Statistics

in focus

RESEARCH AND DEVELOPMENT

THEME 9 - 3/2000

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Manuscript completed on: 15/09/2000 ISSN 1024-7971 Catalogue number: KS-NS-00-003-EN-C Price in Luxembourg per single copy (excl. VAT): EUR 6

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R&D expenditure and personnel in candidate countries and the Russian Federation in 1998

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Figure 1: Gross domestic expenditure on R&D (GERD) as a percentage of GDP in 1998

CY	0,23
LV	0,45
RO	0,50
LT	0,57
BG	0,59
EE	0,62
HU	0,68
PL	0.73
SK	0,86
RU	0,93
CZ	1,27
SI	1,42
EU-15	1.86
US	2,58
JP	3,03
C	0,0 0,5 1,0 1,5 2,0 2,5 3,0 3,5 [%]
	NB: Slovenia 1997.

- Expenditure on R&D in all candidate countries is significantly lower than in the EU, USA and Japan, both in absolute and relative terms.
- The highest R&D spending was in Poland with ECU 1 022 million and the lowest in Cyprus with ECU 19 million.
- Slovenia has the highest gross domestic expenditure on R&D as a percentage of GDP (1.42 %). Nevertheless, this is 0.44 percentage points lower than the EU-15.
- In a majority of candidate countries and in the Russian Federation, the predominant R&D spending sector is the business enterprise sector (BES). In Romania, the Russian Federation, the Slovak Republic and the Czech Republic, the contribution of BES in GERD is higher than the EU average.
- The breakdown of GERD by sectors remained more or less stable in the period 1994-98, except in Bulgaria.
- There was a downward trend in the number of R&D personnel (by head count) in the majority of candidate countries between 1994 and 1998.
- In 1998, the proportion of R&D personnel in the labour force was lower than that of the EU-15 in each candidate country and the Russian Federation.

R&D expenditure: Candidate countries performance is much lower than most EU Member states

In 1998, gross domestic expenditure on research and development (GERD) in candidate countries amounted to between ECU 19 million (CY) and ECU 1 022 million (PL). In the Russian Federation. ECU 2 303 million were spent on R&D activities. The four countries with the highest R&D expenditure were Poland (ECU 1 022 million), Czech Republic (ECU 630 million), Hungary (ECU 285 million) and Slovenia (ECU 228 million). They accounted for about 80 % of R&D spent in the 11 candidate countries under consideration.

These levels of R&D expenditure are more or less comparable with the levels of small EU Member states like Greece (ECU 542 million). Portugal (ECU 582 million) and Ireland (ECU 968 million). The other EU Member states had a higher value of GERD than candidate countries and the Russian Federation Candidate countries' expenditure on R&D lav far below that of Japan (ECU 102 555 million) and the United States (ECU 202 172 million).

In 1998, R&D expenditure as a percentage of GDP varied between 0.23 % in Cyprus and 1.42 % in Slovenia. Other candidate countries with a high R&D expenditure to GDP ratio were the Czech Republic (1.27 %) and the Slovak Republic (0.86 %). In the Russian Federation this ratio was 0.93 %. In comparison with the Triad (EU-15: 1.86 %, the US: 2.58 % and Japan: 3.03 %), the proportion of R&D on GDP in all candidate countries was lower, and represented less than half the GERD/GDP ratio of Japan.

Whereas since 1994 the US and Japan have experienced a growth of GERD as a percentage of GDP, in the majority of candidate countries one can observe a downward trend. A slight growth was experienced in

	EU Member states			Candidate countries and	l Russia
	Mio ECU	% of GDP		Mio ECU	% of GDP
B (¹) (²)	3 953	1.84	BG	65	0.59
DK	2 993	1.93	CY	19	0.23
D	44 051	2.29	cz	630	1.27
EL (1)	542	0.51	EE	29	0.62
E	4 693	0.90	HU	285	0.68
F (²)	28 319	2.19	LV	24	0.45
IRL (¹)	968	1.40	LT	55	0.57
I (²)	10 822	1.02	PL	1022	0.73
L	:	:	RO	184	0.5
NL (¹)	6 789	2.04	SK	156	0.86
А	3 395	1.80	SI (¹)	228	1.42
P (¹)	582	0.63			
FIN	3 335	2.89	RU	2 303	0.93
S (²)	8 000	3.77			
UK	22 865	1.82			
EU-15	141 200	1.86			
(¹) 1997 da	ta.				
(²) Provisio	nal data.			· · · · · · · · · · · · · · · · · · ·	

Table 1: Gross domestic expenditure on R&D (GERD)

in 1998 in Mio ECU and as percentage of GDP



the Czech Republic, Cyprus, Latvia, Lithuania and the Russian Federation.

