.84	2.07
DE	42437.9	50316.4	35789.5	43044.3	2.26	2.48
GR (3)	437.0	795.4	591.5	931.5	0.49	0.67
ES	3623.8	5719.0	4389.9	6128.6	0.81	0.94
FR	27446.6	30152.7	25149.5	26437.4	2.31	2.13
IE (3)	682.7	1075.6	795.8	1030.4	1.34	1.21
IT (3)	8386.3	11524.0	10453.1	11596.8	1.00	1.04
L	:	:	:	:	:	:
NL (3)	6313.3	7563.0	5929.4	6984.3	1.99	2.02
AT	2797.4	3687.5	2436.1	3201.2	1.56	1.80
PT (3)	470.3	814.7	702.7	1086.9	0.57	0.76
FI	2262.7	4422.6	1999.1	3767.6	2.29	3.37
SE (3)	6360.6	8607.9	5537.7	6751.7	3.46	3.78
UK	17097.2	28757.4	19667.3	21301.8	1.97	1.85
Acceding countries (1) (5)	2477.0	2958.2	:	:	0.83	0.84
EU-15 (5)	124427.0	163937.0	118807.0	140249.0	1.89	1.93

(1): 1998 instead of 1995
(2): Slovenian data in 1995 overestimated due to overestimation of HES data on R&D expenditure; (3): 1999 instead of 2000; (4): source:MSTI/OECD;
(5): Eurostat estimate; Acceding countries excluding Malta

The sectoral distribution of R&D differs across the candidate countries

GERD's distribution across the different institutional sectors shows a mixture of patterns in the candidate countries (see table 2). Just like in the EU, the business enterprise sector is the foremost performer of R&D in the acceding countries and in more than half of the candidate countries. Romania and the Slovak Republic's business enterprise sectors perform even higher shares of R&D than the EU's. Conversely, Bulgaria, Cyprus, Estonia and Lithuania's economies display low R&D involvement of the business enterprise sector in GERD, of less than 25% of total GERD in 2000. In Bulgaria, and to a lesser extent, in Cyprus and Lithuania, the government sector dominates R&D, while in Estonia and Turkey, the higher education sector accounted for more than 50% of total GERD in 2000. The higher education sector is the second largest performer of R&D on average in the EU, while the government sector takes up the third place in importance of R&D performance in the Union. In comparison, the higher education sector comes third, after the government, in share of R&D performance in the acceding countries.

Table 2. Gross domestic expenditure (GERD) on R&D by sector of performance in Mio ECU/EUR and as a percentage of total, in 2000

	EU-15 (1)		Acc. c. (1)		BG		CY		CZ		EE		HU (2)		LV		LT		PL		RO		SK		SI		TR (3)	
Sector	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%
Business Enterprise	107137,0	65	1363,4	46	15,3	21	5,2	21	446,1	60	8,3	23	179,6	44	15,1	40	15,7	22	431,8	36	103,2	69	94,0	66	167,5	56	324,2	38
Government	22334,0	14	851,2	29	49,1	69	11,4	47	188,4	25	8,6	23	105,7	26	8,3	22	30,6	42	385,9	32	28,0	19	35,3	25	77,0	26	57,0	7
Higher Education	33333,0	20	709,7	24	7,0	10	6,1	25	105,7	14	19,4	52	97,3	24	14,1	38	26,7	37	377,3	32	17,5	12	13,6	10	49,4	17	470,6	55
Private non-profit	1133,0	1	:	:	0,1	0	1,8	7	3,8	1	0,7	2	:	:	0,0	0	:	:	1,6	0	:	:	:	:	3,5	1		:
Total GERD	163937,0	100	2958,2	100	71,5	100	24,5	100	744,0	100	37,0	100	405,3	100	37,5	100	73,1	100	1196,6	100	148,7	100	142,9	100	297,3	100	851,0	100

(1): Eurostat estimate; Acc. c.: Acceding countries excluding Malta; (2) total GERD does not correspond to the sum of R&D expenditure by sectors and by source of funds
(3) 1999; source for the percentages: MSTI, absolute values calculated by using the percentages

Table 3. Gross domestic expenditure (GERD) on R&D by source of funding in Mio ECU/EUR and as a percentage of total, in 2000

