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Foreword

In the Barcelona summit, the European council remarked that a significant boost of the overall R&D and innovation effort in the Union would be necessary in order to close the gap between the EU and its major competitors. In this context, it set the objective of increasing the overall spending on R&D and innovation in the Union to around 3 % of GDP by 2010, with two-thirds of this new investment to come from the private sector.

Statistics on Science and Technology 2003, prepared by the *Research and development, methods and data analyses* unit of Eurostat, provides data that allow for the continuous reporting and analysis of the situation of R&D in Europe. In particular, this publication presents the latest developments in the field of R&D expenditure, R&D personnel, Government R&D appropriations and Patents, and is a follow up of the former Research and Development: Annual Statistics, which was first published in 1993. Other science and technology indicators collected by Eurostat are excluded from this publication and may be found in Eurostat's reference database, *NewCronos*.

Responding to developments in the policy and scientific communities, *Statistics on Science and Technology 2003* provides some additional information on relevant indicators as compared to the 2001 edition. Data and trends are provided not only for patent applications to the European Patent Office — EPO, but also for patents granted by the United States Patent and Trademark Office — USPTO. Additional data on the number of researchers amongst total R&D personnel are analysed for the European Union and beyond.

As in the 2001 edition, in an effort to provide users of Eurostat data with more detailed information, certain indicators at the regional level are presented at the NUTS 2 level. Although limitations of space have prevented the inclusion of complete time series in all cases, these data can be found in the CD-ROM version of this publication and are, of course, available in Eurostat's reference database, *NewCronos*.

Comprehensive methodological notes are provided in their own section for clearer data utilisation, providing such information as the source, reference unit and coverage of the data, the time series available or any country specific methodological changes in the collection procedures.

All the information in this publication is based on data supplied to Eurostat by the Member States, by the Research DG of the European Commission, by the European Patent Office — EPO, by the United States Patent and Trademark Office — USPTO — and by the OECD. We express our thanks to our colleagues in the Member States (and in Iceland and Norway), the Commission Services, the EPO, the USPTO and the OECD for their excellent co-operation and their willingness to help in meeting the ever-growing demand for information on S&T.

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Introduction

The indicators presented in *Statistics on Science and Technology 2003*, by the Statistical Office of the European Communities — Eurostat, allow the continuous reporting and analysis for a close monitoring of recent performances and the identification of current and potential areas of concern.

The data, which cover R&D expenditure, R&D personnel, Government budget appropriations or outlays for R&D and patents, are as comprehensive, comparable and as up to date as possible.

Their focus is on the 15 European Union Member States and, to a lesser extent, the European Economic Area. To provide high-level international comparison, the United States and Japan are also considered, where possible. At the other end of the scale, a regional analysis across the EU countries is provided.

This publication, intended for both generalists and specialists, is organised as follows. The first Part presents an analysis of the recent trends in R&D and patenting. In Part 2, the accompanying methodological information is provided in some detail for more specialist users. Part 3 presents tables containing both original data and derived indicators, providing users with the opportunity to conduct their own analyses on the Research and Development situation in Europe and beyond. Within R&D expenditure and personnel or patents, data are organised according to geographical detail, with national data being presented before NUTS 2 level regional data.

Given the numerous sources of data involved, the time series differ according to indicator. However, the first considered year for most indicators in this publication is 1991. In any case, the goal of this publication remains the same throughout: to provide the most detailed and coherent time series analysis possible.

Consistency with the analyses conducted in previous publications is also maintained, whilst seeking to complement these aspects with further research. A number of important innovations have been introduced to this publication.

The first is an extended reporting of the data, with data on patents now also presented for patents granted by the United States Patent and Trademark Office — USPTO. Data on high technology patents are now also provided broken down by high technology group.

The data series in national currency included in this publication refer to national currencies at 1 January 2002 and therefore include 'Euro fixed' series for Eurozone countries along with non-Eurozone countries series that continue to be expressed in DKK, SEK, GBP, and USD for example. To maintain the possibility of using data in national currency for time series analysis also for the period prior to the adoption of the Euro, data were converted from the former national currency series by applying the irrevocably fixed Euro exchange rate for the entire time series presented — including years before the adoption of the Euro. This means that these series cannot be used in general for comparisons over space. In particular, users are warned about the possible misunderstanding in using these data for geographical comparisons or aggregations of Eurozone countries for periods prior to the adoption of the Euro. For such purposes it is advisable to use the series in current Euro, which have been calculated by using the current exchange rates.

Concerning the data series in real terms, unlike in previous years when data were presented in constant Euro, data in this publication are given in PPS at 1995 prices.

In an effort to provide users with a set of rigorous and comprehensive methodological notes, Part 2 of this publication presents in some detail the information behind the data. For each variable — GBAORD, R&D expenditure and personnel or patents — Part 2 specifies the appropriate definitions, sources, reference units, time series, geographical coverage, method of calculation, etc. Also documented in this section are the country specific notes, such as breaks in series or methodological changes.

Due to constraints of space, the comprehensive statistical tables used for the analysis are not always available in the paper version of the present publication. Instead, they are provided in their entirety in the electronic version of *Statistics on Science and Technology 2003*. Electronic versions of this publication can be obtained by visiting the Eurostat Web-site at:

http://www.europa.eu.int/comm/eurostat.

Readers should note that the data used for the analyses of *R&D in Europe — Part 1* are those available in the third quarter of 2002. They may not correspond exactly with those in the tables in Part 3, or in Eurostat's *NewCronos* database, when these have been subsequently updated.

Government budget appropriations or outlays for R&D — GBAORD

In Part 1, Chapter 1 documents the main trends of GBAORD in the EU and EEA, first placing Europe in an international context and then concentrating on developments at the national level. In 2001, budget appropriations in the Member States of the European Union totalled roughly EUR 67 400 million, a rise of around EUR 3 300 million in nominal terms on 2000 — or 3 % in real terms, i.e. corrected for inflation. Although GBAORD as a percentage of GDP in the EU showed a downward trend through out the nineties, a slight improvement was registered in 2000 and 2001. Comparisons with the US and Japan reveal that Japan has caught up both the EU and the US to a significant degree since the end of the '80s, registering almost systematic higher year-on-year absolute growth. Nevertheless, the US still retains the highest values of government budgeting to R&D activities.

Within the EU, Finland and France show the highest proportions of government budgeting to R&D activities, both as a proportion of their GDPs and total general government expenditure. Spain and Portugal, on the other hand, have shown the highest growth rate over the last five years and are approaching the EU average.

Changing trends are also evident in the socio-economic objectives of these funds. The importance of budgeting towards 'Defence' declined during the 90s. So too have 'Agricultural production and technology' and 'Exploration and exploitation of the earth'. Meanwhile, 'Research financed from general university funds' has continued to see budgetary increases, as has 'Protection and improvement of human health'.

Introduction

R&D expenditure and personnel

Chapter 2 gives the most recent trends in both R&D expenditure and personnel. In 2001, EUR 171 billion at current prices were spent on R&D in EU-15, displaying a rise of 2.9 % compared to the previous year in real terms. Despite this increase, the gap between the EU and both the US and Japan remains stable when R&D expenditure as a share of GDP is compared for each institutional sector. In 2001, the EU devoted 1.94 % of its GDP to R&D expenditure against 1.93 % in 2000. Meanwhile, this percentage reached 2.98 % in Japan and 2.70 % in the United States in 2000. Concerning the distribution across institutional sectors, most of the R&D expenditure corresponds to the business enterprise sector, which in 2001 accounted for 66 % of the total in EU-15, 71 % in Japan and 75 % in the United States in 2000. At the Member State level, as for the previous year, Sweden (1999 data) and Finland (2001 data) performed best, with 3.78 % and 3.67 % of their respective GDP being devoted to R&D expenditure.

R&D personnel is also increasing in the EU: In 2001, there were 1.8 million people in full-time equivalent or 2.4 million in head count engaged in R&D, which represented 1.41 % of the EU's labour force in 2001, compared to 1.38 % in 2000. Amongst R&D personnel, the number of researchers in EU-15 increased to 960 000 persons (FTE) in 2001, an increase of over 100 000 researchers since 1995. Within the EEA, most researchers are employed in Germany, whereas the highest proportion of researchers on total R&D personnel is observed in Portugal (76 %) and Norway (72 %). With regard to the gender distribution, women are unequally represented in R&D personnel, in particular when they are researchers and employed in the business enterprise sector.

At the regional level, German regions concentrate most R&D activity in Europe, both in terms of volume and as a percentage of GDP. With Oberbayern (D) as the leading region, the 6 first classified German regions represent 16 % of the total R&D expenditure in Europe (current EUR). In terms of R&D expenditure as a share of GDP, Braunschweig (D) is, with 6.34 % in 1999, the first region in Europe and shows a very strong increase of about 1.5 percentage points during the previous 2 years.

Braunschweig remains in the leading position in the business enterprise sector with 4.60 % of its GDP devoted to R&D expenditure in this sector. Açores (P) is in the lead in the government sector and Tröndelag (NO) in the higher education sector with 2.12 and 1.63 % of their respective GDP devoted to R&D.