By field of science, the latest available data show that the largest

amount of candidate countries' R&D expenditure was spent in the field of engineering and technology, except for Cyprus (agricultural sciences) and Lithuania (natural sciences).



Table 2: Gross domestic expenditure on research and development (G.	ERD)
by sector of performance in Mio ECU in 1998	

Sectors	BG	CY	CZ	EE	HU	LV	LT	PL	RO	RU	SK	SI (1)
Total GERD	64.8	18.7	629.5	28.6	285.2 (*)	24.3	54.5	1 022 2	183 6	2 303.2	155 6	228 3
of which												
Business enterprise sector	12.1	2.6	406.4	5.6	109.6	5.1	10	424.0	140 9	1 588.3	102 4	121 1
Government sector	49.0	10.5	161.8	6.9	88.9	7.6	32.2	315 1	34.3	593 7	38 5	64 4
Higher education sector	3.3	4.7	59.8	16.0	71.8	11.5	211	282.5	8.4	119.1	14 7	397
Private non-profit sector	0.4	0,9	1.5	0.1	-	0.1	0.2	0.7	0.0	2.1	0.0	3.1
GERD as a % of GDP	0.6	0.2	1.3	0.6	0.7	0.5	0.6	0.7	0.5	0.9	0.9	14
(¹) Data for 1997.												

Table 3: GERD by type of costs in Mio ECU in 1998

Type of costs	BG	CY	CZ	EE	HU	LV	LT	PL	RO	RU	SK	SI (')
Total GERD	64.8	18.7	629.5	28.6	285.2	24.3	54.5	1 022.2	183.6	2 303 2	155.6	228.3
of which												
Labour costs	32.4	12.9	159.1	14.7	114.4		32.2	407.2	100.9	905.7	62.9	126 9
Other current expenditure	29.5	3.7	395.3	10.0	108.7		18.2	374.6	73.3	1 332.4	75.0	79.0
Current expenditure-total	61.9	16.6	_554.4	24.7	237.9 (^a)	:	50.4	781.8	174.2	2 238.1	137.9	205.9
Capital expenditure	2.9	2.1	75.1	3.9	47.3		4.1	240.4	9.4	65 1	17 7	22.4
(¹) Data for 1997.												

Table 4: GERD by main field of science in Mio ECU in 1998

Field of science	BG	CY	CZ	EE	HU	LV	LT	PL_	RO	RU	SK	SI (¹)
Total GERD	64.8	18.7	629.5	28.6	285.2 (^a)	24.3	54.5	1 022.2	183.6	2 303.2	155.6	228 3
of which												
Natural sciences	:	5.6	121.9	;	50.5	:	15.8	201.0	39.0	396.5	25.8	30.5
Engineering and Technology	:	1.3	428.4	:	126.1	:	12.8	551.4	110.1	1 729.1	85.5	117.2
Medical sciences	:	0.7	30.1	:	21.4	1	6.6	105.0	6.7	53.8	14.4	38.6
Agricultural sciences	:	6.4	27.9	:	29.2	:	6.5	90.6	20.2	57.0	213	16.6
Social sciences	:	2.6	16.7	;	43.3 (^b)	:	6.4	49.7	3.3	42.7	7.7	21.6
Humanities	:	2.1	4.5	:		1	6.4	24.5	4.3	24.1	0.9	3.9
(¹) Data for 1997.		-										
(*) Total GERD is not equal to the sum of R	&D expenditure b	y sectors and	by field of scier	nce.								
(^b) Including also humanities.												

Sectoral distribution: The business enterprise sector is not always the main actor in candidate countries unlike the EU

Except for Lithuania, Cyprus, Bulgaria, Estonia and Latvia, the largest share of total GERD was accounted for by the business enterprise sector. In the five following countries more than half of total R&D was spent in the business enterprise sector: Romania (76.7%), the Russian Federation (69.0 %), the Slovak Republic (65.8 %), the Czech Republic (64.6 %) and Slovenia (53.0 %).

In the top four countries mentioned

above, businesses accounted for a higher proportion of R&D expenditure than the EU average (63.7 %). The lowest proportion of business enterprise sector in GERD was experienced in 1998 in Lithuania (1.9%), Cyprus (14.1%), Bulgaria (18.6 %), Estonia (19.7 %) and Latvia (21.0 %).