	EU-15 (1)		Acc. c. (3)		BG		CY		CZ		EE		HU (2)		LV		LT		PL		RO		SK		SI		TR (1)	
Sector	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%
Business Enterprise	90985,0	56	1184,9	41	17,4	24	4,3	18	381,0	51	9,0	24	153,0	38	11,1	29	:	:	390,3	33	72,8	49	77,7	54	158,5	53	368,5	43
Government	57378,0	35	1524,7	53	49,5	69	16,3	67	331,1	45	21,9	59	200,8	50	15,6	41	:	:	759,1	63	60,7	41	60,9	43	119,0	40	405,9	48
Gov. University Funds	:	:	:	:	:	:	4,5	18	:	:	:	:	:	:	:	:	:	:	0,0	0	2,0	1	:	:	4,5	2	:	:
Direct Government	:	:	:	:	:	:	11,8	48	331,1	45	21,9	59	:	:	15,6	41	:	:	759,1	63	58,7	39	60,9	43	114,5	39	:	:
Higher Education	:	:	:	:	0,6	1	0,5	2	3,6	0	0,7	2	:	:	:	:	:	:	20,4	2	7,7	5	0,9	1	1,2	0	:	:
Private non-profit	3606,6	2	:	:	0,2	0	1,1	5	4,9	1	0,8	2	1,2	0	:	:	:	:	5,0	0	0,2	:	0,1	0	0,1	0	35,7	4
Abroad	11967,4	7	127,9	4	3,8	5	2,3	9	23,4	3	4,7	13	43,1	11	10,9	29	:	:	21,8	2	7,3	5	3,3	2	18,5	6	40,8	5
Total GERD	163937,0	100	2885,2	100	71,5	100	24,5	100	744,0	100	37,0	100	405,3	98	37,5	100	73,1	:	1196,6	100	148,7	100	142,9	100	297,3	100	851,0	100

(1): 1999; source for the percentages: MSTI, Secretariat 1999 estimate or projection based on national sources; Private non-profit sector = Other national sources of GERD; absolute values calculated by using the percentages; (2): total GERD does not correspond to the sum of R&D expenditure by sectors and by source of funds; (3) Acc. c.: Acceding countries excluding Malta and Lithuania

Table 4. Gross domestic expenditure (GERD) on R&D by type of costs in Mio ECU/EUR and as a percentage of total, in 2000

	Acc. c. (1)		BG		CY		CZ		EE		HU (2)		LV		LT		PL		RO		SK		SI	
Type of cost	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%
Current expenditure	2457,6	83	67,3	94	21,6	88	647,9	87	32,8	89	312,9	77	35,8	95	61,2	84	946,3	79	132,9	89	130,8	92	268,4	90
Labour costs	1199,3	41	39,4	55	16,5	67	215,2	29	19,2	52	175,1	43	17,5	47	37,0	51	481,8	40	77,0	52	59,1	41	177,7	60
Other current expenditure	1258,3	43	27,9	39	5,0	21	432,7	58	13,5	37	137,7	34	18,3	49	24,2	33	464,5	39	55,9	38	71,7	50	90,7	30
Capital expenditure	478,0	16	4,2	6	2,9	12	96,1	13	4,2	11	69,8	17	1,8	5	11,8	16	250,3	21	15,8	11	12,1	8	29,0	10
Total GERD	2958,2	100	71,5	2	24,5	100	744,0	100	37,0	100	405,3	100	37,5	100	73,1	100	1196,6	100	148,7	100	142,9	100	297,3	100

(1): Acc. c.: Acceding countries excluding Malta; (2): total GERD does not correspond to the sum of R&D expenditure by sectors and by source of funds

Table 5. Gross domestic expenditure (GERD) on R&D by main field of science in Mio ECU/EUR and as a percentage of total, in 2000