Patenting activities in the EEA, Japan and the USA

As documented in Chapter 3, patent applications to the European Patent Office have been increasing in the second part of the 90's. In 2000 there were 57 473 patent applications to the EPO from inventors resident in the EU, 43 761 from inventors resident in the US and 18 780 from Japanese resident inventors. Note that the EU Member States may have a home advantage.

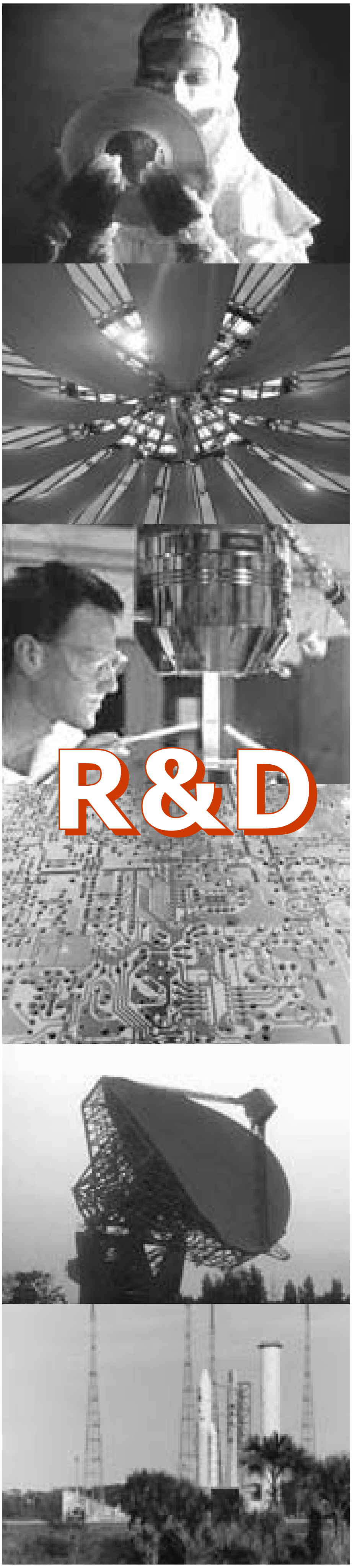
Within Europe, Germany is leading, accounting for 42.4 % of total European patent applications in 2000, followed by France (14.4 %) and the UK (12.9 %). In relative terms, the country with the highest number of patent applications per million inhabitants was Sweden (346) followed by Finland (320). Both countries outperformed Germany, France and the UK and their ratios more than doubled the EU and US ones.

At the regional level, inventors from the French capital region of Île de France applied for most patents in absolute terms (3 424 patent applications), followed by those from the southern German regions of Oberbayern (3 092) and Stuttgart (2 533). Oberbayern was the region with the highest proportion of patent applications per million inhabitants (767) in the EU.

Among the patent applications to the EPO, an increasing proportion relates to high technology areas. Throughout the 1995-2000 period, high tech patent applications in Europe grew at an annual average growth rate of 22.0 %, compared to 10.9 % of patent applications overall. This increase for high tech patents was evident not just for the EU, but also for patent applications made to the EPO by Japan and the US.

In 2000, the USPTO published 86 563 patents granted to US inventors, 31 643 patents granted to Japanese inventors and 27 783 patents granted to inventors resident in the EU. Within the EU, Germany accounted for 39.4 % of the total patents granted, the UK for 15.4 % and France for 15.2 %.

The number of patents granted by the USPTO to EU inventors has been growing in all Member States, especially during the second part of the nineties. When taking population into consideration, in 2000, Sweden was leading (196 patents granted per million inhabitants), followed by Germany (133) and Luxembourg (133).



PART 1

R&D IN EUROPE: ANALYSIS

Chapter 1
Government budget appropriations or outlays on Research and Development — GBAORD

1.1. Introduction

Government budget appropriations or outlays on R&D — GBAORD — are a way of measuring government support to R&D activities. They include all appropriations allocated to R&D in central government or federal budgets. Provincial or state government should be included only where the contribution is significant. Unless otherwise stated, data include both current and capital expenditure, and cover not only government-financed R&D performed in government sector, but also government-financed R&D in the business enterprise, private non-profit and higher education sectors, as well as abroad (i.e. international organisations). Data are collected according to the guidelines outlined in the OECD's *Proposed standard Practice for surveys of research and experimental development — Frascati Manual*, 2002.

GBAORD data do not consider the amount of money actually spent, but are based on budget provisions, and so should be seen as intentions of spending. This is why data on actual R&D expenditure, which are not available in their final form until some time after the end of the budget year concerned, may well differ from the original budget provisions. The process of political consensus about public expenditures creates gaps between budgets and final expenditures — gaps in terms of time and amount of resources. The reporting unit also differs between GBAORD and R&D expenditure: the reporting unit for GBAORD is the Government, whereas for R&D expenditure the reporting unit is the performer of the R&D activity. However, since there is a greater time lag for data on final R&D expenditure, data are usually collected from budget statistics in order to provide timely indicators.

Data are collected at the national level and the procedure can be articulated in a two step process:

- within the budget statistics, it is first necessary to identify the budget items that involve R&D;
- the R&D content of these budget items must then be measured or estimated.

Government R&D appropriations are broken down by socio-economic objectives on the basis of NABS — *Nomenclature for the analysis and comparison of scientific programmes and budgets*, Eurostat, 1994. These data reflect policies at a given moment in time and the concomitant priorities of the policy makers when allocating their budgets. These data are hard to collect because they are not obtained from *ad hoc* surveys, but from national budget statistics. More specifically, the difficulty is due to the fact that national budgets already have their own terminology and methodology and therefore do not accord entirely with the Eurostat guidelines and the methodology proposed by the *Frascati Manual*.

The 1983 version of NABS applies to all the figures up until the 1992 final budgets and the 1993 provisional budgets. The 1993 version applies from the 1993 final and the 1994 provisional budgets onwards. As a result of the revision of NABS, some caution should be employed when comparing the data for some NABS headings with those of earlier years. The greatest differences are to be found in chapters 1, 3, 5, 7, 10 and 11 of NABS ([1]). Furthermore, not all countries transpose their data directly to NABS: some follow other compatible classifications — OECD, Nordforsk, which are then converted to the NABS classification — see Table 8.2., p.115 of the *Frascati Manual*, OECD 2002.

The analysis in this chapter covers the period 1991 to 2001, with provisional data for 2001. The chapter is divided into two main sections. The first section takes an international perspective and compares the respective trends in the EU ([2]), Japan and the USA. The second section begins by analysing the evolution of GBAORD for the EU, Iceland and Norway, and then presents some specific developments in the Member States by means of individual country reports.

1.2. GBAORD — an international perspective 1991-2001

This section considers government budgeting to R&D activities in the European Union compared to that of Japan and the United States. Overall levels of GBAORD are examined as well as breakdowns by socio-economic objectives.

1.2.1. Total GBAORD

At the beginning of the 1990s, the USA allocated more funds to R&D activities, as a percentage of GDP, than EU-15 and Japan. At this time, the GBAORD of the EU-15 and the United States were respectively twice and two and a half times greater than that of Japan. Figure 1.1. clearly shows this substantial difference at the beginning of the 1990s, but it also helps show the convergence in the appropriations allocated to R&D over the course of the decade.

In terms of nominal value (current EUR), the USA GBAORD in 1991 was approximately EUR 53 billion, or four to five times higher than that of Japan. In 2000, this same ratio is down to 2.5.

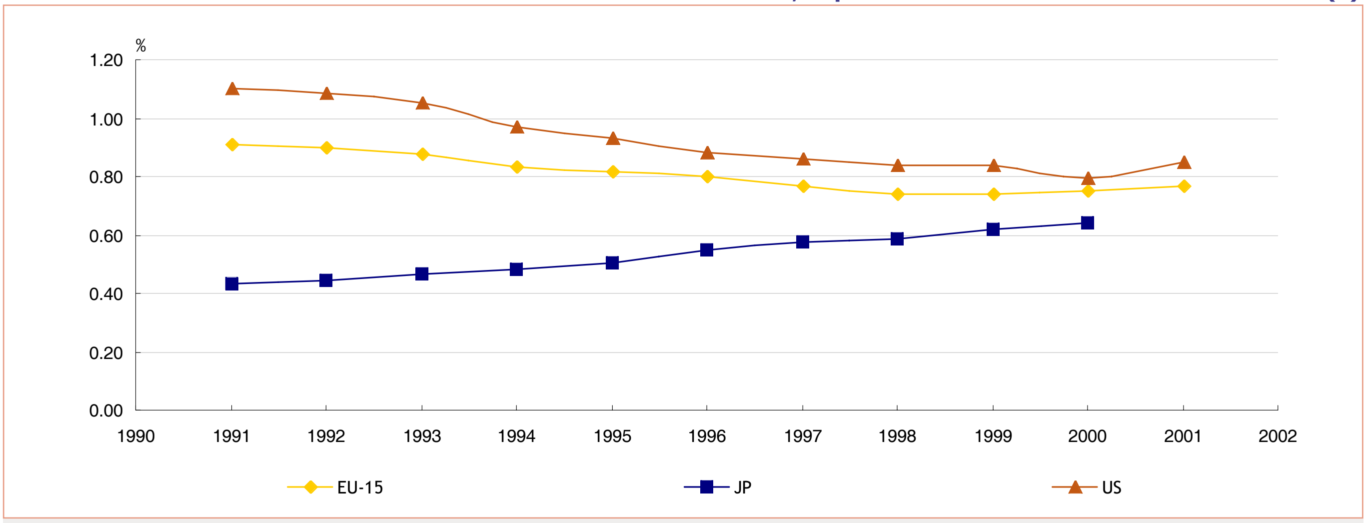
Between 1991 and 2001, Japan's GBAORD rose by 65 % in real terms (1995 PPS) whereas those of the USA and the EU-15 remained virtually stable.