The government sector is the second most important sector in terms of R&D expenditure. Three countries had the highest share of

GERD in the government sector: Bulgaria (76.2%), Cyprus (61.0%) and Lithuania (59.4 %). In the rest of the candidate countries and also in the Russian Federation. the government sector share in R&D expenditure varied from 18.7 % for Romania to 31.4 % for Latvia.

In the higher education sector the proportions of R&D expenditure in GERD ranged from a high of 56.0 % in Estonia to a low of 4.6 % in Romania.



Finally, since the private non-profit sector accounted for a negligible share of R&D spending, it was incorporated into government sector expenditure in figure 3.

The breakdown of GERD by sector has remained fairly stable since 1994. Considerable change between the business enterprise sector and the government sector only occurred in Bulgaria, where the business enterprise sector accounted for 18.6 % of GERD and the government sector 76.2 % of GERD in 1998, respectively 49.8 % and 42.0 % in 1994. This change was due to a new national classification of activities that was implemented in Bulgaria in 1997, which is far more compatible with Eurostat and OECD standards.



R&D personnel: Sharp decrease in Bulgaria and Russia

Between 1994 and 1998. the evolution of the number of R&D personnel varied from one candidate country to another. While the number of R&D personnel by head count was higher in 1998 with comparison to 1994 in the Czech Republic (+21.2%),Poland (+ 8.8 %) and Hungary (+ 3.8 %), other countries experienced а downward trend. The largest decrease of R&D personnel in head counts happened in Bulgaria (-31.8%)and the Russian Federation (-22.7 %), the reduction of R&D personnel concerned relatively more the technicians than the researchers.

In 1998 the proportion of R&D personnel in the labour force varied between 0.49 % for Romania and 1.20 % for Slovenia, which is only 0.07 percentage points lower than the EU average.

The R&D workforce is mostly located in the business enterprise sector in Romania (68.9%), the Russian Federation (61.1%), the Czech Republic (49.6%), Slovenia Figure 4: Growth rate of R&D personnel 1994-98 (head count)



(47.3 %) and the Slovak Republic (40.8 %). The higher education sector dominates in Estonia (67.3 %), Latvia (55.0 %), Lithuania (51.8 %), Poland (50.3 %) and Hungary (37.2 %). In Bulgaria and Cyprus the government sector employs the majority of R&D personnel.





Figure 6: Distribution of R&D personnel in full time equivalent by institutional sector in 1998



Structure of R&D personnel: Large proportion of researchers

Researchers represented the biggest part of R&D personnel in each country. The number of technicians was higher than the number of other supporting staff in half of the candidate countries.

In the business enterprise sector the number of R&D personnel in FTE by NACE $(^{1})$ Rev.1 was the highest in of the Manufacturing coke, petroleum, chemicals, rubber and Lithuania plastics in (63.4 %). Hungary (45.8 %), Bulgaria (33.2%), and Cyprus (27.3%). Manufacturing of machinery, equipment, instruments and transport instruments was the most important provider of R&D jobs in the Czech Republic (47.4 %), Poland (44.1 %), Romania (43.5 %), Slovenia (41.2 %) and the Slovak Republic (23.3 %).

Researchers Other Total Technicians 19 116 8G 11 972 4 862 2 282 168 CY 564 159 237 7 015 CZ 23 740 12 566 3 159 ΕE 4 914 2 979 865 1 070 HU 20 315 11 731 4 907 3 677 Lν 4 437 2 557 777 1 103 2 104 LT 12 847 2 307 8 436 PI 16 939 84 510 56 179 11392 RO 52 454 27 494 11 511 13 449 16 461 4 331 1 985 SK 10 145 St (1) 7 985 4 022 1723 2 240 Rυ 967 499 492 494 83 499 391 506 EU-15 1 625 500 1 102 000 $US(^2)$ 964 800 JP 925 569 652 845 (1) 1997 data (2) 1993 data US and JP: Source OECD