	Acc. c. (1)		BG		CY		CZ		EE		HU (2)		LV		LT		PL		RO		SK		SI	
Field of science	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%	Mio EUR	%
Natural sciences	629,6	22	15,4	22	8,4	34	185,9	25	:	:	59,1	15	12,9	34	17,9	25	261,9	22	12,1	8	37,6	26	45,9	15
Engineering and technology	1473,1	50	22,5	32	2,0	8	438,8	59	:	:	191,4	47	11,7	31	14,6	20	596,4	50	106,9	72	67,2	47	151,0	51
Medical sciences	302,6	10	4,9	7	1,2	5	51,5	7	:	:	30,6	8	1,5	4	5,6	8	146,4	12	5,6	4	11,5	8	54,3	18
Agricultural sciences	224,9	8	21,2	30	6,8	28	34,9	5	:	:	37,1	9	3,0	8	6,0	8	109,6	9	14,4	10	16,9	12	10,7	4
Social sciences	139,1	5	2,4	3	3,8	15	8,8	1	:	:	26,0	6	6,5	17	6,2	8	49,2	4	7,8	5	8,3	6	30,5	10
Humanities	104,1	4	5,0	7	2,4	10	24,0	3	:	:	29,1	7	1,9	5	7,2	10	33,2	3	2,0	1	1,3	1	4,9	2
Total GERD	2921,2	100	71,5	100	24,5	100	744,0	100	37,0	100	405,3	100	37,5	100	73,1	100	1196,6	100	148,7	100	142,9	100	297,3	100

(1): Acc. c.: Acceding countries excluding Malta and Estonia; (2): total GERD does not correspond to the sum of R&D expenditure by sectors and by source of funds

In contrast, the government sector is the main provider of funds for R&D on average in the acceding countries. This is also the case in the majority of the candidate countries, bar the Czech Republic, Romania, the Slovak Republic and Slovenia, where the business enterprise sector's share of funding is slightly higher (see table 3). In these four, the distribution of R&D funding sources more closely resembled the EU's in 2000. The business enterprise and government sectors together make up the lion's share of R&D funding in the candidate countries, although funding from abroad is fairly important in a number of countries such as Cyprus, Hungary and Estonia and even more so in Latvia (where it equalled the business enterprise sector's contribution to R&D in 2000).

Most R&D efforts in 2000 were directed towards engineering and technology in the acceding countries, except for Cyprus, Latvia and Lithuania, where the share of R&D expenditure spent on natural sciences was higher than in the other fields of science (see table 5).

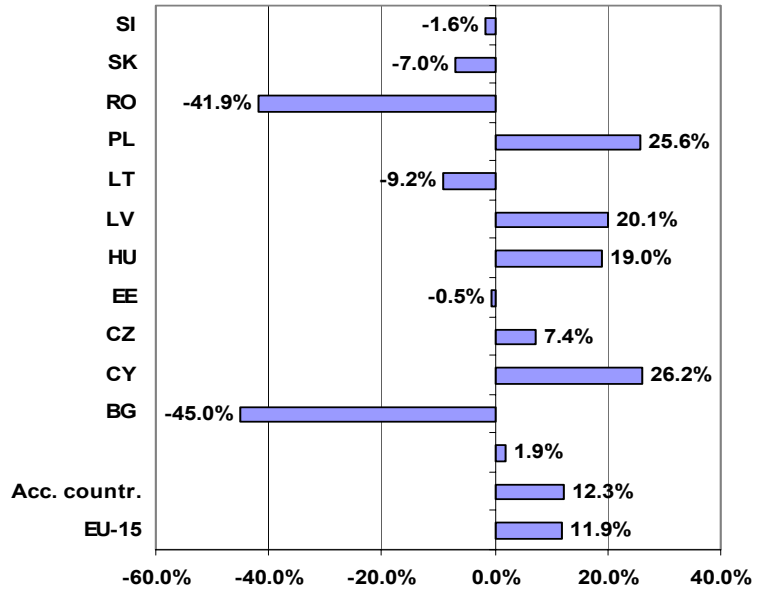
Acceding countries showed an increase in R&D personnel between 1998 and 2000

Bulgaria and Romania have seen their R&D personnel workforce shrink by almost half between 1995 and 2000 (figure 2). Researchers were on average less likely than technicians and other R&D personnel to suffer from a decline in the workforce. On the contrary, in Cyprus, Hungary, Latvia and Poland, the total number of R&D personnel has shown healthy increases of between 19 and 26% during the same period. Overall in the acceding countries, the total number of R&D personnel has risen 12.3% between 1998 and 2000. This compares to an increase of the EU's R&D personnel of about 12% between 1995 and 2000.