After correction for inflation, absolute year-on-year growth was thus higher for Japan, which had annual growth rates of between 2 % and 12 % whereas the EU-15 and the United States recorded rates, which fluctuated between positive and negative growth.

(1) These NABS chapters cover the following fields:
Chapter 1 — Exploration and exploitation of the Earth;
Chapter 3 — Control and care of the environment;
Chapter 5 — Production, distribution and rational utilisation of energy;
Chapter 7 — Industrial production and technology;
Chapter 10 — Research financed from General University Funds (GUF);
Chapter 11 — Non-oriented research.

(2) No data exist for Luxembourg and therefore EU-15 totals in this chapter exclude Luxembourg.

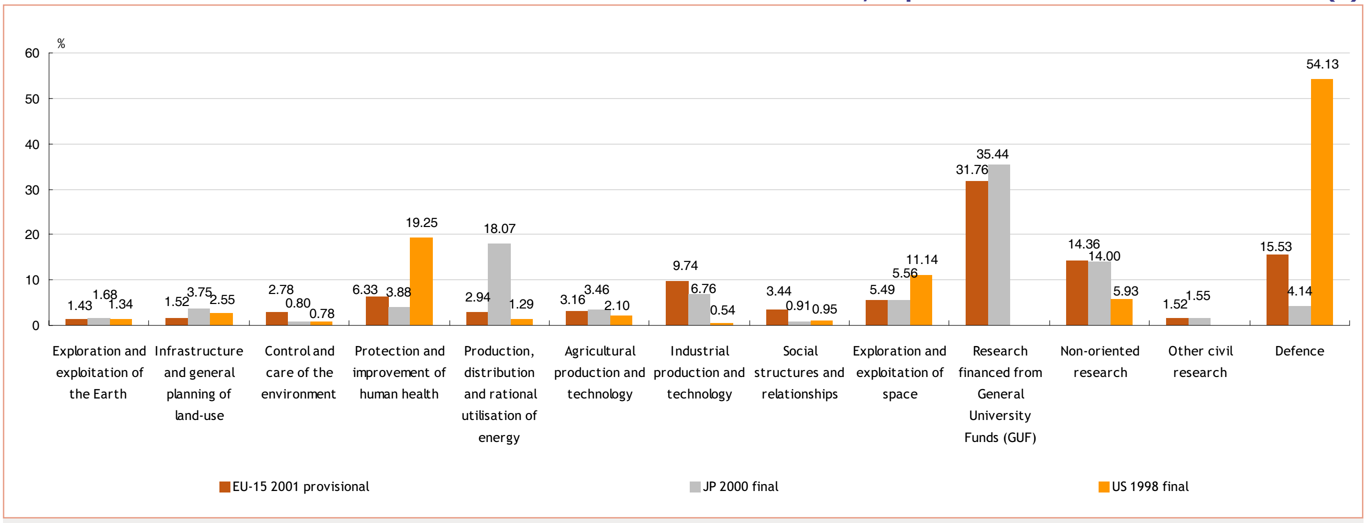
Figure 1.1. **GBAORD as a % of GDP**
EU-15, Japan and the United States — 1991-2001 (1)



(1) EU-15 2000 — Eurostat estimate; EU-15 2001 — Eurostat estimate based on provisional data.
US 2001 — provisional data.

Sources: Eurostat, OECD (JP, US).

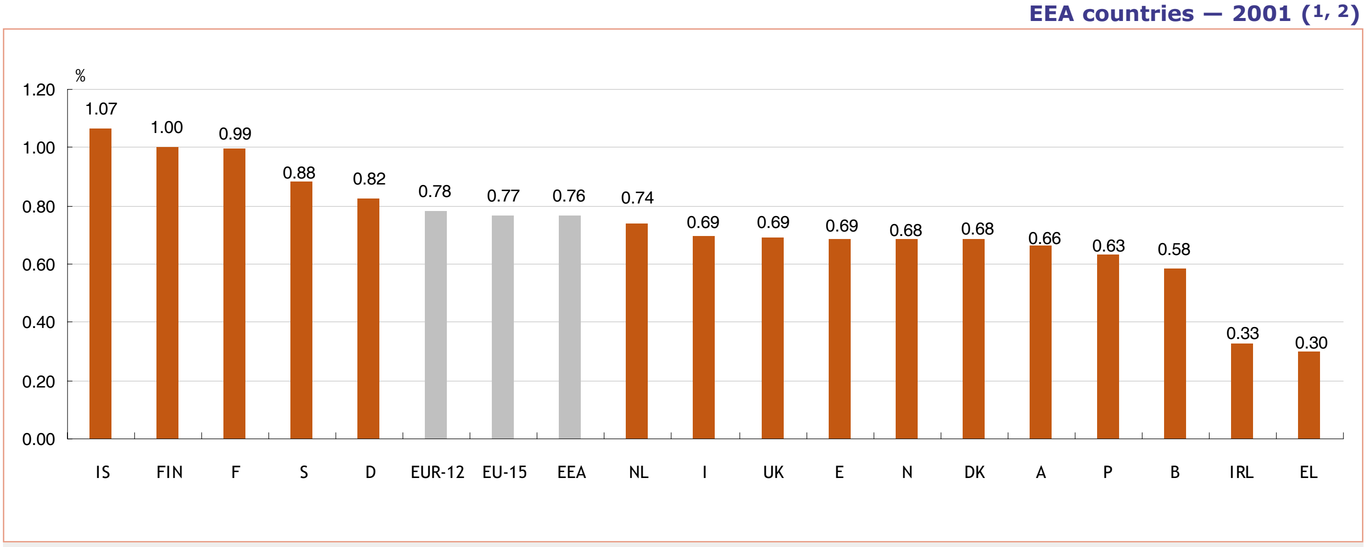
Figure 1.2. **Distribution of GBAORD by socio-economic objective in %**
EU-15, Japan and the United States — 2001 (1)



(1) EU-15 — Eurostat estimates based on provisional data.

Sources: Eurostat, OECD (JP, US).

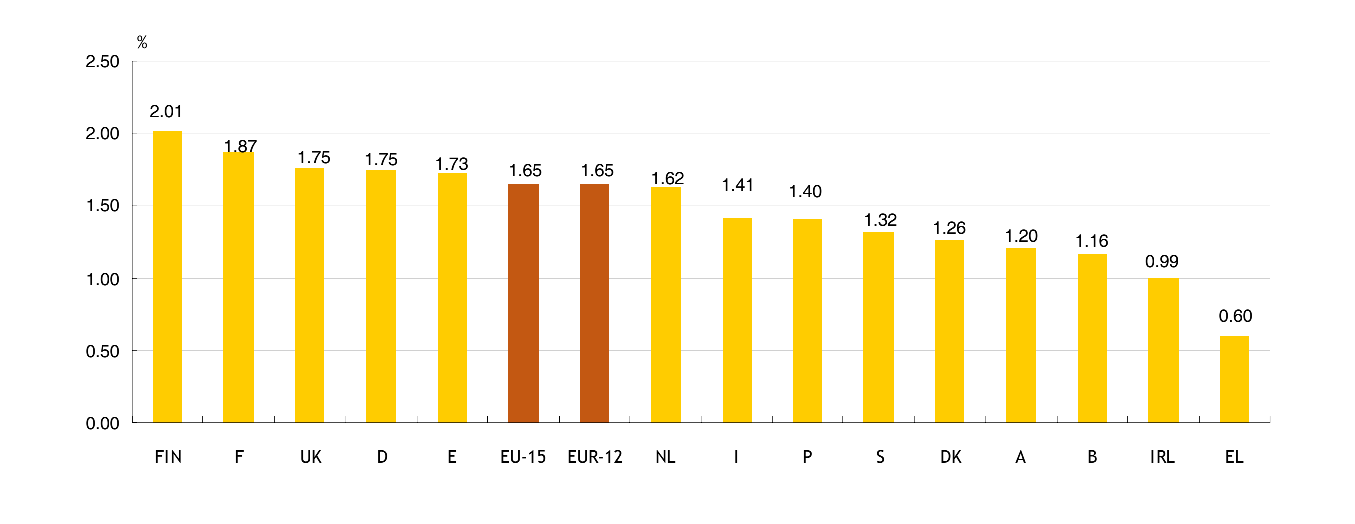
Figure 1.3. **GBAORD as a % of GDP**
EEA countries — 2001 (1, 2)



(1) EEA, EU-15 and EUR-12 — Eurostat estimates based on provisional data.
(2) Exceptions to the 2001 reference year — DK and E: 2000 provisional.

