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The critical mass

1. The Critical Mass

The figures presented in this Chapter provide a thorough overview of gender patterns for scientists and researchers studying and working in Europe.

PhD Graduates

The gender balance of the graduate population serves as an indication of the profile of the potential highly-qualified workforce of the future. Patterns of graduation from higher education can be taken as baseline for examining access to knowledge-intensive careers, including science. The International Standard Classification of Education (ISCED) identifies a specific level – ISCED 6 – as "*tertiary programmes which lead to the award of an advanced research qualification*" (UNESCO, 1997). Education programmes such as PhDs and their equivalents are included in this level for all countries, as well as some post-doctoral programmes and, in a few cases, some shorter post-graduate programmes that are a pre-requisite for the Doctorate (for example the D.E.A. in France). In the Higher Education (HES) and Government (GOV) sectors, the PhD qualification is often a baseline qualification for a research career. By looking specifically at ISCED 6 graduates we are therefore identifying people who have been directly learning and executing research and are becoming qualified for research careers.

It is sometimes suggested that the scarcity of women researchers may be due to differences in trends in educational attainment, but this Chapter reveals that this is not the case. Since we know that access to higher education increased throughout the 1990s (Strack, 2003) we can assume that the labour force in general is becoming more highly qualified. The approach here is to calculate the recent growth of numbers of graduates by sex over a three-year period[1]. This approach capitalises upon the most recent data, but smoothes out the effect of any sudden changes. In countries with smaller numbers of ISCED 6 graduates it is important to look at the increase in absolute terms as well, since a higher growth rate in the numbers of women does not necessarily signal that the increase is largely female. We can see that although women only constitute 39.6% of ISCED 6 graduates in Europe, their numbers are increasing by an annual average of 4.8%, as opposed to just 0.9% for men. This is therefore an environment in which noticeable and positive changes are taking place, both in the EU-15 and Associated Countries.

[1] *Another approach is to study retrospective data going back one generation. However, since the implementation of the revised ISCED and because of structural changes relating to access to higher education in Europe over the last two decades, it is not certain how much the results of such a study would tell us about the career outcomes of today's researchers.*

Scientific Employment

Many employment indicators vary according to gender and the gender patterns are again different between Member States and Accession Countries (Franco & Jouhette, 2003; Franco & Blöndal, 2003). Furthermore, prime-age[2] women are more likely (18%) than prime-age men (< 2%) to withdraw from the labour force to assume family responsibilities (Van Bastelaer & Blöndal, 2003). The indicators in this Chapter should therefore be interpreted with the different employment contexts in mind.

In this chapter, the gender patterns of three different employment groups are examined:

- Human Resources in Science & Technology (HRST). This is the widest possible definition of scientists and includes S&T qualified graduates in the labour force and people who are working in professional or technician occupations.
- Scientists and Engineers (S&E). Data for this group are also drawn from the Community Labour Force Survey, but are restricted to "Physical, mathematical and engineering science professionals" and therefore exclude the other fields of science, such as social, agricultural or medical sciences.
- Researchers. According to the common definition in the Frascati Manual (OECD, 2002), "Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned". The data on researchers are drawn from R&D surveys.

From a gender perspective, it is important to examine each of these groups separately since they do not always yield the same results. More detailed information on the definitions and data sources can be found in Annex 5.

HRST (Human Resources in Science & Technology)

The HRST methodology proposed in the Canberra manual (OECD, 1994) enables us to identify S&T qualified graduates in the labour force (HRSTE); people who are working in professional or technician[3] occupations (HRSTO); and people who fall into both these categories (HRSTC). In 2002, women constituted an average of 47.5% and 48.3% of HRSTE and HRSTC respectively in the Member States. An average of 46.6% of HRSTE women are also HRSTC, the corresponding figure for men being 45.1%. This means that more or less half of the human resources in science and technology in Europe are women, and that the appropriately qualified women are slightly more likely than men to be working in an S&T occupation.

It is important here to remember the breadth of the HRST categories, which include science-based workers who are not necessarily involved in research. In fact, closer analysis whereby the data are broken down by level of qualification for each Professionals and Technicians reveals that 67% of professionals with less than upper secondary education (2%)

[2] 25-54 year-olds. These averages mask considerable differences for women between countries, ranging from less than 2% in Denmark, Finland, Sweden, Iceland and Norway to 21% in Ireland and 26% in Greece.

[3] The definitions of Professionals and Technicians are taken from the International Standard Classification of Occupations (ISCO-88) and are more fully described in Annex 5.

are men. On the other hand, among technicians, 53% of the 33% share that have achieved tertiary education are women[4]. These findings really confirm that under-qualification can no longer be regarded as a factor that is keeping women out of scientific employment. Furthermore, women seem to be more likely to take jobs for which they are over-qualified.

Scientists and Engineers

If we focus more specifically upon S&Es, then a marked change in the indicator results can be seen. With the exception of Finland, women S&Es are in the minority across the EU-15. Interestingly, in the countries with the highest percentages of S&Es in the labour force, women account for more than 40% of S&Es, signifying the actual and potential value of women S&Es to national economies.

Researchers

A closer look at researchers by sex across the sectors of the economy confirms that women remain under-represented in European research, but that the overall patterns of distribution are strikingly similar between countries. Women are consistently least present in the Business Enterprise Sector (BES) where they only account for 15% of researchers.

The same is true for the Associated Countries, with the exceptions of Bulgaria, Latvia and Romania where the Higher Education sector (HES) has the lowest proportions of women. The overall proportions of women researchers are generally higher in the Associated Countries than in the Member States. This is a reflection of the higher levels of female employment, including scientific employment and research, in the economies of these countries during recent decades.

The EU average of 33.6% women researchers in the Higher Education Sector (HES) in 2000 has increased from 31.7% in 1999[5], but the average has remained at 31% for Government institutions (GOV) and at 15% for the BES (see Rübsamen-Waigmann et al., 2003). However, the lack of time series data for the Business Enterprise Sector prevents us from seeing whether any change has occurred[6]. It is particularly important to redress this imbalance in view of the increased numbers of researchers that are needed in the BES to reach the Barcelona objective of 3% of GDP devoted to R&D, of which two thirds should come from the BES.