The two candidate countries with the highest percentages of R&D personnel to total active labour force in 2000 were Hungary and Slovenia, the latter only 0.02 percentage points away from its EU counterparts' average of 1.38%.

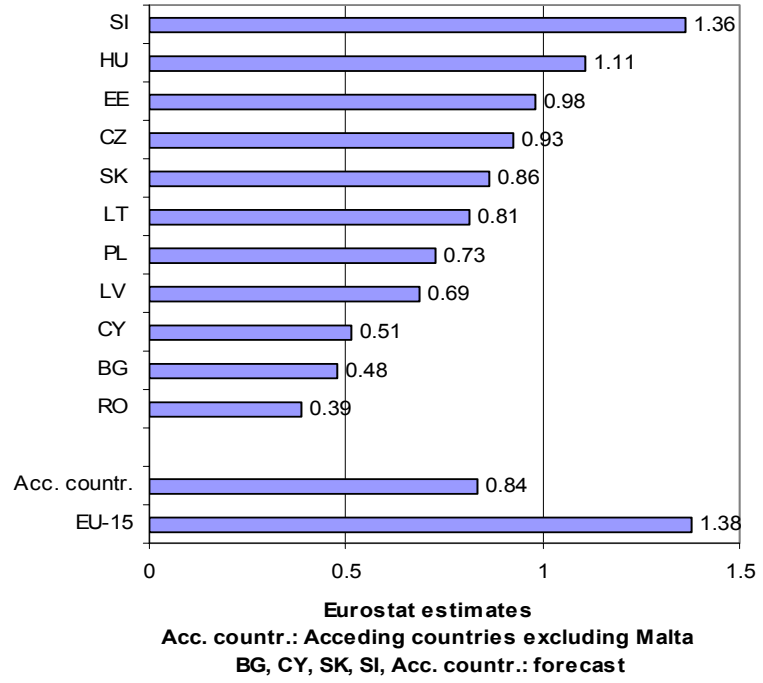
On average, the R&D personnel made up 0.84% of the total active labour force in the acceding countries in that year. The sharp decreases in R&D employment in Bulgaria and Romania seem to have taken their toll as both these countries as well as Cyprus display the lowest number of R&D personnel as a percentage of total active labour force among the candidate countries.

Figure 2. Growth rate of R&D Personnel between 1995 and 2000 (in head count)



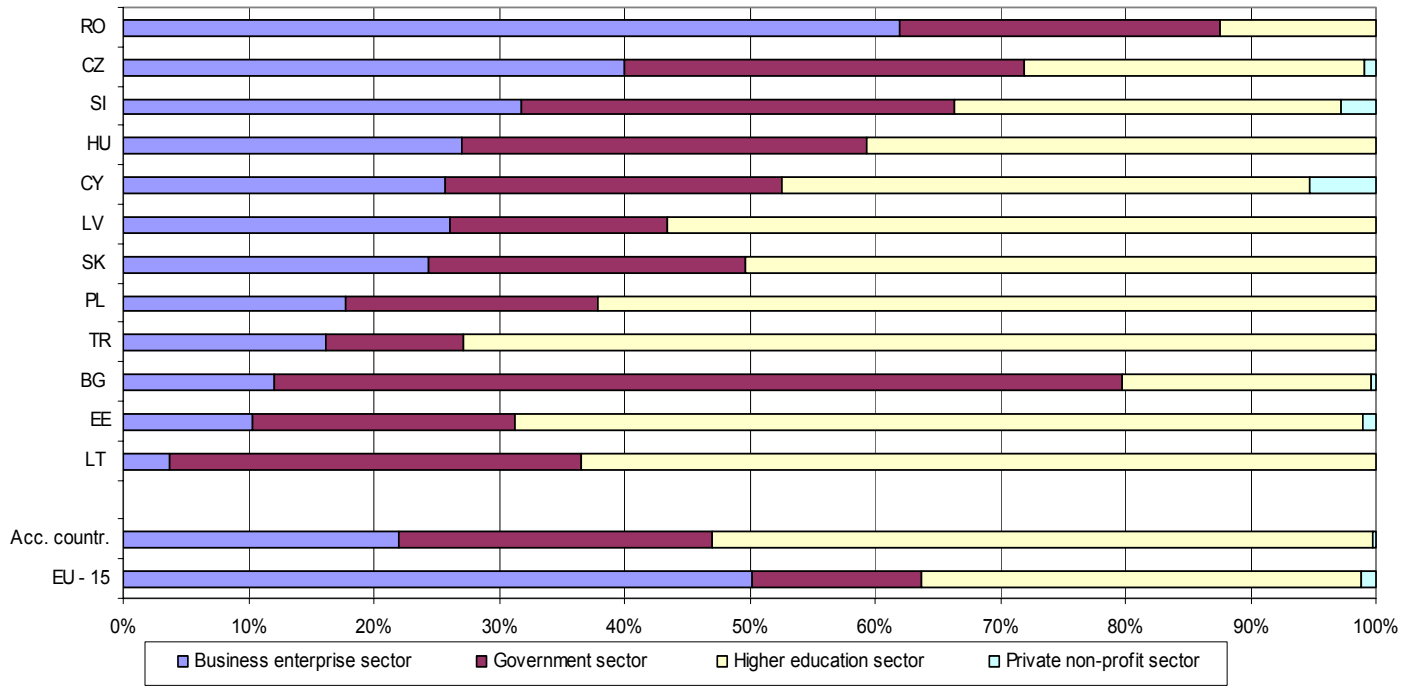
CY and EE: 1998-2000; LT: 1996-2000;
Acc. countr.: Acceding countries excluding Malta, 1998-2000;
EU-15: Eurostat estimate