Source: Eurostat.

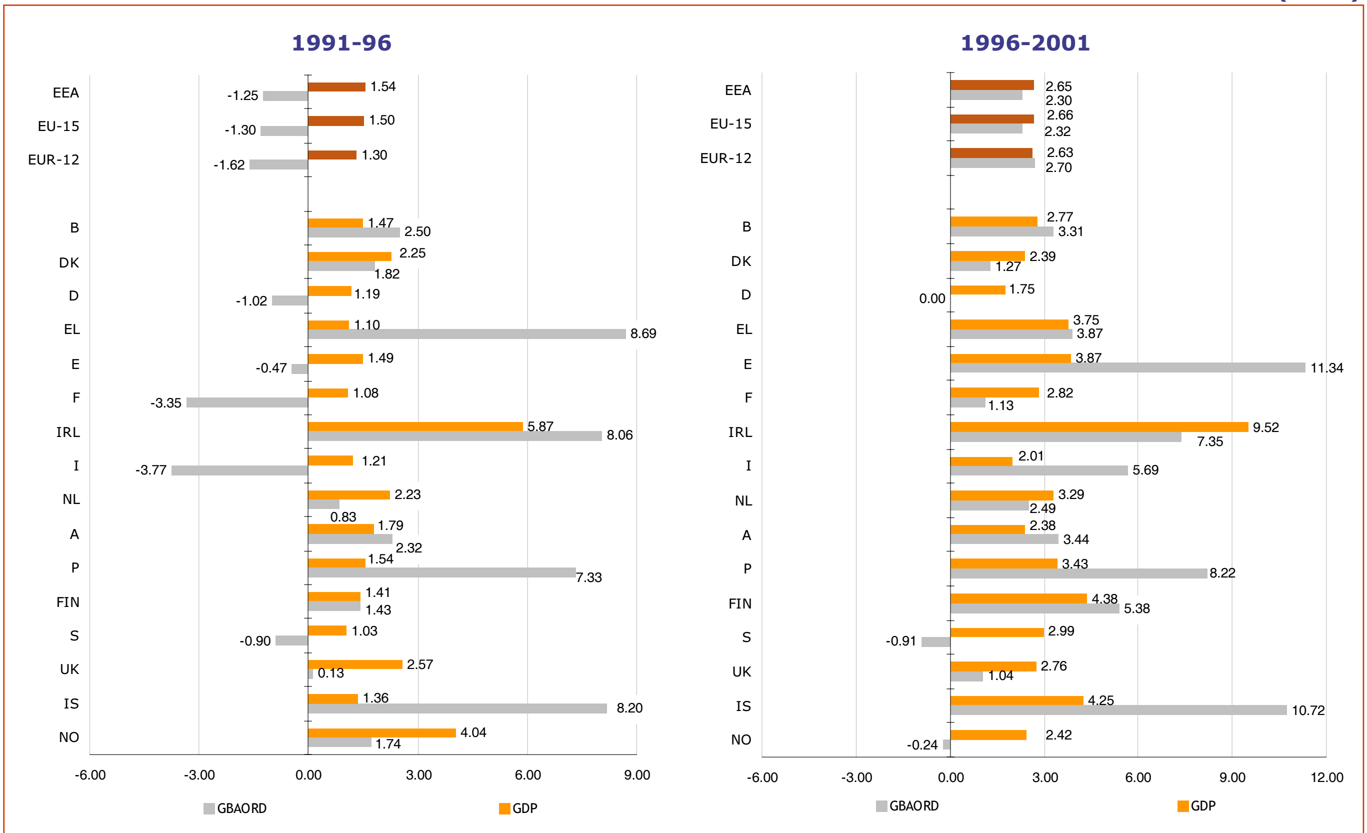
Figure 1.4. **GBAORD as a % of total general government expenditure EU-15 countries — 2000 (1)**



(1) EU-15 and EUR-12 — Eurostat estimates.
DK and E: provisional data.

Source: Eurostat.

Figure 1.5. **Annual average growth rates for GBAORD and GDP EEA countries — 1991-96 and 1996-2001 (1, 2, 3)**



(1) EEA, EU-15 and EUR-12 2001 — Eurostat estimates based on provisional data.
(2) Growth rates calculated using data expressed in constant 1995 PPS.
(3) Exceptions to the 1996-2001 years — DK and E: 1996-2000.

Source: Eurostat.

1.2.2. GBAORD by socio-economic objective

Not only does the level of budgeting towards R&D activities vary from one geographical entity to another, but the objectives are also different.

GBAORD is broken down into socio-economic objectives, thus providing information on changing trends and attitudes towards different types of R&D activities.

Figure 1.2. displays these different attitudes to budgetary appropriations (EU-15 = 2001, USA = 1998 and JP = 2000).

In 2001, as in previous years, 'Research financed from general university funds (GUF)' accounted for the lion's share of EU GBAORD (31.8 %). 'Non-oriented research' and 'Defence' claimed 14.4 and 15.5 % respectively of budgetary appropriations allocated to R&D. 'Industrial production and technology' represented 9.7 % of total EU GBAORD in 2001. 'Exploration and exploitation of the earth', 'Infrastructure and general planning of land-use' and 'Other civil research' were the socio-economic objectives with the lowest budgets at 1.4, 1.5 and 1.5 % respectively.

In Japan, 'Research financed from GUF' was also the leading socio-economic objective (in 2000) with 35.4 % of total GBAORD. A further 18.1 % was allocated towards 'Production, distribution and rational utilisation of energy', which includes such research as 'Radioactive waste management' and 'Renewable energy sources'. The lowest proportion of budgeting in Japan was allocated towards 'Control and care of the environment' which accounted for 0.8 % of total GBAORD in 2000.

In the United States, over half of all GBAORD in 1998 was allocated to 'Defence' (54.1 %). 'Protection and improvement of human health', which comprises such sub-chapters as 'Medical research' and 'Preventive medicine', took up almost a fifth of government budgeting to R&D activities and 'Exploration and exploitation of space' just over a tenth. No data are available for 'Research financed from GUF' and 'Other civil research' for the USA.

1.3. GBAORD — an European perspective

This section is split into two main parts. The first examines the trends and developments in total GBAORD at national level for the Eurozone countries, EU-15 and the EEA. The second part evaluates the socio-economic priorities of these same countries. Finally, a section looks at the individual situations in these countries via the country reports.

1.3.1. Total GBAORD

GBAORD in the EU represented 0.77 % of GDP, but this figure conceals differences between the Member States. Figure 1.3. shows that in 2001 (provisional data) the greatest efforts in terms of R&D funding were made by Iceland, Finland and France, with 1.07, 1.00 and 0.99 % of GDP respectively. In Sweden and Germany, there was also more emphasis placed on government budgeting towards R&D activities than the EU average of 0.77 %. Ireland and Greece, on the other hand, allocated fewer budgetary appropriations to R&D, their respective figures of 0.33 and 0.30 % of GDP being around two-fifths of the Community average. The nine other EEA countries fell within 0.74 % (Netherlands) and 0.58 % (Belgium) of GDP.

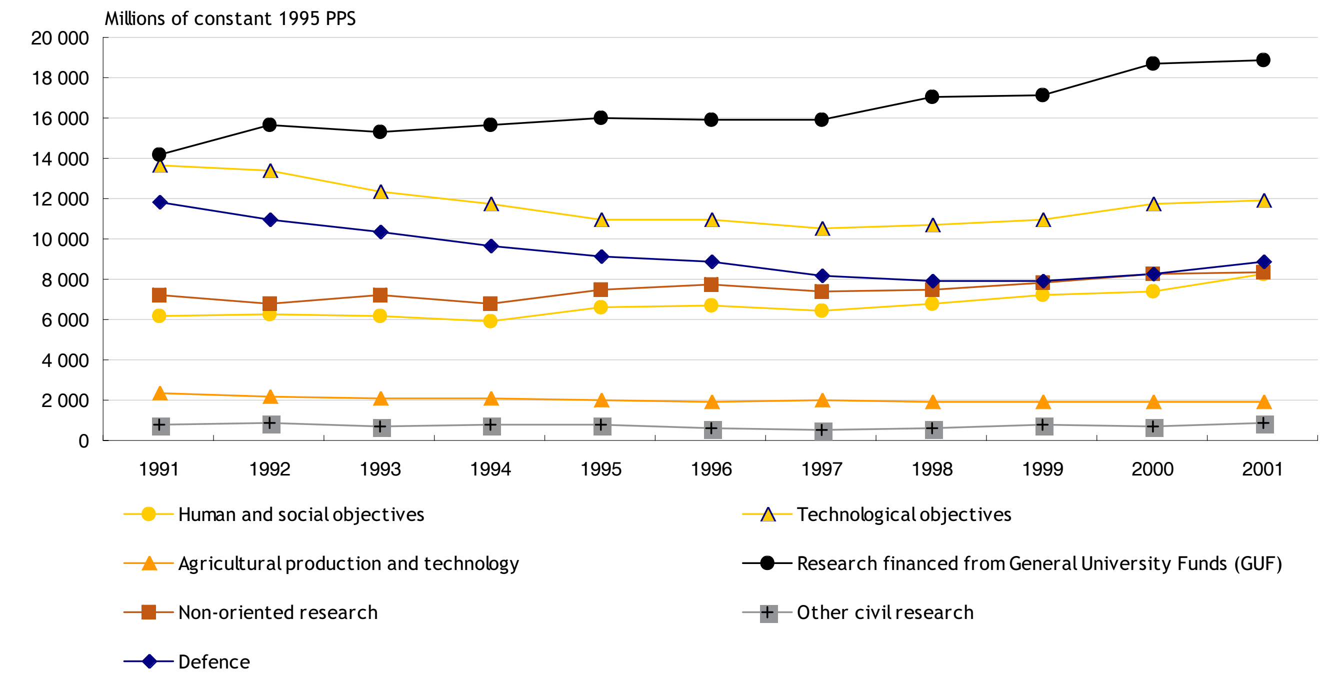
In terms of the percentage of total general government expenditure — see Figure 1.4. — GBAORD provides a proxy of the relative emphasis that governments place on funding R&D. Once again Finland, France and Germany are amongst the countries which budgeted most to R&D activities at 2.01, 1.87 and 1.75 % respectively of total general government expenditure in 2000. The UK and Spain also budgeted more than the EU average (1.65 %) at 1.75 and 1.73 % of public expenditure, although their activities fell short of the EU average when measured against GDP.