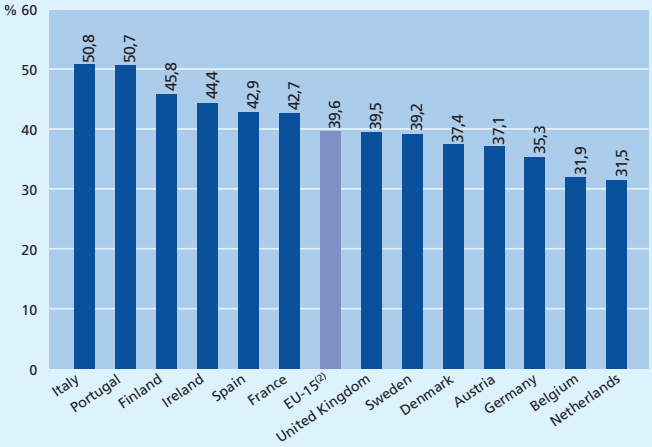
[4] *European Commission, (2003)*

[5] *See http://europa.eu.int/comm/research/science-society/women/wssi/pdf/how_many_iii.pdf*

[6] *Although there are currently data gaps, several countries have just introduced surveys, to obtain these data. Belgium (since 2003 for 2001), the Netherlands (ad hoc survey for 2001), Sweden (since 2003) and the United Kingdom (the gender split was piloted in 2002 and will have been incorporated by reference year 2004).*

Figure 1.1.a

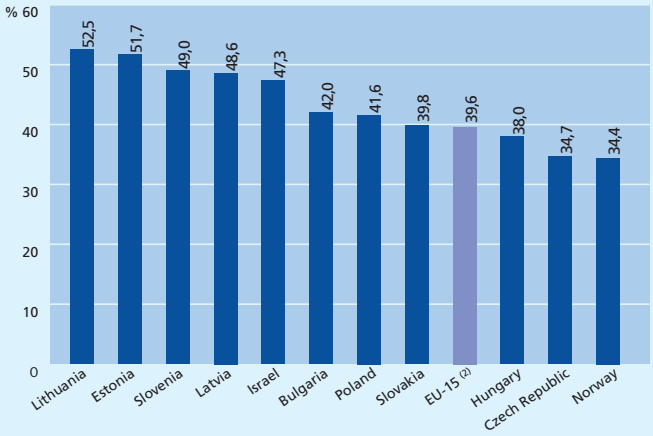
Percentage of ISCED 6 graduates who are women in EU Member States, 2001[1]



Source: Eurostat, Education
Notes: [1]Exceptions to the reference year: DK, FR, IT, FI: 2000
[2]EU-15 estimate excludes EL and LU. Above exceptions to reference year apply

Figure 1.1.b

Percentage of ISCED 6 graduates who are women in Associated Countries, 2001[1]



Source: Eurostat, Education; Israel Central Bureau of Statistics & Council for Higher Education
Notes: [1]Exception to the reference year: CY, HU: 2000; IL: 1999
[2]EU-15 estimate excludes EL and LU. Exceptions to reference year as in Figure 1.1 a

At the age of 18, women in all the Member States, especially Ireland, are more likely (75%) than men (70%) to continue their studies (Dunne, 2003). While women consequently account for more than half of the two million graduates from the whole of higher education (the estimated EU average was 55.2% in 2000 and 55.8% in 2001) the EU average for PhD (ISCED level 6) graduates is lower at 39.6% for women.

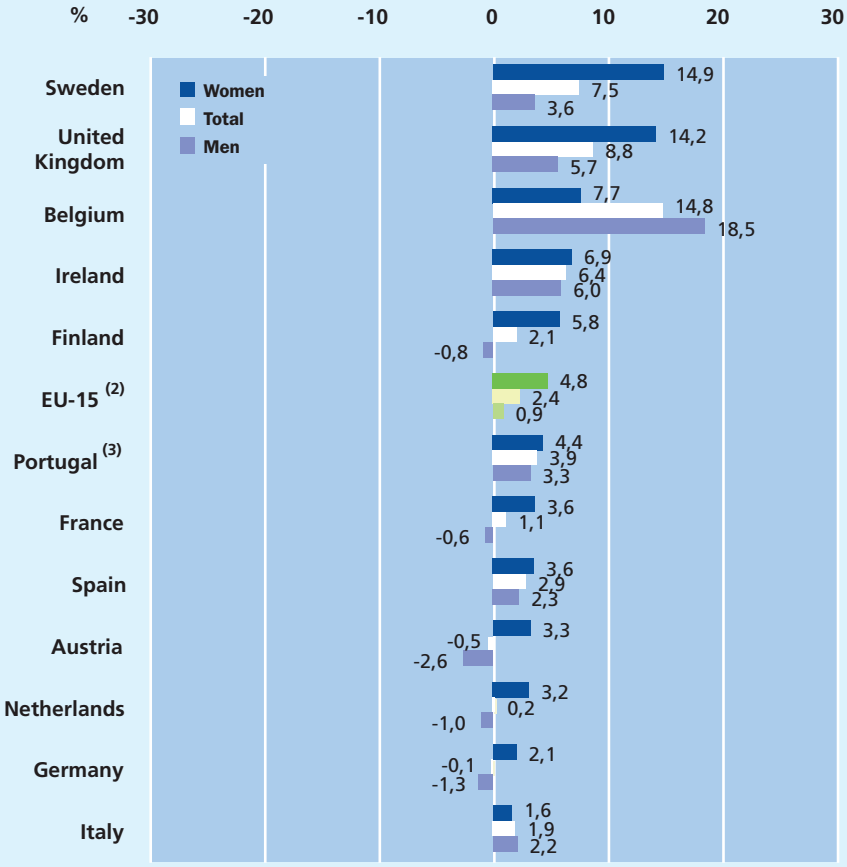
However, this average has increased by one percentage point since 2000. These results indicate that the levels of women as PhD graduates are likely to increase gradually over the coming years.

Like the Member States, Norway has a high level of retention in education at age 18 (87.6% women and 84.6% men) but only a third of ISCED 6 graduates are women. Several of the Accession and Candidate Countries (Bulgaria, Cyprus, Malta, Romania and Slovakia) appear to have more difficulty than the Member States retaining both young women and young men in education at the age of 18.

On the other hand, the Accession countries and Bulgaria tend, on the whole, to have higher proportions of women undergraduates and women ISCED 6 graduates than the Member States. This may be indicative of the different status of women in the economies of these countries. (See Annex 5 for country groupings).

Figure 1.2.a

Compound annual growth rate of ISCED 6 graduates by sex in EU Member States, 1998-2001[1]



Looking at the compound annual growth rates (see Box 1) since 1998, we can see that numbers of ISCED 6 graduates, in particular women, are largely on the increase. Growth is higher for women than for men in all countries except in Belgium and Italy. In Ireland, the increase was slightly higher for men than for women in absolute numbers, although the growth rate was higher for women.

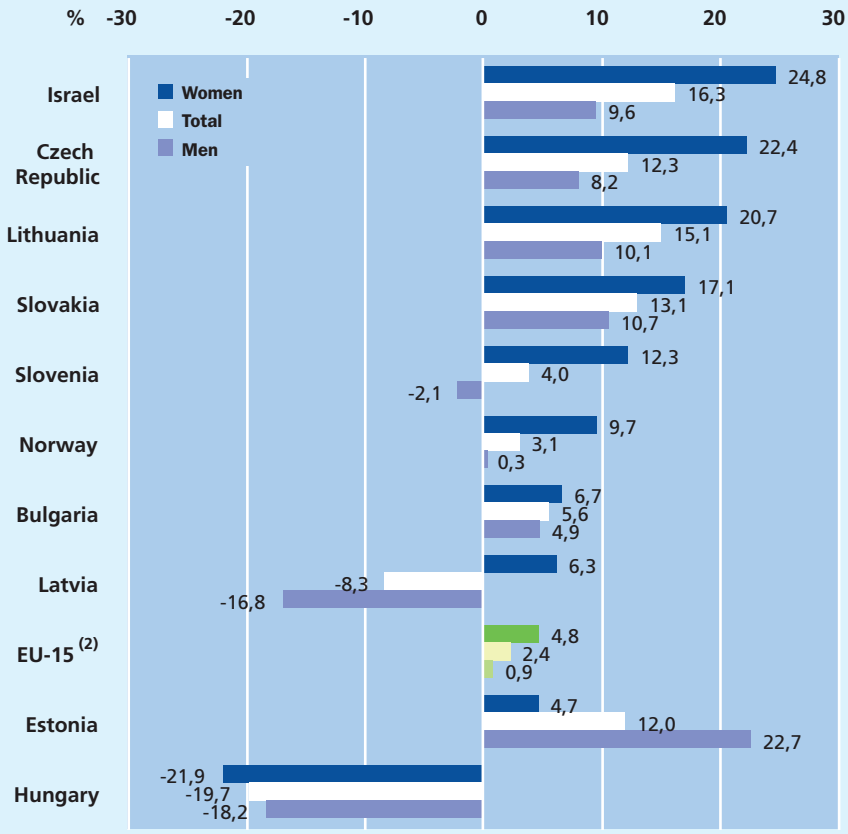
With the exceptions of Spain (where the percentage of women decreased between 2000 and 2001), Ireland, Italy and Portugal, the rates are generally very different for men and for women.