Fig. 3 R&D personnel as a percentage of labour force in 2000 (head count)



Eurostat estimates
Acc. countr.: Acceding countries excluding Malta
BG, CY, SK, SI, Acc. countr.: forecast

Fig 4. Breakdown of researchers by institutional sector in full time equivalent in 2000



Acc. countr.: Acceding countries excluding Malta; private non-profit sector share calculated using only the reporting countries' shares; EU-15: Eurostat estimate; Turkey: 1999, source: MSTI/OECD

The predominance of Estonia and Turkey's higher education sector in the national R&D performances is reflected in the proportion of researchers it employs (see figure 4). Other candidate countries with more than half of researchers in FTE employed in the higher education sector are Latvia, Lithuania, Poland and the Slovak Republic.

The higher education sector ranks first on average in the acceding countries in terms of share of researchers' FTEs (with over 50% of total researchers' FTEs in 2000), while the government sector (25%) and the business enterprise sector (22%) come second and third respectively.

Only in Romania, where over 60% of researchers were employed in the business enterprise sector in 2000, and in the Czech Republic, does the business enterprise sector take up the largest share of researchers' FTEs, likewise in the EU. The two candidate countries where the government sector is the biggest employer for researchers are Bulgaria, where more than two thirds of the total number of researchers are employed by it, and Slovenia.

Among those countries that separately report R&D activities of the private non-profit sector, only Cyprus and Slovenia were able to attract more than 2.5% of the total number of researchers' FTEs in 2000.

Largest proportion of female researchers in the Baltic countries, Bulgaria and Romania

The Baltic countries, Bulgaria and Romania employed the highest percentage of female researchers in 2000. In these five countries, over 40% of the total number of researchers were female. Cyprus had the lowest proportion of female researchers in that year, with 26% (figure 5).

Researchers are the core of the R&D personnel workforce, representing about 50% or more of all R&D personnel in the candidate countries. Technicians and other R&D personnel make up the rest of the R&D personnel (see table 6).