Figure 1.5. shows that the increase for Spain followed a period (1996-2001) that witnessed strong increases in GBAORD. The annual average growth rate of GBAORD in real terms was 11.3 % during this period, whereas it was negative (- 0.5 %) for the period from 1991 to 1996. Similarly, Italy's GBAORD, which recorded negative annual growth rates (- 3.8 %) over the period from 1991-96, grew appreciably during the period 1996-2001 with an annual average growth rate of 5.7 %. France is in a similar situation, although the growth in annual rates is less pronounced, rising from - 3.4 to 1.1 %.

Ireland, Portugal and Greece increased their budgeting to R&D activities over the two periods with annual average growth rates of 7.7, 7.8 and 6.3 % respectively. The same applies for Austria, Belgium, Denmark, Finland, the United Kingdom and Iceland, although it should be noted that the increase in Iceland during the period 1996-2001 came mainly in 1999 and 2000. Sweden recorded negative annual average growth rates of around - 0.9 % between 1991 and 2001, whilst Germany moved from a slightly negative growth rate between 1991 and 1996 to more or less zero growth between 1996 and 2000. In Norway, finally, GBAORD rose during the first period and then fell thereafter.

Whilst, generally speaking, EU GBAORD remained relatively stable over this 10-year period, this is as a result of the increase in government budgeting to R&D activities during the period from 1996-2001, which offset the reductions in these same appropriations made during the previous five years.

Figure 1.6. **GBAORD by grouped socio-economic objective in millions of constant 1995 PPS EU-15 — 1991-2001 (1)**



(1) EU-15 2000 — Eurostat estimate; EU-15 2001 — Eurostat estimate based on provisional data.

Source: Eurostat.

Table 1.1. **Distribution of GBAORD by socio-economic objective in % EEA countries — 2001 (1, 2)**

NABS	EU-15	EUR-12	B	DK	D	EL	E	F	IRL	I	NL	A	P	FIN	S	UK	EEA	IS	NO
1. Exploration and exploitation of the Earth	1.42	1.45	0.86	1.28	1.75	2.98	1.98	0.77	0.38	1.88	0.96	2.21	1.74	1.28	0.37	1.48	1.43	-	2.15
2. Infrastructure and general planning of Land-use	1.50	1.32	0.78	1.84	1.67	2.55	0.65	0.64	1.04	0.41	3.83	1.79	8.15	2.14	3.31	1.93	1.52	7.55	2.34
3. Control and care of the environment	2.77	2.88	2.66	2.79	3.14	4.32	2.67	2.89	1.39	2.28	3.92	1.50	4.75	2.18	0.90	2.62	2.77	0.75	2.78
4. Protection and improvement of human health	6.33	5.02	1.41	1.99	4.01	7.47	4.82	5.79	3.83	6.99	3.11	2.93	7.16	6.44	0.69	14.23	6.34	8.67	7.16
5. Production, distribution and rational utilization of energy	2.93	3.47	2.78	1.99	3.40	1.35	3.64	3.93	-	3.64	3.00	0.64	0.94	5.71	2.62	0.47	2.91	2.46	2.03
6. Agricultural production and technology	3.10	2.77	2.51	12.42	2.41	5.83	4.21	2.12	14.41	1.80	3.17	2.57	13.36	5.57	2.14	3.86	3.23	22.55	8.94
7. Industrial production and technology	9.67	11.95	24.09	6.39	12.09	8.57	15.81	6.29	21.16	14.80	13.54	9.07	10.24	27.42	2.17	0.57	9.74	2.51	13.66
8. Social structures and relationships	3.39	3.07	5.37	11.16	4.52	6.24	0.58	0.81	7.01	4.38	2.92	2.00	3.70	5.56	6.56	3.47	3.51	38.75	7.11
9. Exploration and exploitation of space	5.49	6.32	11.73	2.79	4.68	0.29	5.52	9.80	-	7.30	2.45	0.14	0.59	2.16	2.40	2.36	5.42	-	2.33
10. Research financed from General Universty Funds (GUF)	31.83	33.57	19.35	38.96	38.99	48.69	21.38	21.60	19.24	43.74	45.46	60.71	35.62	25.92	45.55	19.98	31.89	-	37.32
11. Non-oriented research	14.35	15.00	24.06	17.83	16.14	10.55	7.32	19.82	31.54	8.76	10.63	13.79	8.83	14.06	-	13.74	14.27	16.76	9.32
12. Other civil research	1.57	1.28	4.16	-	0.05	0.77	1.23	2.31	-	-	4.82	2.71	3.66	-	15.10	0.42	1.54	-	-
13. Defence	15.66	11.90	0.24	0.57	7.15	0.39	30.18	23.24	-	4.03	2.19	-	1.25	1.56	18.19	34.89	15.44	-	4.84
Total civil appropriations	84.34	88.10	99.76	99.43	92.85	99.61	69.82	76.76	100.00	95.97	97.81	100.00	98.75	98.44	81.81	65.11	84.56	100.00	95.16
Total appropriations	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

(1) EEA, EU-15 and EUR-12 — Eurostat estimates based on provisional data.
(2) Exceptions to the 2001 reference year — DK and E: 2000 provisional.

Source: Eurostat.

1.3.2. GBAORD by socio-economic objective

Figure 1.2. shows the distribution of GBAORD by socio-economic objective for EU-15, the USA and Japan. Figure 1.6., in turn, highlights the evolution of these different socio-economic objectives within the EU.

The social and human objectives encompass 'Infrastructure and general planning of land-use' (NABS 02), 'Control and care of the environment' (NABS 03), 'Protection and improvement of human health' (NABS 04) and 'Social structures and relationships' (NABS 08). The technological objectives are made up of 'Exploration and exploitation of the Earth' (NABS 01), 'Production, distribution and rational utilisation of energy' (NABS 05), 'Industrial production and technology' (NABS 07) and 'Exploration and exploitation of space' (NABS 09).

The key objective in the EU is 'Research financed from General University Funds (GUF)'. During the period 1991-2001, it rose significantly from 25.2 to 31.8 % (EUR 18910 million) of the EU-15's total GBAORD. This growth was primarily at the expense of the 'Technology' and 'Defence' objectives, which fell from 24.3 and 21.1 % to 20.1% (EUR 11911 million) and 15.7 % (EUR 8851 million) of EU GBAORD respectively between 1991 and 2001.

The 'Human and social' and 'Non-oriented research' objectives showed little change over this period and followed a similar trend in rising from 12.9 and 11.0 % to 14.1 (EUR 8250 million) and 14.0 % (EUR 8350 million) respectively.

Finally, the 'Other civil research' and 'Agricultural production and technology' objectives, which accounted for around 1.3 to 4.2 % of total EU GBAORD, remained fairly stable between 1991 and 2001.

Looking at the situation more closely using Table 1.1., it can be seen that 'Research financed from General University Funds (GUF)' is the main priority in over half of the Member States. At EU level, it alone accounts for almost one-third of GBAORD. In Austria, the figure is over 60 %. In Germany, Denmark, Greece, Italy, and the Netherlands, it makes up around or at least 40 % of GBAORD.

The other priorities at EU level are mainly 'Non-oriented research' and 'Defence' which each claim about 15 %. With regard to defence, the appropriations allocated are below the Community average — and 10 % of national GBAORD — in 10 of the Member States. However, 'Defence' is the priority objective for Spain, France and the United Kingdom, where it accounts for 30.2, 23.2 and 34.9 % respectively. In Sweden, it is not the national priority, but nevertheless accounts for almost one-fifth of total GBAORD.