Source: Eurostat, Education

Notes: [1]Exceptions to the reference year: BE: 2000-2001; DK: 1999-2000; FR, IT, FI: 1998-2000,
[2]EU-15 estimate excludes EL, LU and is calculated for 3-year period. Above exceptions to reference years apply
[3]Provisional data

Figure 1.2.b

Compound annual growth rate of ISCED 6 graduates by sex in Associated countries, 1998-2001[(1)]



The growth rates of ISCED 6 graduates favour women in all countries except Estonia and Hungary, although in Slovakia, there was a marginally higher increase in the numbers of men graduates. The decline in Hungary's growth rate is more accentuated for women than for men, but in absolute terms the decrease was higher for men.

Even though the rates of increase are higher for women here than they are for men, it is important to bear in mind that the percentage of women graduates from ISCED 6 programmes declined in Bulgaria, Iceland, Norway, Czech Republic, Estonia, Latvia and Slovakia between 2000 and 2001.

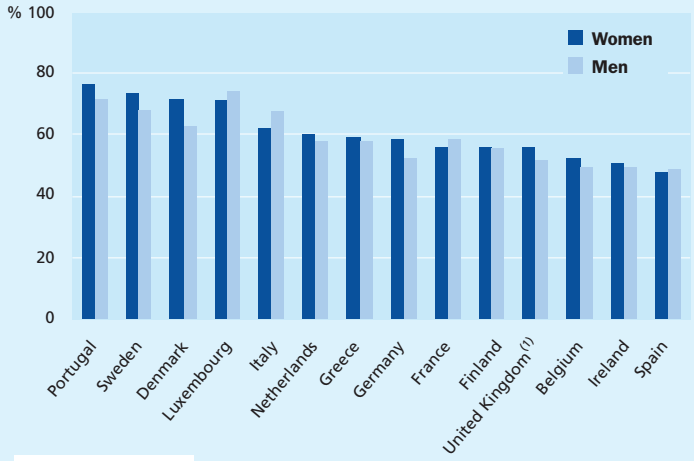
Source: Eurostat, Education; Israel Central Bureau of Statistics & Council for Higher Education

Notes: [(1)]Exceptions to the reference year: HU: 1999 - 2001; IL: 1998-1999

[(2)]EU-15 rate calculated for 3-year period. Exceptions to reference years as per Figure 1.2.a

Figure 1.3.a

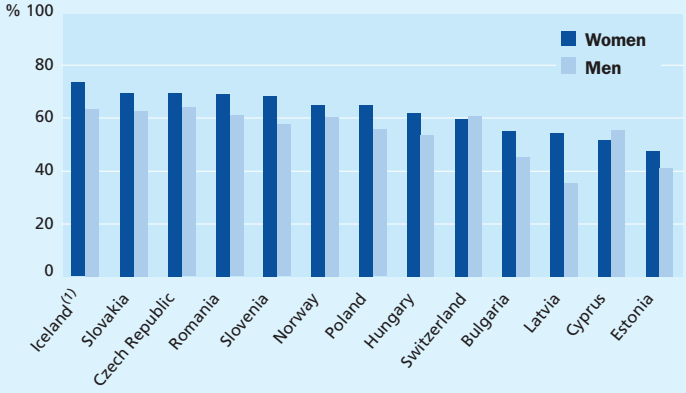
Percentage of HRSTE who are HRSTC by sex, EU Member States, 2002



Women constitute 51.6% of the population aged 15+ in Member States, 52.6% of the population aged 15+ in Accession Countries and 43.1% and 45.5% of the labour force in each group of countries respectively. In this context, 47.5% of S&T qualified graduates in the labour force (HRSTE) and 48.3% of people who are both HRSTE and working in professional or technician occupations (HRSTC) are women. Since about half of the HRSTE women (46.6%) and men (45.1%) are also HRSTC (i.e. both S&T qualified and working in professional or technician occupations), there appears on the surface to be very little gender difference in the utilisation of HRST and in the S&T returns to education.

Figure 1.3.b

Percentage of HRSTE who are HRSTC by sex, Associated countries, 2002

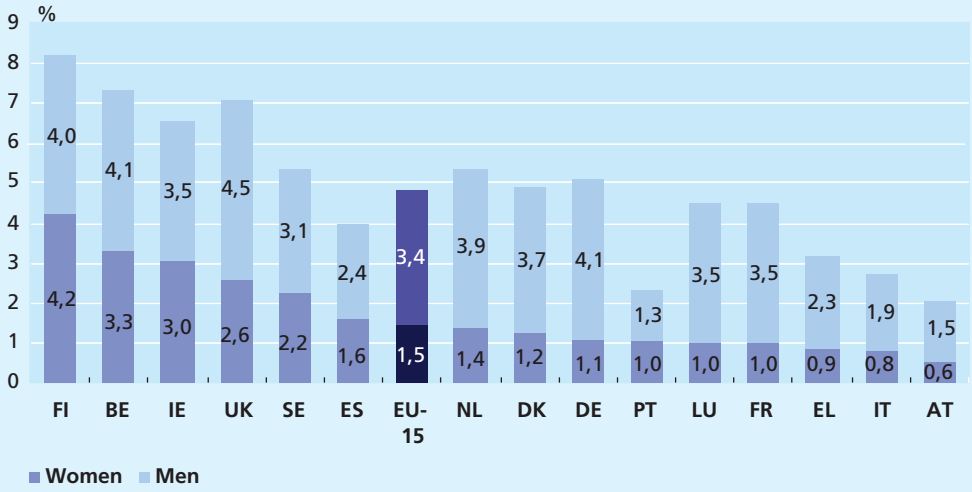


In the Accession Countries women constitute on average 54.2% of HRSTE and 57.5% of HRSTC. Furthermore, 53.4% of HRSTE who are HRSTC are women. After enlargement, the Accession Countries will boost the HRSTC stocks by 17.9% (women) and 12.4% (men), bringing the new EU-25 average of HRSTE that are HRSTC to 48.5% (women) and 46.1% (men).

Source: Eurostat, Community Labour Force data
Notes: (1) Exceptions to reference year: UK: 2000; IS: 2001.