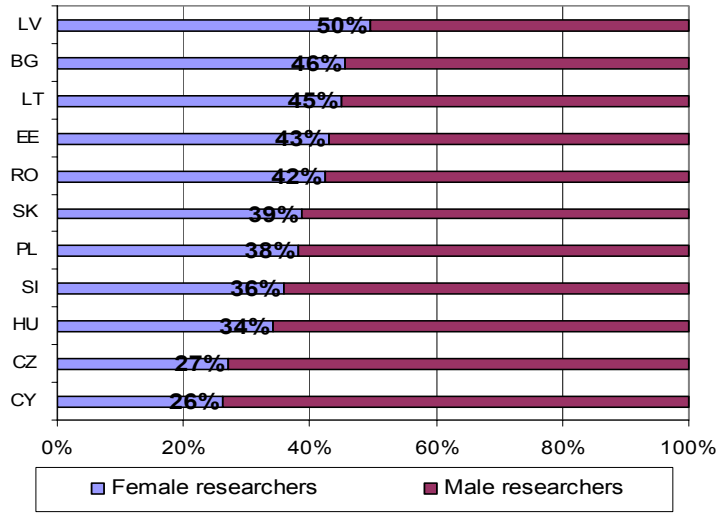
Taking a look at the total number of R&D personnel in the candidate countries, one will notice that the same conclusions can be made as for researchers: the highest share of female workers is to be found in the Baltic countries, Bulgaria and Romania. Technicians and other R&D personnel have an even larger number of female workers than do researchers, raising the overall proportion of female workers active in R&D activities.

In most candidate countries' business enterprise sector, the majority of the R&D personnel's efforts in 2000 (expressed in full time equivalent or FTE) were concentrated in manufacturing (NACE Rev. 1 D). Only Cyprus, Estonia and Latvia reported more R&D personnel devoted to services rather than manufacturing in 2000 (see table 7). In general, most of the services sector's R&D personnel are to be found in the Real estate, renting and business activities (NACE Rev. 1 70 to 74).

One exception is Poland, where, in 2000, more R&D personnel were to be found in the Community, social and personal service activities (NACE Rev. 1 75 to 99) than in the Real estate, renting and business activities.

In manufacturing, Chemicals, chemical products and man-made fibres (NACE Rev. 1 24) and Machinery and equipment n.e.c.; instruments; manufacturing of transport equipment (NACE Rev. 1 29 to 35) took up most of the R&D personnel's efforts in 2000.

Figure 5. Female researchers as a percentage of total researchers (head count) in 2000



SK: percentage calculated from FTE data

Table 6. R&D personnel in head count by occupation in 2000

	Total	number of females	Number of Researchers	number of females	Number of Technicians	number of females	Other R&D personnel	number of females
BG	16853	8906	10527	4797	4192	2683	2134	1426
CY	1630	594	792	208	423	158	415	228
CZ	48004	16992	26173	7055	13972	5864	7859	4073
EE	6531	3279	4570	1969	936	619	1025	691
HU	45325	20407	27876	9537	8313	4844	9136	6026
LV	8229	4211	6117	3033	931	519	1181	659
LT	14592	7338	10100	4542	2052	1345	2440	1451
PL	125614	54326	88189	33572	20298	10578	17127	10176
RO	37241	17114	23179	9841	6754	3982	7308	3291
SK	22256	:	15747	:	4406	:	2103	:
SI	12220	4962	6562	2358	2512	1129	3146	1475

Table 7. R&D personnel in full time equivalent by NACE in the business enterprise sector in 2000