In Belgium, Finland and Ireland, the 'Industrial production and technology' objective is important. Its share of the total national GBAORD in these countries is 24.1, 27.4 and 21.2 % respectively, which is significantly higher than the Community average of 9.7 %.

Another priority for Denmark, Ireland and Portugal is 'Agricultural production and technology', their allocations of around 12.4 to 14.4 % of total GBAORD being around four times higher than the Community average. A closer analysis would suggest that this is linked to the importance of fisheries in these countries.

In Iceland, this same objective ('Agricultural production and technology') even accounts for over one-fifth of total GBAORD, giving it second-highest priority after 'Social structures and relationships'. In Norway, as in the majority of the Member States, 'Research financed from General University Funds' is the national priority.

1.4. Specific developments in the EEA — Country reports

This section presents the specific developments in the Member States on the basis of the country reports where these are available. Data for some socio-economic objectives are grouped according to the following plan:

- 'Human and social objectives' NABS groups:
  2. Infrastructure and general planning of land-use,
  3. Control and care of the environment,
  4. Protection and improvement of human health,
  8. Social structures and relationships.
- 'Technological objectives' NABS groups:
  1. Exploration and exploitation of the earth,
  5. Production, distribution and rational utilisation of energy,
  7. Industrial production and technology,
  9. Exploration and exploitation of space.

Readers should refer to Table 34 in Part 3 of this publication to obtain the relevant exchange rates applicable to non-Eurozone countries when converting the national currency figures into EUR.

1.4.1. Belgium

Table 1.2. presents the percentage breakdown of government R&D budget appropriations for the 1999 and 2000 financial years (final budgets) and for 2000 and 2001 (provisional budgets), carried out by the different Belgian public authorities.

The final budget for the 2000 financial year totalled EUR 1 423.228 million, which is an increase of EUR 41.140 million over 1999.

The following remarks refer to the final budget data for 1999 and 2000.

It can be seen that over one-third of Belgian government R&D activities (almost 40 %) have technological objectives (NABS 1+5+7+9), with just over half of these resources being the responsibility of the regions.

22.9 % of government R&D activities were devoted (2000) to industrial production and technology (NABS 7). The Flemish Community was responsible for over half of this figure.

11.9 % of government R&D activities were devoted (2000) to the exploration and exploitation of space (NABS 9). These activities are the sole responsibility of the Federal Authority.

Just over 24 % of these government R&D activities are allocated to non-oriented research, with half these appropriations falling to the Flemish Community, followed by the Federal Authority and the French Community.

Just under a quarter of Belgian government R&D activities come from general university operating funds; the bulk of these funds are the responsibility of the Communities.

It can be concluded that between 1999 and 2000 (or even 2001), there were, in general, only slight variations by objective or by group of NABS objectives.

Looking at the period from 1989 to 2001, it can be seen that within total GBAORD:

- the importance of 'Technological objectives' (NABS 1+5+7+9) increased the most (from 35 % in 1989 to 39 % in 2001); this percentage is the highest in the EU;
- 'Research financed from General University Funds' (NABS 10) fell from 24 % in 1989 to 19 % in 2001.

The context

Belgium's federal structures — which arose form the reforms of 1980, 1988, and 1993 — give primary responsibility for basic and university research to the Communities, while the Regions are primarily responsible for supporting industrial and technological research. The Federal Government has particular responsibility for the federal scientific and cultural establishments, space research, thematic research programmes linked to federal competencies, nuclear research and Belgian participation in the activities of the international research bodies.

The Interministerial Conference for Science Policy — CIMPS — and its administrative bodies are the instruments for dialogue between the Government, the Regions and the Communities.

Table 1.2. **Distribution of GBAORD by grouped socio-economic objective in %**
Belgium — 1999-2001

	Groups of NABS objectives	Final budgets 1999	Final budgets 2000	Initial budgets 2000	Initial budgets 2001
2+3+4+8	Human and social objectives	9.30	10.40	10.80	10.20
1+5+7+9	Technological objectives	39.70	38.50	38.10	39.50
6	Agricultural production and technology	3.10	3.00	3.00	2.50
10	Research financed from General University Funds (GUF)	19.40	19.30	19.20	19.40
11	Non-oriented research	22.80	24.10	23.90	24.10
12	Other civil research	5.30	4.40	4.70	4.20
13	Defence	0.40	0.30	0.40	0.20
	Total	**100**	**100**	**100**	**100**

NB: Sum of constituent parts may not equal total due to rounding.

Source: Federal Office for Scientific, Technical and Cultural Affairs,

Priorities

At federal level

Scientific support for the preparation of federal policies (particularly in the area of sustainable development and promotion of the information society); ongoing support for networks of excellence ('interuniversity poles of attraction'); support for the implementation of space programmes

At regional and community level

Flemish Community/Region: increased support for public funding of R&D in order to reach total R&D spending of 2 % of gross regional product in 2000; modernisation and improvement of the system of R&D financing; promotion of high-technology sectors and encouragement of the dissemination of technology; promotion of the social aspects of technology.

French-speaking Community: increase in the appropriations for research in the field of higher education and, more specifically, in university institutions.

Walloon Region: maintenance of, or increase in, the overall R&D effort and in assistance to leading-edge technological sectors, in particular technological sectors with high employment potential.

Brussels-Capital Region: promotion of SME access to R&D and of networking of regional R&D potential; greatest possible integration of R&D results into the economic processes of the region.

1.4.2. Greece

Changes in GBAORD in nominal and real terms

In 2000, the GBAORD budget (final data) amounted to EUR 420.1 million. Compared to EUR 349.4 million in 1999, the GBAORD budget registered an increase of 20.2 % in nominal terms and 16.3 % in real terms. In 2000, GBAORD as a percentage of GDP, reached a historical peak rising from 0.31 % in 1999 to 0.35 % — See Table 1.3.

However, provisional data for 2001 indicate a probable decline of GBAORD (- 6.6 % in nominal terms and - 9.5 % in real terms). The absolute figures of GBAORD amount to EUR 392.2 million (current prices) and EUR 380.1 million (constant prices 2000). This decline should be attributed in the first place to a temporary decrease of the inflow of structural funds in Greece. As a matter of fact, 2001 was the last year of financing through the 2nd CSF — Community Support Framework — while the financing through the 3rd CSF started to be substantial only in 2002.

Most important socio-economic objectives

During the period under review, 'Research financed from GUF' remains by far the most important recipient of government R&D financing. It accounts for the largest share of GBAORD although its contribution was characterised by a downward trend between the years 1999 (48.9 %) and 2000 (43.0 %). This trend was reversed in 2001 and its share in GBAORD reached 48.7 %. As a matter of fact, in 2001, for which provisional data are available 'Research financed from GUF' was the only objective which registered an increase both in nominal and in real terms (+ 5.8 and + 2.5 % respectively).

The second most important objective of the Greek government R&D financing proves to be 'Non-oriented research'. Its share in GBAORD increased from 7.8 % in 1999 to 11.3 % in 2000 and then dropped down to 10.6 % in 2001 (provisional data). Moreover 'Non-oriented research' registered an impressive increase in absolute figures between 1999 and 2000 (+ 74.7 % in nominal and + 68.9 % in real terms), which can be attributed to the increased financing through the structural funds of a great number of research projects (e.g. under the program PENED) just aiming at maintaining research capacity in the higher education institutes, research centres and institutes.

'Industrial production and technology' showed a progressive decrease during the period 1999-2001 both as part of the overall government R&D financing and in absolute figures; this may be due to the fact that the major research programs in this category have attained a post-maturity phase with lower rates of financing while, in the meantime, the launching of new programmes under the 3rd CSF moves slowly.

As far as it concerns the trends in the financing of biotechnology and information technologies, the absence of data for NABS objective 10, due to special methodological aspects of the estimation of GUF, leads to underestimation of their importance in overall R&D government budgets.

Table 1.3. shows the breakdown of GBAORD by broad NABS objectives for the reference years 1999 and 2000 (final budgets) and for the reference year 2001 (provisional budget). The share of the group 'Human and social objectives' shows an upward trend while the share of the group 'Technological objectives' is in decline (in absolute figures, however, it remains rather stable).

Table 1.3. **Distribution of GBAORD by grouped socio-economic objective in %**
Greece — 1999-2001

		Final budgets		Initial budgets	
	Groups of NABS objectives	1999	2000	2000	2001
2+3+4+8	Human and social objectives	16.70	23.10	18.26	20.60
1+5+7+9	Technological objectives	18.30	15.30	20.00	13.20
6	Agricultural production and technology	7.10	6.10	6.95	5.80
10	Research financed from General University Funds (GUF)	48.90	43.00	45.78	48.70
11	Non-oriented research	7.80	11.30	7.96	10.60
12	Other civil research	0.30	0.80	0.30	0.80
13	Defence	0.90	0.40	0.77	0.40
	Total	**100**	**100**	**100**	**100**

NB: Sum of constituent parts may not equal total due to rounding.

Source: GSRT.