Figure 1.4

Distribution of Scientists and Engineers by sex as a percentage of the total labour force, EU Member States, 2001[(1)]



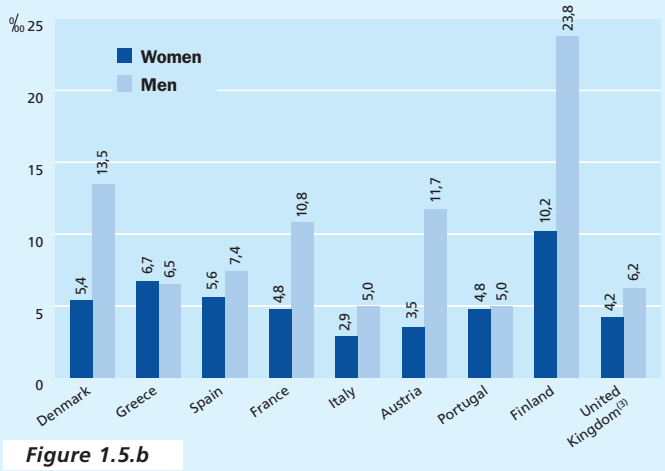
Source: Eurostat, S&T statistics, Community Labour Force data. Graph adapted from Statistics in Focus, Catalogue No. KS-NS-03-005-EN-C

Notes: [(1)]Exceptions to the reference year: AT (1997); SE & UK (2000) These exceptions also apply to the EU-15 total

Information on Scientists and Engineers (S&Es) is derived from the labour force surveys, and refers to "Physical, mathematical and engineering" occupations and "Life science and health" occupations which are subgroups 21 and 22 – of the ISCO major group 2 "Professionals". It does not therefore include any of the people working in social or agricultural sciences that are included in the HRST data. Focussing on S&Es appears to exclude a disproportionate number of women since the proportion of women tails off markedly in many Member States. The countries with the most S&Es in the labour force are generally the ones with the highest proportions of women.

Figure 1.5.a

Distribution of researchers per thousand labour force by sex in EU Member States, HC, 1999[(1)(2)]

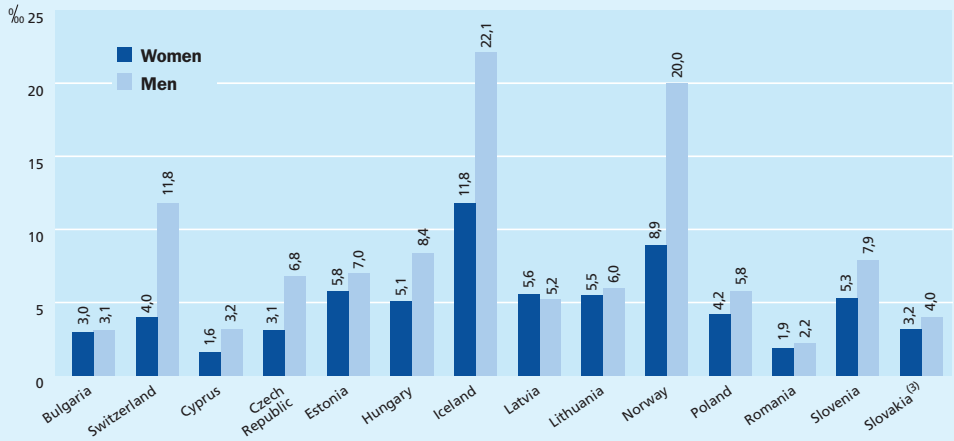


Although the definition of researchers encompasses a wider range of fields of science than S&E, they are a more specific and therefore far smaller group, as can be seen by comparing these results per thousand with those of Figure 1.4 in percent. As in Figure 1.4, Finland leads Europe in terms of the percentage of researchers and women researchers within the total labour force, but the presence of women as researchers is much lower than it is for S&E. There are high levels of male researchers in Finland, Norway and Iceland. Otherwise these results are very diverse, both between the sexes and between countries – especially for men.

Source: Eurostat, S&T statistics, Community Labour Force data; DG Research, WiS database
Notes: [(1)]Exceptions to the reference year: FR, FI: 2000; AT (RSEs only): 1998
[(2)]Excludes PNP
[(3)]HES and GOV only

Figure 1.5.b

Distribution of researchers per thousand labour force by sex in Associated Countries, HC, 2000[(1)(2)]

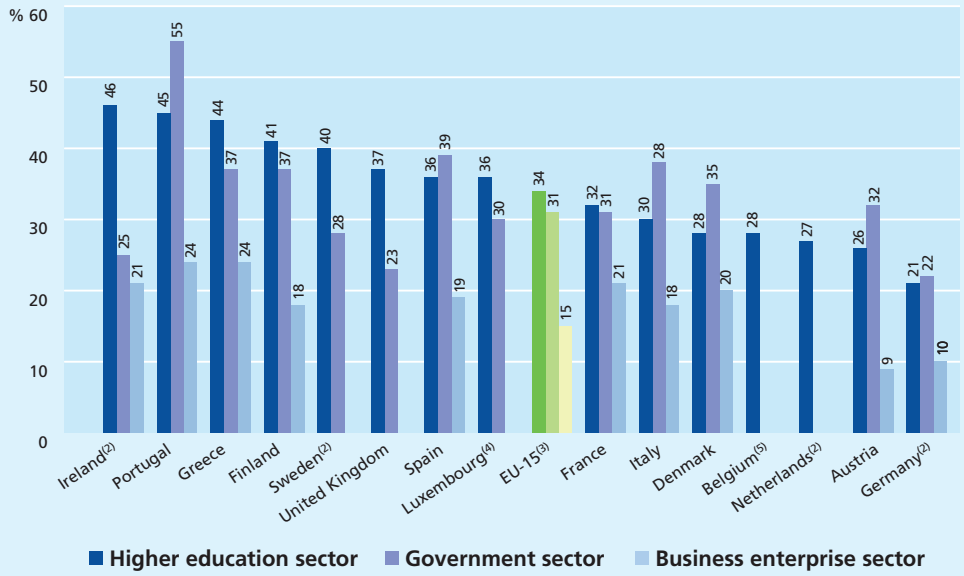


Iceland and Norway join Finland whereby research constitutes an important part of their labour forces. The intensity of research employment is far lower in Candidate countries, and the gender differences appear less pronounced.