NACE	Sector	BG	CY	CZ	EE	HU	LV	LT	PL	RO	SK	SI
01 to 05	Agriculture, hunting, forestry and fishing	149	8	101	:	160	:	:	397	3539	926	8
10 to 14	Mining and quarrying	54	:	16	:	3	:	:	1205	1397	c	38
15 to 37	Manufacturing	1129	61	7284	162	4541	253	521	13509	14922	2176	3171
15 to 16	Food products; beverages and tobacco	7	19	51	32	160	10	11	375	27	c	63
17 to 19	Textiles and textile products; manufacture of leather and leather products	c	:	250	4	16	12	74	536	584	70	151
20 to 22	Wood and paper products, publishing and paper	12	:	11	1	54	20	:	168	186	c	17
23	Coke, refined petroleum products and nuclear fuel	c	:	10	:	38	:	:	190	192	:	:
24	Chemicals, chemical products and man-made fibres	561	22	915	69	2279	96	61	2855	1143	480	802
25	Manufacture of rubber and plastic products	c	1	174	5	79	:	12	363	119	279	125
26	Other non-metallic mineral products	c	2	130	2	27	7	42	245	555	c	68
27	Basic metals	16	:	216	:	24	5	:	821	1285	c	76
28	Fabricated metal products, except machinery and equipment	c	1	339	6	54	5 r	5	165	:	c	145
29 to 35	Machinery and equipment n.e.c.; instrum.; man. of transport equipment	299	16	5014	32	1780	103 r	316	7583	10548	1031	1687
36	Manufacturing n.e.c.	0	:	173	11	26	:	:	147	283	26	37
37	Recycling	0	:	1	:	4	:	:	65	:	:	:
40 to 41	Electricity, gas and water supply	c	:	3	1	197	:	3	371	982	c	:
45	Construction	c	:	96	3	37	:	:	518	355	18	:
50 to 99	Services	716	76	4027	251	1533	1113	45	2588	1346	1954	282
50 to 52	Wholesale, retail trade; and repair of motor vehicles	c	3	157	9	454	2	:	33	:	c	21
55	Hotels and restaurants	c	:	0	:	0	:	:	0	:	:	:
60 to 63	Transport,storage	155	:	89	9	34	:	4	251	196	c	:
64	Post and telecommunications	c	3	4	46	231	:	:	567	:	c	:
65 to 67	Financial intermediation	0	0	0	:	38	:	:	17	:	:	:
70 to 74	Real estate, renting and business activities	127	62	3566	178	722	1100	41	722	1148	1898	854
73	Research and development	0	:	2891	54	88	438	41	696	416	1870	737
75 to 99	Community, social and personal service activities	31	8	211	9	54	11	:	998	2	c	18
Total		2137	144.9	11527	417	6471	1366	569	18586	22541	5172	4110

➢ ESSENTIAL INFORMATION – METHODOLOGICAL NOTES

This analysis encompasses the following *candidate countries*: Bulgaria (BG), Cyprus (CY), the Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Poland (PL), Romania (RO), the Slovak Republic (SK), Slovenia (SI) and Turkey (TR). The *acceding countries* are the ten countries among the candidate countries that are expected to become full members of the European Union in 2004. These include: the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic and Slovenia.

The candidate countries experienced significant changes in their R&D statistics last decade, due to the changes in economic conditions and by the introduction of new methodology compatible with the EU. Most candidate countries introduced the OECD methodology between 1994 and 1996, enabling internationally comparable analyses from the mid-1990s onwards.

Definitions

Definitions of R&D expenditure and R&D personnel are taken from the Frascati manual (OECD).

Gross domestic Expenditure on R&D (GERD) includes all intramural expenditure within the statistical unit devoted to R&D (capital and current expenditures alike). R&D expenditure and personnel are broken down by the institutional sector in which the R&D is carried out.

The *business enterprise sector* includes: (paragraph 145 of Frascati Manual)
- 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;
- the private non-profit institutes mainly serving them.

The *government sector* includes: (paragraph 168 of Frascati Manual)
- 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;

- non-profit institutes controlled and mainly financed by the government.

The *higher education sector* includes: (paragraph 190 of Frascati Manual)
- 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.

The *private non-profit sector* includes: (paragraph 178 of Frascati Manual)
- non-market, private non-profit institutions serving households (i.e. the general public);
- private individuals or households.

R&D personnel are persons directly engaged in R&D as well as employees rendering direct services to R&D who carried out R&D activity or direct service in scope of at least 10% of their work during last year.
R&D personnel are reported either in head counts or full-time equivalent (FTE).

Full-time equivalent (FTE)
One FTE may be thought of as one person-year. For instance, a person who spends 40% of his time on R&D and the rest of it on other work (e.g. lecturing, university administration, guidance), accounts for 0.4 FTE.

Categories of R&D personnel:

Researchers (RSE) (paragraph 311 of Frascati Manual)

Are professionals engaged in the conception or creation of new knowledge, products processes, methods and systems, and in the management of the projects concerned.

Technicians and equivalent staff (paragraph 316 of Frascati Manual)

Technicians and equivalent staff are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, physical and life sciences, or social sciences and humanities. They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods, normally under the supervision of researchers. Equivalent staff perform the corresponding R&D tasks under the supervision of researchers in the social sciences and humanities.

Other supporting staff (paragraph 319 of Frascati Manual)

Other supporting staff includes skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects or directly associated with such projects.

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