Table 1.4. **Distribution of GBAORD by grouped socio-economic objective in %**
France — 1998-2001

	Groups of NABS objectives	Final budgets 1998	1999	2000	Initial budgets 2001
2+3+4+8	Human and social objectives	9.20	9.50	8.70	10.10
1+5+7+9	Technological objectives	22.50	22.80	22.70	20.80
6	Agricultural production and technology	3.80	3.90	3.00	2.10
10	Research financed from General University Funds (GUF)	17.10	18.00	18.20	21.60
11	Non-oriented research	19.90	20.10	21.80	19.80
12	Other civil research	2.50	2.40	2.90	2.30
13	Defence	25.00	23.40	22.70	23.20
	Total	**100**	**100**	**100**	**100**

NB: Sum of constituent parts may not equal total due to rounding.

Source: MENRT.

Table 1.5. **Distribution of GBAORD by grouped socio-economic objective in %**
Ireland — 1999-2001

	Groups of NABS objectives	Final budgets 1999	2000	Initial budgets 2000	2001
2+3+4+8	Human and social objectives	11.00	12.00	13.27	18.00
1+5+7+9	Technological objectives	31.00	22.00	21.54	13.00
6	Agricultural production and technology	21.00	15.00	14.41	23.00
10	Research financed from General University Funds (GUF)	24.00	20.00	19.24	18.00
11	Non-oriented research	13.00	33.00	31.54	28.00
12	Other civil research	:	:	:	:
13	Defence	:	:	:	:
	Total	**100**	**100**	**100**	**100**

NB: Sum of constituent parts may not equal total due to rounding.

Source: Forfas.

Table 1.6. **Distribution of GBAORD by grouped socio-economic objective in %**
Italy — 1998-2001

	Groups of NABS objectives	Final budgets 1998	1999	2000	Initial budgets 2001
2+3+4+8	Human and social objectives	13.30	17.80	12.30	14.10
1+5+7+9	Technological objectives	23.00	21.40	26.90	27.60
6	Agricultural production and technology	1.90	1.80	2.20	1.80
10	Research financed from General University Funds (GUF)	48.00	45.30	47.80	43.70
11	Non-oriented research	11.10	11.20	10.00	8.80
12	Other civil research	-	-	-	-
13	Defence	2.70	2.50	0.80	4.00
	Total	**100**	**100**	**100**	**100**

NB: Sum of constituent parts may not equal total due to rounding.

Source: ISTAT.

1.4.3. France

Responsibility for co-ordinating national research and development policy lies with the Ministry responsible for Research via the BCRD (civil research and development budget). R&D budget appropriations do not come from the CRDB alone, but also from university funds and the research budget of the Ministry of Defence. As of 2000 and the changes in the method of calculating civil pensions in universities, the latter account for a larger share. The reduction in the defence budget has come to an end. In 2000, it was comparable to the 1999 budget and it started to increase again thereafter.

Table 1.4. shows the breakdown in % of government budget appropriations for R&D for the 1998 to 2000 financial years (final budgets) and for 2001 (provisional budget).

Total final budget appropriations in 2000 amounted to EUR 13 842 million; this total is not directly comparable to that of previous years on account of the new method of calculating civil pensions in universities. It would be reasonable to assume that if the method had remained the same, total budget appropriations would have risen by just over 1 % in value, i.e. a variation which is much lower than that for GDP. This situation can be explained by the trend in defence appropriations, with the BCRD having seen a 2.0 % increase in value between 1999 and 2000.

There was a sharp increase in value of over 5 % in 2001. The upsurge in budgetary appropriations for defence explains 57 % of the overall increase, with the rest falling to the civil R&D budget, which rose in value terms by 3.8 %.

The trends in the pattern of the BCRD by socio-economic objectives largely explain those in budget appropriations.

1 The prime objective of R&D government budget appropriations is the 'general advancement of knowledge'. They comprise general university funds and 'non-oriented research'.

2 Technological objectives occupy second place in terms of civil budget appropriations; their share has remained stable for three years at almost 23 %, with 'exploration and exploitation of space' accounting for half of these objectives. In 2000 and 2001, the amounts are comparable with increased efforts in the field of industry.

3 The share of human and social objectives was identical in 2000 and rose significantly in 2001 when a number of large establishments became more actively involved in the fields of environment and health.

1.4.4. Ireland

The total budgetary allocation to R&D in 2001 amounted to EUR 378 million, an increase of EUR 59.8 million over the 2000 level. In real terms, there has been a 37 % increase in funding since 1999. A breakdown by socio-economic objectives is provided in Table 1.5.

Funding for 'exploration and exploitation of the earth' has increased from EUR 1.3 million in 2000 to 11.4 million in 2001. This is an increase of over 900 % and can be attributed mainly to extra funding of EUR 10.1 million from the Department of Public Enterprise. This will fund a seabed survey (EUR 9.5 million) and a geological survey (EUR 0.6 million) which will be undertaken by the Geological Survey of Ireland.

Funding for 'infrastructure and general planning of land use' has increased almost threefold from EUR 3.4 million in 2000 to EUR 10.1 million in 2001. A large component of this increase is accounted for by an increase of EUR 5 million from the Higher Education Authority (HEA) for buildings for R&D.

Appropriations for environmental objectives have increased from EUR 4.6 million in 2000 to EUR 6.4 million in 2001. This increase of almost EUR 2 million is composed of extra funding from the Higher Education Authority for environmental research.

Funding for the 'protection and improvement of human health' from the Department of Health & Children has increased by EUR 2.7 million over the 2000 figure. In real terms there has been an increase of 187 % in appropriations for human health since 1999.

'Agricultural production & technology' appropriations have almost doubled, with an increase of EUR 40.9 million since 2000. This increase is comprised of an extra EUR 28.4 million from the Department of Agriculture for agricultural production and food research and EUR 13 million for fisheries innovation from the Department of the Marine.

'Industrial production and technology' has seen a decrease in funding of EUR 11.6 million over the 2000 figure. The funding for this objective amounted to EUR 76.3 million in 1999 and the decrease in real terms since then amounts to EUR 26.5 million.

There is an increase of EUR 2.7 million over the 2000 funding for 'social structures and relationships'. (One of the programmes previously categorised in this chapter is no longer deemed to be R&D, this is why the 1999 and 2000 figures have changed).

'Research financed from General University Funds' has seen an increase of EUR 5.9 million, from EUR 63.3 million in 2000 to EUR 69.2 million in 2001. The majority of this increase has been in the social and human sciences categories.

Funding for 'non-oriented research' has increased in real terms by 291 % since 1999 and can be attributed to extra funding from the HEA and Science Foundation Ireland.

1.4.5. Italy

In 2000, the final GBAORD budget amounted to EUR 7 656 million. Final data for 2000 registered a significant positive difference (+ 13.3 %) on provisional 2000 data. First of all, this is due to the revision of GUF data (see methodological notes in Part 2), which increased 27.3 % with regard to provisional data. 'Protection and improvement of human health' (+ 11.6 %) and 'Agricultural production and technology' (+ 19.4 %) marked a recovery of the allocations. 'Exploration and exploitation of the earth' presented a slight decrease (- 2.4 %) — See Table 1.6.

The final 2000 budget presents an important increase on the 1999 budget, that is + 25.9 % in nominal terms (and + 23.2 % in real terms, at 1995 prices). The better performance of 'Protection and improvement of human health' (+ 18.6 %) is due to the investment of the Department of health and the performance of 'Agricultural production and technology' (+ 24.1 %) to the increased allocations of the research institutes. CNR (the biggest research agency of the country), which finances every socio-economic objective, and ENEA (National Agency for New Technologies and Environment) received less funds in nominal terms (- 0.9 and - 5.3 % respectively). The two big institutes devoted to physical sciences (National Institute of Nuclear Physics and National Institute of Physics of the Matter) register better performances (+ 5.3 % together in 2000 in front of 1999) and balance to a certain extent the negative trend of the big agencies.

Higher allocations of GBAORD are due mainly to the Departments of Health and of Education, University and Research (MIUR): the objective of 'Protection and improvement of human health' registered an important increase (+ 16.3 %) and the 'Industrial production and technology' registered a sharp jump (+ 126.7 %). Moreover, MIUR plays an important role also in the resources devoted to 'Exploration and exploitation of space' (+ 9 %) (appropriations to the ESA) and to 'Non-oriented research' (through the Fund for basic research, + 6.5 %). The other objectives registered small variations in nominal terms. Major investment in R&D to 'Non-oriented research' produced a growth of the chapter (+ 3.9 %). 'Research financed from GUF', which covers 47.8 % of the whole GBAORD, marked an increase of 0.9 %.

Table 1.7. **Distribution of GBAORD by grouped socio-economic objective in %**
Netherlands — 2000-2002

	Groups of NABS objectives	Final budgets 2000	Final budgets 2001	Initial budgets 2001	Initial budgets 2002
2+3+4+8	Human and social objectives	13.70	14.90	13.80	14.70
1+5+7+9	Technological objectives	21.40	18.00	20.00	17.80
6	Agricultural production and technology	3.10	3.70	3.20	3.10
10	Research financed from General University Funds (GUF)	44.50	46.30	45.50	47.50
11	Non-oriented research	10.30	10.70	10.60	10.60
12	Other civil research	4.80	4.80	4.80	4.60
13	Defence	2.20	1.70	2.20	1.70
	Total	**100**	**100**	**100**	**100**

NB: Sum of constituent parts may not equal total due to rounding.