Source: Eurostat, S&T statistics, Community Labour Force data; DG Research, WiS database
Notes: [(1)]Exceptions to the reference year: CZ, HU, LT, NO, RO, SK: 2001; IS: 1999
[(2)]Excludes PNP
[(3)]FTE as exception to HC (RSEs only)

Figure 1.6.a

Percentage of researchers who are women by sector in EU Member States, HC, 2000[(1)]



Source: Eurostat, S&T statistics; DG Research, WiS database

Notes: [(1)]Exceptions to the reference year: IT (HES), LU (HES & GOV), SE (HES): 2001; DK (BES), DE (BES), EL, ES (BES), IE (GOV, BES), IT (GOV), PT, SE (GOV): 1999; AT: 1998

[(2)]FTE as exception to HC: SE (GOV only); IE (GOV & BES only)

[(3)]EU-15 estimate excludes BE & NL for GOV and BE, LU, NL, SE & UK for BES

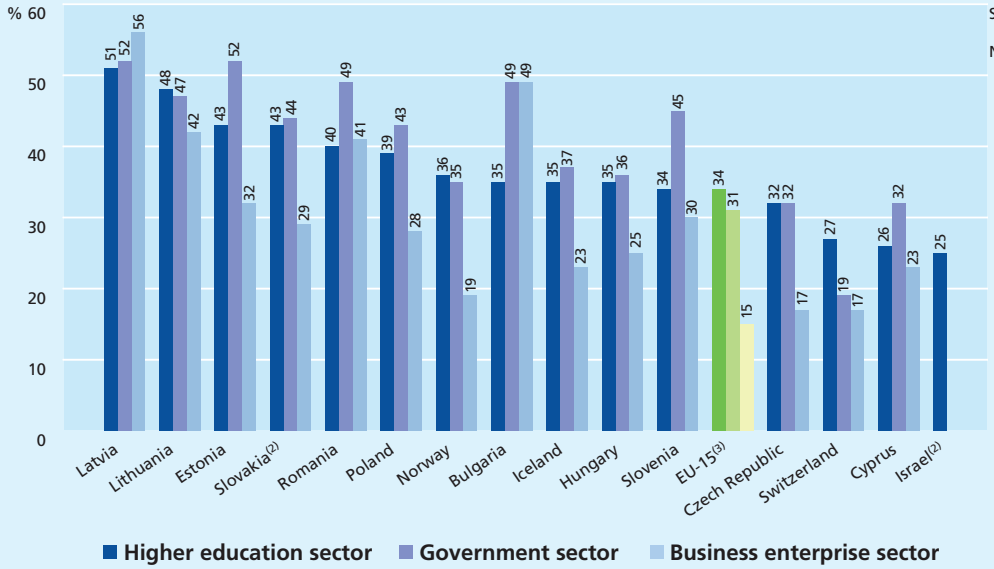
[(4)]Data provisional

[(5)]Data not official

The overall presence of women as researchers is lower than we would have expected from the graduates and HRST figures. Although the sex breakdown is only available for 70% of the BES researchers in the Member States, the scarcity of women in the BES is more extreme than in public sector research (HES & GOV). Portugal is the only country that has more than 50% women researchers in a sector (GOV). It is useful to interpret these figures alongside results from Figures 1.2.a and 1.2.b to see where the feminisation of education is having an impact on the feminisation of research.

Figure 1.6.b

Percentage of researchers who are women by sector in Associated Countries, HC, 2000[(1)]



Source: Eurostat, S&T statistics; DG Research, WiS database

Notes: (1)Exceptions to the reference year: CZ, HU, IL, LV (BES), NO, RO, SK: 2001; IS: 1999

(2)FTE as exception to HC

(3)EU-15 estimate excludes BE & NL for GOV and BE, LU, NL, SE & UK for BES. See footnotes for Figure 1.3.a for exceptions to reference year

As we may have expected from the ISCED graduates, there are higher proportions of women in research in the Associated Countries than in the EU. In most countries, women are again more seriously under-represented in the BES than in the other sectors, although every country has more than 15% women researchers (the EU average) in this sector. Latvia has the highest percentages of women in both the BES and the HES out of all of the countries in Europe. Based on 2000 data, Accession Countries will increase the numbers of EU researchers in the HES by more than 45 000 women and 72 000 men in 2004. Europe will also benefit from an estimated 14 000 women and 20 000 men in GOV and an estimated 8 000 women and 23 000 men in the BES, that is, an overall estimate of 182 000 researchers.

Table 1.1.a

Distribution of researchers by sector and by sex in EU Member States, HC, 1999[1]

		HIGHER EDUCATION SECTOR	GOVERNMENT SECTOR	BUSINESS ENTERPRISE SECTOR	TOTAL RESEARCHERS[2]
Belgium	**Women**	:	:	:	:
	Men	:	:	:	:
Denmark	**Women**	36,0	32,0	32,0	7 350
	Men	33,5	21,4	45,0	20 990
Germany[3]	**Women**	37,5	23,2	39,4	36 616
	Men	24,2	13,7	62,1	218 641
Greece	**Women**	83,7	8,5	7,8	12 066
	Men	73,0	9,9	17,2	17 410
Spain	**Women**	75,3	15,8	8,9	37 710
	Men	69,3	12,7	17,9	77 860
France	**Women**	53,4	15,0	31,6	56 320
	Men	41,9	12,7	45,4	150 654
Ireland[3]	**Women**	35,9	15,8	48,3	2 247
	Men	15,4	16,8	67,8	6 201
Italy	**Women**	54,4	26,0	19,6	26 328
	Men	50,5	15,5	34,0	71 683
Luxembourg[4]	**Women**	11,0	89,0	:	82
	Men	8,2	91,8	:	195
Netherlands	**Women**	:	:	:	:
	Men	:	:	:	:
Austria	**Women**	65,9	12,5	21,6	5 830
	Men	43,8	6,1	50,1	25 386
Portugal	**Women**	65,7	27,1	7,2	10 974
	Men	64,4	17,3	18,3	13 839
Finland	**Women**	47,6	17,1	35,3	12 686
	Men	26,6	11,2	62,2	32 106
Sweden	**Women**	98,1	1,9	:	9 747
	Men	97,1	2,9	:	17 096
United Kingdom	**Women**	93,7	6,3	:	54 677
	Men	88,3	11,7	:	100 506

It is important to interpret this table closely with the data in Figure 1.6.a. For example, we can now see that the high percentage of women in GOV in Portugal is representative of just one quarter of Portugal's women researchers.

The interface between the HES and GOV sectors in the context of national R&D systems vary from country to country. For example, a researcher in the HES in Germany or France may nonetheless be a civil servant. In other countries, key characteristics of research institutions such as source of funding, performance, management and employment status may all pertain clearly to the same sector.

The significance of the BES as an employer of researchers is highly diverse both between the sexes and between countries.

Source: Eurostat, S&T statistics; DG Research, WiS database

Notes: [1]Exceptions to the reference year: FR, IE (HES), FI, UK: 2000; AT: 1998
[2]Researchers in PNP not included
[3]FTE as exception to HC
[4]Data provisional

Table 1.1.b

Distribution of researchers by sector and by sex in Associated Countries, HC, 2000[1]

Bulgaria and Romania have different patterns of researchers from the other Candidate Countries, since they are the only countries where less than four in every ten of researchers are concentrated in the HES. In Bulgaria, researchers are more likely to be in the GOV sector and in Romania, half of all researchers, both men and women, work in the BES. In Iceland, Norway and Switzerland although the gender differences are quite pronounced, the distributions in each country are all different.