Table 5: R&D personnel in full time equivalent by occupation in 1998

Sectors Agriculture Mining Manufacturing Food, beverages and topacco	43 43 24 2 092	<u>сү</u> 10 9	<u>CZ</u> 130 <i>17</i>	EE 3	<u>40</u> 326	<u></u>	<u>LT</u>	PL	<u></u>	RU	SK	<u></u>
Agriculture Mining Manufacturing Food, beverages and topacco	43 24 2 092	ີ10 ູດ	130 17	Э	326		0	430	5 8 40			10
Mining Manufacturing Food, beverages and tobacco	ે.4 2 092	J	17					-00	2 449		92.5	כי
Manufacturing Food, beverages and tobacco	2 092			٥	0		0	1 264	1 382	1		34
Food, beverages and tobacco		49	7 776	104	4 356	:	267	16 653	23 7 3 2	:	3 264	2 929
	63	16	47	11	130		2	435	257		8	63
Textiles for and leather	12	2	170	6	50	;	4	629	1 018	;	91	132
Wood, paper, printing, publishing	8	1	22	2	18	:	:	189	296	:	:	66
Coke, petrol., nuc.fuel, chem.and products, rubber & plas.	1 128	21	1 262	28	2 564	:	242	4 142	3 304	:	1 143	848
Non-metallic mineral products	22	1	19 7	1	32	ţ	:	288	824	:	:	35
Basic metals	136	o	337	0	15	2	:	965	1 940	:	168	71
Fabricated metal products (except machin.and equip.)	8	1	319	2	29	:	:	159		:	55	109
Machinery and equipment, instrum, & transport equip.	710	б	5 355	42	1 513	÷	19	9 662	15711	:	1 563	1 557
Sumiture, other manufacturing nec.	2	1	67	12	5	:	1	123	382		:	48
Recycling	3	0	0	Q	0	:	:	61			0	0
Electricity, gas & water supply	53	0	2	6	121		0	384	2 396	:		0
Construction	101	0	119	2	18	:	Q	540	552	:	77	0
Service sector	1 079	18	3 243	325	772	:	115	2 635	2 230	:	1 784	797
Mholesale, retail trade and motor vehicle repair etc.	16	0	43	11	32	1	0	32	:		D	12
lotels and restaurants	0	Û	ſ	0	٥	:	a	0	:	:	0	۵
Fransport, storage	353	٥	112	0	39	:	0	618	394		:	0
Communications	495	2	6	110	228	1	D	493	:	:	:	0
inancial intermediation	:	D	٥	0	Q	:	0	0	;		0	Q
Real estate, renting and business activities	215	13	3 065	180	441		115	808	1 799	5	1 530	764
Research and development	:	0	2 682	48	32	:	106	786	798		1 288	567
Community, social and personal service activities etc.		3	16	24	32	:	0	684	37	:	0	21
Fotal	3 402	77	11 287	440	5 593	507	382	21 914	36 141	590 830	6 708	3 775
	Fexbiles fur and leather Nood, paper, Printing, publishing Coke, petrol., fluc,fuel, chem.and products, rubber & plas. ton-metallic mineral products Basic metals Fabricated metal products (except machin and equip.) Aachinery and equipment, instrum. & transport equip. Furniture, other manufacturing nec. 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(¹) NACE: Nomenclature générale des activités économiques des Communautés européennes



> ESSENTIAL INFORMATION - METHODOLOGICAL NOTES

COVERAGE

This analysis concerns 11 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 also the Federation of Russia (RU). The R&D survey of Estonia did not cover the business enterprise sector before 1998, so data on total Gross domestic expenditure on R&D (GERD) and total R&D personnel are available only for 1998.

Candidate countries experienced a significant change in the development of their R&D statistics in the last decade, which was affected by the change of economic conditions and by the introduction of new methodology compatible with EU methodology. Most of these countries introduced the OECD methodology according to the Frascati manual in 1994 or 1995, so reasonable data for analysing the trends are mostly available for the period 1994-98.

DEFINITIONS

The definitions of R&D personnel and R&D expenditure are taken from the Frascati manual.

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 working time during the year.

R&D personnel are reported, except for physical persons (head counts) in full time equivalent.

Full time equivalent - FTE

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

Gross domestic expenditure on R&D (GERD)

includes all intramural expenditures within the statistical unit devoted to R&D, capital and current expenditures as well. R&D expenditure and R&D personnel are broken down by the institutional sector in which the R&D is carried out.

The business enterprise sector includes: (paragraph 145 of the Frascati manual)

- all firms, organisations and institutions whose primary activity is the market production of goods or services for sale to the general public at an economically significant price;
- private non-profit institutes mainly serving these business enterprises.

The government sector includes: (paragraph 168 of the 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 government.

The higher education sector contains (paragraph 190 of the 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 the Frascati manual):

- non-market, private non-profit institutions serving households (i.e. the general public);
- individuals or households.



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