		HIGHER EDUCATION SECTOR	GOVERNMENT SECTOR	BUSINESS ENTERPRISE SECTOR	TOTAL RESEARCHERS[3]
Bulgaria	**Women**	18,3	69,0	12,7	4 781
	Men	28,3	60,8	10,9	5 695
Switzerland	**Women**	57,4	2,1	40,4	7 035
	Men	42,6	2,4	55,0	26 125
Cyprus	**Women**	43,3	28,9	27,8	194
	Men	44,3	22,2	33,5	546
Czech Republic	**Women**	49,5	31,6	18,9	7 079
	Men	39,5	25,3	35,3	19 210
Estonia	**Women**	73,7	17,9	8,4	1 947
	Men	74,1	12,6	13,3	2 582
Hungary	**Women**	67,4	19,7	12,9	9 363
	Men	63,0	17,5	19,5	18 988
Iceland	**Women**	40,8	36,0	23,2	850
	Men	36,0	28,4	35,6	1 813
Israel	**Women**	:	:	:	:
	Men	:	:	:	:
Latvia	**Women**	67,9	13,8	18,3	3 033
	Men	64,0	12,4	23,6	3 082
Lithuania	**Women**	71,6	23,2	5,2	4 801
	Men	70,2	23,4	6,3	5 412
Malta	**Women**	:	:	:	:
	Men	:	:	:	:
Norway	**Women**	55,2	14,4	30,4	9 811
	Men	39,1	10,7	50,2	24 917
Poland	**Women**	74,3	15,8	9,9	33 564
	Men	71,6	12,9	15,5	54 590
Romania	**Women**	24,4	27,7	47,8	10 107
	Men	27,5	22,0	50,6	13 490
Slovakia[2]	**Women**	54,7	28,4	16,9	3 817
	Men	48,6	23,5	28,0	5 768
Slovenia	**Women**	43,0	36,8	20,1	2 340
	Men	47,3	25,7	27,1	4 118

Source: Eurostat, S&T statistics; DG Research, WiS database

Notes: [1]Exceptions to the reference year: CZ, HU, LT, NO, RO, SK: 2001; IS: 1999
[2]FTE as exception to HC
[3]Researchers in PNP not included

Table 1.2

Researchers in PNP sector by sex; percentage women; FR; RSEs in PNP as a percentage of RSEs, and number of researchers in all sectors in available countries, HC, 2000[1]

The Private non-profit sector (PNP) has fewer researchers than the other sectors. On the other hand, for most of the countries that report these data, with the only exceptions of the Czech Republic and Slovenia, we can see that women are better represented as researchers here than in the HES and the GOV.

		PERCENTAGE WOMEN	FEMINISATION RATIO	PNP AS A %AGE OF ALL SECTORS[2]	ABSOLUTE NUMBERS
Denmark	**Women**	45	83	1,5	115
	Men			0,7	138
	Total			0,9	253
Greece	**Women**	45	80	0,3	37
	Men			0,3	46
	Total			0,3	83
Spain	**Women**	43	74	1,8	708
	Men			1,2	953
	Total			1,4	1 661
Austria	**Women**	38	61	1,2	71
	Men			0,5	117
	Total			0,6	188
Portugal	**Women**	37	58	10,6	1 301
	Men			14,0	2 261
	Total			12,6	3 562
Finland	**Women**	32	48	1,1	145
	Men			0,9	304
	Total			1,0	449
Bulgaria	**Women**	31	46	0,3	16
	Men			0,6	35
	Total			0,5	51
Cyprus	**Women**	27	37	6,7	14
	Men			6,5	38
	Total			6,6	52
Czech Republic	**Women**	19	24	0,8	54
	Men			1,2	229
	Total			1,1	283
Estonia	**Women**	54	116	1,1	22
	Men			0,7	19
	Total			0,9	41
Iceland	**Women**	54	117	6,9	63
	Men			2,9	54
	Total			4,2	117
Latvia	**Women**	80	400	0,1	4
	Men			0,0	1
	Total			0,1	5
Lithuania[3]	**Women**	42	71	0,2	10
	Men			0,3	14
	Total			0,2	24
Slovenia	**Women**	17	21	0,8	18
	Men			2,0	86
	Total			1,6	104

Source: Eurostat, S&T statistics; DG Research, WiS database

Notes: [1]Exceptions to reference year: AT, FI (PNP) (1998); EL; PT; IS (1999); CZ (2001)
[2]Data for other sectors are for 1999, except AT (1998); FI, BG, CY, EE, LV, SI (2000) and CZ, HU, LT (2001)
[3]FTE instead of HC

Box 1

Compound Annual Growth Rates

In order to measure how much a group of people has increased or decreased in a given period there are a number of possible methods, which depend on the type of growth. The growth of graduates or researchers over a period of several years is not necessarily linear. In fact it is likely to be compounded (or indeed diminished) by growth (or decline) from the previous year(s) and is subject to changing trends during the period in question. The value of the compound annual growth rate is therefore that it takes these effects into account and then smoothes the variation over time to yield a rate that is relevant in a medium- to long-term perspective. It also provides an approximation for the annual linear growth rate within a short period.

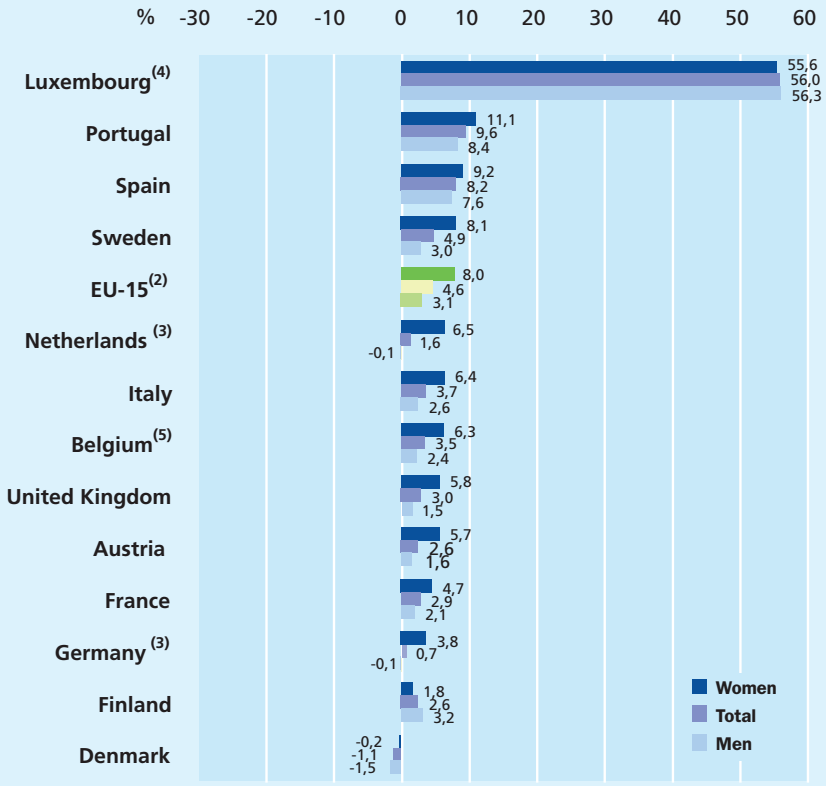
The formula is the following: $$\left(\sqrt[(y-x)]{\mathrm{Py} / \mathrm{Px}} - 1 \right) \times 100$$

Where: y is the final year of observation (for example 2001)
x is the initial year of observation (for example 1998)
Py is the population in year y
Px is the population in year x

The Compound Annual Growth Rate has political, social and economic relevance because it allows decision-makers to monitor the performance of the sector over time and provides the possibility of comparing the growth of sub-groups. It should however be borne in mind that the results for men and women only tell us about growth during the period – and not about increase or decrease in the absolute number of people. It is therefore possible, especially in a climate of rapid change, to see higher growth rates for one sex (usually the minority group), but a greater increase in absolute numbers for the other sex.

Figure 1.7.a

Compound annual growth rate of researchers in HES by sex in EU Member States, HC, 1998-2001[(1)]



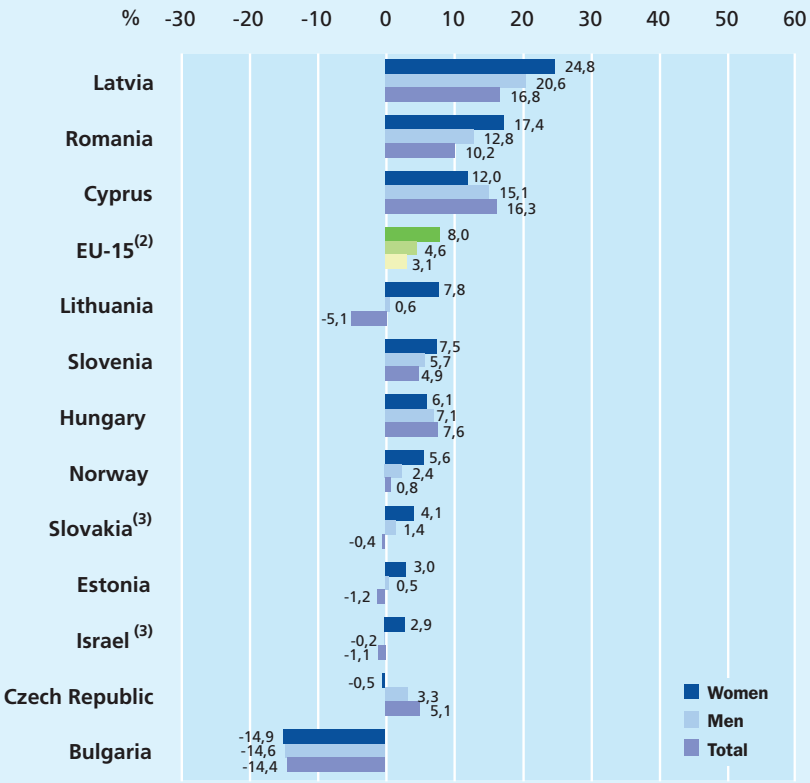
The compound annual growth rates (see Box 1) enable us to appreciate the dynamics of each sector and to make a preliminary assessment of the progress towards gender equality in research. Growth for Luxembourg is high in the HES because there has only been a University since 2000. The outlook here is encouragingly positive for research and for women. Another way of assessing the progress towards gender equality is to extrapolate the number of years to a 50% balance, based on current trends. However, no firm methodology currently exists for undertaking such projections at cross-national level, in view of the diversity of R&D systems and rates of change.

Source: Eurostat, S&T statistics; DG Research, WiS database

Notes: (1)Exceptions to the reference years: BE: 1999-2001; FR, FI: 1999-2000; DK, ES, NL, UK: 1997-2000; LU: 2000-2001; PT: 1997-1999; AT: 1993-1998
(2)EU-15 estimate excludes EL and IE and includes data for 1993 for AT. Data for NL and DE in FTE. Above exceptions to reference years apply. CAGR based on average 2,1 years growth
(3)FTE as exception to HC
(4)Data provisional
(5)Data not official

Figure 1.7.b

Compound annual growth rate of researchers in HES by sex in Associated Countries, HC, 1998-2001[(1)]



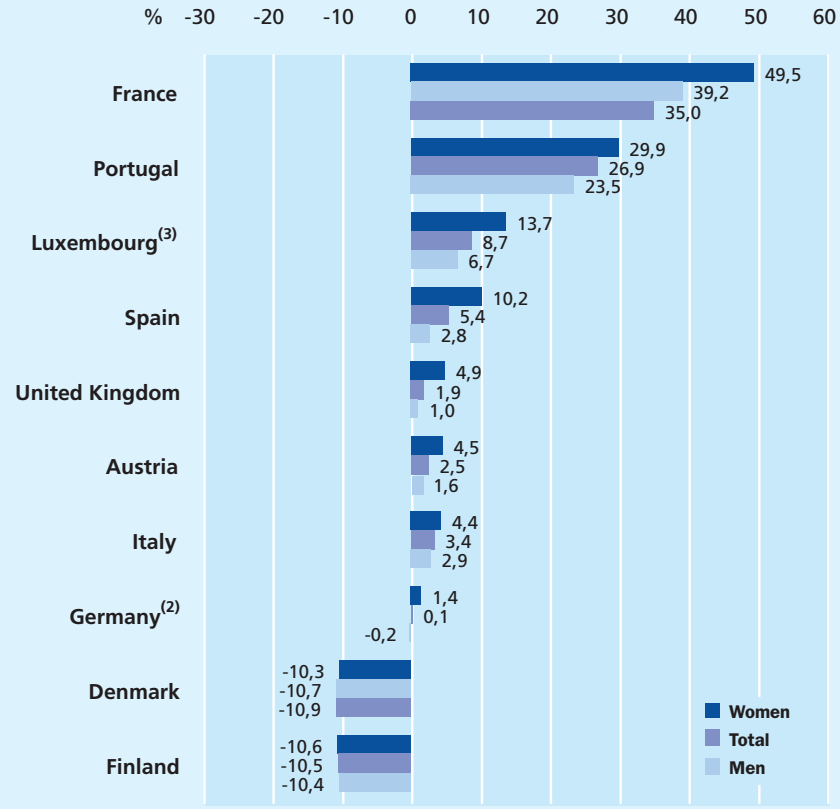
In Figures 1.2.a and b we saw that the growth rates for ISCED 6 graduates are generally stronger than the European average in the Associated Countries. However, the increase in researchers in the HES appears to have more momentum in the Member States than in all but three of the Associated countries, even though the general trend here is positive.

The economic data however indicate that this sector is flourishing. The total expenditure on R&D in the HES (HERD) for the Candidate Countries in this Figure increased from €225 million in 1997 to €357 million in 2000 – a compound annual growth rate of 16.6%. These figures also represent an increased share of gross domestic expenditure on R&D (GERD) for all sectors from 14% in 1997 to 18% in 2000. In this favourable climate, the increase in researchers in the HES can be seen for all the Associated Countries, except for Bulgaria, although only Latvia can match the 16.6% economic growth.

Source: Eurostat, S&T statistics; DG Research, WiS database
Notes: [(1)]Exceptions to the reference years: BG, SI: 1997-2000; CY: 1998-2000; CZ, LV, LT: 2000-2001; EE: 1999-2000; NO: 1997-2001
[(2)]EU-15 estimate: see footnotes for Figure 1.4.b
[(3)]FTE as exception to HC

Figure 1.8.a

Compound annual growth rate of researchers in GOV by sex in EU Member States, HC, 1997-2000[(1)]

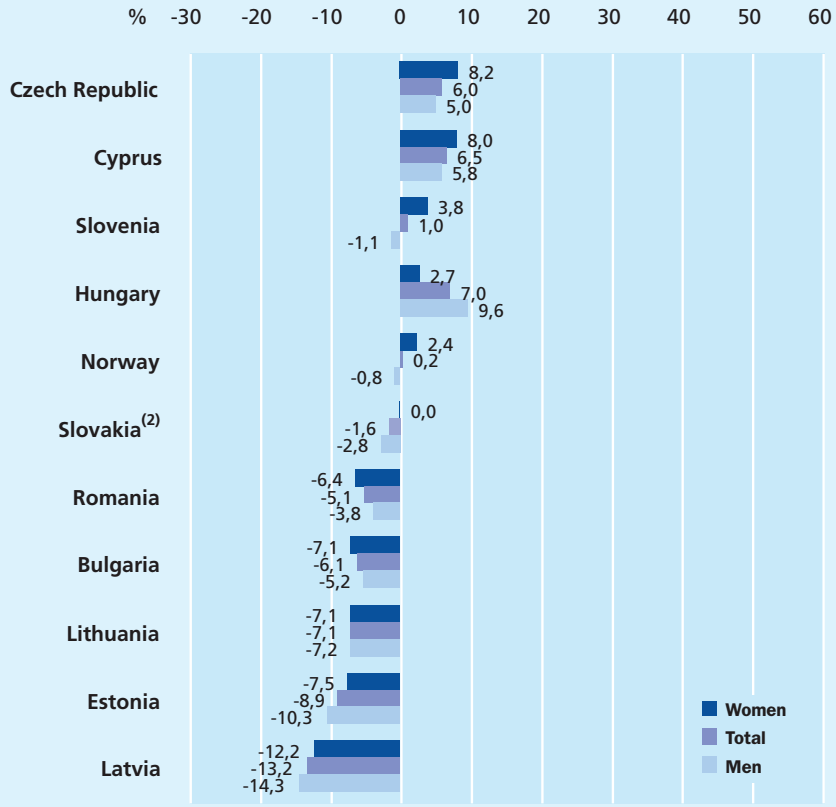


Researchers in Government institutions in most EU countries are also experiencing growth and again, the trend is generally stronger for women than for men. The context of this growth must be reviewed with the variable significance of the GOV sector across the Member States in mind. For example, in 1999, it performed as little as 3.4% of GERD in Sweden and as much as 27.9% in Portugal. The attractiveness of the sector is not necessarily the same in every country either. During the period 1998-2001, the estimated GOV expenditure on R&D (GOVERD) increased by just under €2 billion in the EU, although its share of the overall estimated expenditure on R&D (GERD) decreased from 14.8% to 13.5%. In Finland, where the FRs are the highest in Europe and where RSEs form an important part of the labour force there has been a sharp decline in the number of researchers during the period.

Source: Eurostat, S&T statistics; DG Research, WiS database
Notes: (1)Exceptions to the reference years: LU: 2000-2001; DK, FR, FI: 1999-2000; IT: 1998-1999; AT: 1993-1998; PT: 1997-1999; UK: 1998-2000
(2)FTE as exception to HC
(3)Data provisional

Figure 1.8.b

Compound annual growth rate of researchers in GOV by sex in Associated Countries, HC, 1998-2001[(1)]



Government institutions in Bulgaria, Cyprus and Lithuania are crucial centres of performance among candidate countries, representing over 40% of R&D performance. In eight out of ten candidate countries (no data for Malta and Turkey), the share of total R&D performance executed in the GOV sector declined between 1997 and 2000, especially in Latvia and Lithuania. In Slovakia and Romania, the GOV performance remained the same during the period, but overall R&D performance declined.

This economic background bears witness to a sector where there is a worrying decline in the numbers of researchers, both female and male, for the majority of countries.

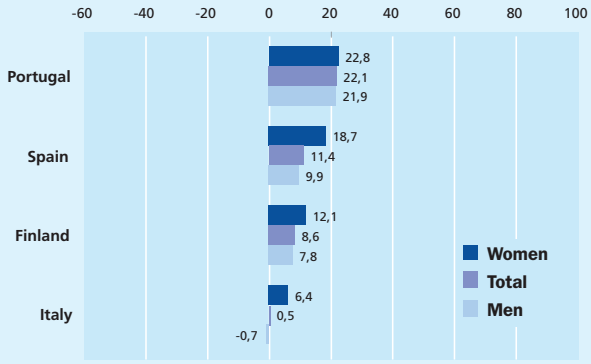
Source: Eurostat, S&T statistics; DG Research, WiS database

Notes: (1)Exceptions to the reference years: BG, EE, LV, SI: 1997-2000; CY: 1998-2000; CZ, LT: 2000-2001; NO: 1997-2001

(2)FTE as exception to HC

Figure 1.9.a

Compound annual growth rate of researchers in BES by sex in EU Member States, HC, 1997-1999[(1)]



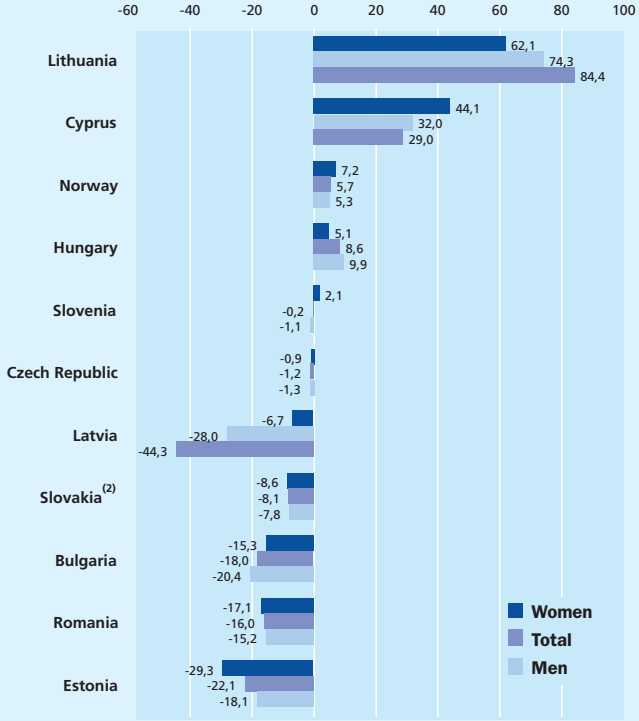
Source: Eurostat, S&T statistics; DG Research, WiS database
Notes: [(1)]Exceptions to the reference years: IT, FI: 1999-2000
[(2)]FTE as exception to HC

In 2000, R&D expenditure in the BES (BERD) as a percentage of GDP was an estimated 1.26% in the EU-15, an average annual real growth rate of 4.3% since 1995 (European Commission, 2003). This general increase in BERD was highest in Finland (16.1%) and lowest in Italy (1.7%). It is borne out by an overall increase in the numbers of BES researchers, particularly women.

During 1997-2000 there was only decline in Romania and Slovakia for R&D expenditure in the BES. Among four Accession Countries, there was a decline in the numbers of researchers regardless of the increased expenditure, but no common gender pattern. Lithuania's extreme growth corresponds, in absolute numbers, to 95 new women researchers and 157 new men researchers.

Figure 1.9.b

Compound annual growth rate of researchers in BES by sex in Associated Countries, HC, 1998-2001[(1)]



Source: Eurostat, S&T statistics; DG Research, WiS database
Notes: [(1)]Exceptions to the reference years: BG, SI: 1997-2000; CY: 1998-2000; CZ, LV, LT: 2000-2001; EE: 1999-2000; NO: 1997-2001
[(2)]FTE as exception to HC