Source: CBS.

Table 1.8. **Distribution of GBAORD by grouped socio-economic objective in %**
Austria — 1998-2001

	Groups of NABS objectives	Final budgets 1998	Final budgets 1999	Final budgets 2000	Initial budgets 2001
2+3+4+8	Human and social objectives	8.28	7.81	7.69	8.21
1+5+7+9	Technological objectives	9.77	10.38	10.57	12.07
6	Agricultural production and technology	2.81	2.97	2.87	2.57
10	Research financed from General University Funds (GUF)	65.73	65.18	65.42	60.71
11	Non-oriented research	13.25	13.66	13.36	13.79
12	Other civil research	0.08	-	0.08	2.71
13	Defence	-	-	-	-
	Total	**100**	**100**	**100**	**100**

NB: Sum of constituent parts may not equal total due to rounding.

Source: ÖSTAT.

Table 1.9. **Distribution of GBAORD by grouped socio-economic objective in %**
United Kingdom — 1998-2001

	Groups of NABS objectives	Final budgets 1998	Final budgets 1999	Initial budgets 2000	Initial budgets 2001
2+3+4+8	Human and social objectives	22.00	22.60	22.10	20.80
1+5+7+9	Technological objectives	5.40	5.00	5.70	7.90
6	Agricultural production and technology	4.50	4.20	4.10	3.00
10	Research financed from General University Funds (GUF)	19.00	18.70	19.40	20.70
11	Non-oriented research	11.90	11.30	12.00	13.80
12	Other civil research	0.50	0.30	0.30	0.30
13	Defence	36.80	37.90	36.30	33.50
	Total	**100**	**100**	**100**	**100**

NB: Sum of constituent parts may not equal total due to rounding.

Source: ONS.

Considering the increasing trend both of finalised and non-finalised research — including the resources devoted to 'Non-oriented research' and to 'Research financed from GUF', the purpose of the Government to play a role in the recovery of Italian GBAORD emerges.

In 2001, provisional data amounted to EUR 8 441 million with an increase of 10.2 % on final 2000 data. There was a general increase of the objectives. The most important positive variation has occurred in 'Infrastructure and general planning of land-use' (+ 88.3 %), 'Social structures and relationships' (+ 52.9 %) and 'Defence' (this objective multiplied fivefold). The exception to the growth is registered in 'Agricultural production and technology' (- 10.2 %), due mainly to the incompleteness of data, and in 'Non-oriented research' (- 3.9 %).

The reorganisation of faculty courses in Universities is ongoing yet, but the autonomy facilitates their approaching to the market.

The National Research Council (CNR) of Italy completed its reorganisation, by reducing the number of its institutes and pursuing the criterion of excellence and efficiency. Unfortunately, its endowment is steady in real terms.

MIUR established measures in order to increase the financing through FAR (a special Fund for the Facilities to Research).

1.4.6. The Netherlands

Central government budget appropriations for R&D shows a nominal increase of EUR 174 million between the figures of the budgetary years 2000 and 2001 (final budget) and EUR 247 million between 2001 and 2002 (provisional budget).

The final budget for 2001 amounts to EUR 3.4 billion in current terms, while the provisional budget for 2002 is only a fraction higher that the 2001 one. The difference is + EUR 21.8 million, an increase of 0.6 % in nominal terms, but a decrease in real terms.

Comparing the relative positions of the different objectives there seems to be only small changes apparent — See Table 1.7. The decreasing share of the 'technological' objectives is caused by the decreasing share of the research on 'Exploration and exploitation of the earth', energy research (both decreasing in nominal terms) and research on 'Industrial production and technology' (stable budget in nominal terms). Also decreasing is the share of defence research — a decrease in nominal terms too.

The share of the government budget devoted to general university funds shows an upward development up to a level of 47.5 % in the budget of 2002. The share of 'Non-oriented research' (10-11 %) remains stable. This 'Non-oriented research' is performed within institutes of the research council NWO — Netherlands Organisation for Scientific Research, of the KNAW — Royal Netherlands Academy of Arts and Sciences — and within the international research organisations like CERN and ESA.

Priorities

Important fields within S&T policy are genomics, nanotechnology and information and communication technologies. The research council NWO has been made responsible for a programme on genomics research for the period 2001-2006. ICT is a major topic in science and technology policy. In 2000 a White Paper was published 'Competitiveness with ICT-competences'. Based on this paper a special task force was installed. This task force advised to double the volume of public research in this field and to reinforce the exchange between public ICT-research and the private sector. Every second year a broad ICT-benchmark is performed, partly oriented to knowledge and innovation.

Nanotechnology is one of the themes to be funded from the extra budget for knowledge.

1.4.7. Austria

Public R&D funding totalled EUR 1.287 billion (final budget) in 2000. This means that public R&D expenditure rose nominally by 0.5 % in 2000 compared with 1999.

The 2001 provisional budget earmarks State funds of EUR 1.401 billion for R&D for the 2001, which represents an increase of 8.8 % compared with the value of the final budget for 2000 (EUR 1.287 billion).

In the provisional Federal budget for 2001, a total of EUR 508.7 million, which can be placed in reserve, is listed for the 'Research and Technology Offensive' and earmarked for R&D expenditure in 2001, 2002 and 2003. If all these funds were then to be taken into account in 2001, this would seriously distort the estimates of the federal authorities' proportion of funding not just for 2001 and 2002 but also for subsequent years. The estimate of the federal authorities' proportion of funding produced by *Statistik Austria* only therefore takes account of the EUR 130.2 million which, according to the information available to date on payments actually made, was spent in 2001.

Up to the year 2002, there was basically no change in the special Austrian situation in which some 65 % of the Federation's total R&D expenditure is allocated to NABS Chapter 10 'Research funded from GUF' owing to the dominant position of the universities in State sector research — see Table 1.8. In 2001, the shares of the research objective groups 'Industrial production and technology' (with that of the 'Technological objectives' group rising to 12.0 %) and 'Other civil research' (2.7 %) will increase because the above-mentioned EUR 130.2 million for the 'Research and Technology Offensive' have been allocated to the NABS objectives. At the same time, the share of 'Research funded from GUF' will fall in 2001 to 60.7 %, although in 2002 its share will be back up again to a level of just under 66 %.

Public R&D funding in 2002 will total EUR 1.283 billion according to the provisional Federal budget (= provisional budget for 2002; excluding funds from the '2001 Research and Technology Offensive').

1.4.8. United Kingdom

Data on government expenditure and employment on Research and Development are collected by means of an annual survey of central government departments. The results of the latest survey are available in the OST's Science, Engineering and Technology Statistics 2002 on the Internet at http://www.dti.gov.uk/ost/.

Total net Government expenditure on R&D in 2000-2001 was GBP 6563 million. This represents 2.4 % of total Central Government expenditure and 0.69 % of Gross Domestic Product. The expenditure on R&D in 2000-01 increased in cash terms by GBP 371 million (6.0 %) on 1999-2000.

Table 1.9. shows UK Government expenditure on R&D in 'Defence' has increased. In 2000-2001 expenditure on defence was GBP 2 384 million, which was GBP 37 million (2 %) up on the previous year.

After 'Defence' the biggest category of R&D expenditure in 2000-2001 was 'Social Sciences & Humanities', which continues to show an increase in expenditure from GBP 1 398 million in 1999-2000 to GBP 1 452 million in 2000-01. The increase in this area from 1995-96 onwards is due in part to the fact, that for 1995-96 UK NHS figures have been obtained from the Department of Health and the Scottish Office on the basis of the Culyer directive, which for the first time confirmed the extent of R&D spending in the NHS.

Table 1.10. **Distribution of GBAORD by grouped socio-economic objective in %**
Iceland — 1998-2001

	Groups of NABS objectives	Final budgets 1998	Final budgets 1999	Final budgets 2000	Initial budgets 2001
2+3+4+8	Human and social objectives	61.26	50.10	50.22	55.72
1+5+7+9	Technological objectives	3.25	5.65	6.04	4.96
6	Agricultural production and technology	22.91	29.69	28.15	22.55
10	Research financed from General University Funds (GUF)	-	-	-	-
11	Non-oriented research	12.58	14.56	15.59	16.76
12	Other civil research	-	-	-	-
13	Defence	-	-	-	-
	Total	**100**	**100**	**100**	**100**

NB: Sum of constituent parts may not equal total due to rounding.

Source: **The Statistical Bureau of Iceland.**

Table 1.11. **Distribution of GBAORD by grouped socio-economic objective in %**
Norway — 1999-2001

	Groups of NABS objectives	Final budgets 1999	Final budgets 2000	Initial budgets 2000	Initial budgets 2001
2+3+4+8	Human and social objectives	19.60	19.30	19.30	19.40
1+5+7+9	Technological objectives	18.90	18.70	18.90	20.20
6	Agricultural production and technology	8.70	8.90	9.00	8.90
10	Research financed from General University Funds (GUF)	39.30	39.50	39.00	37.30
11	Non-oriented research	8.10	8.60	8.80	9.30
12	Other civil research	-	-	-	-
13	Defence	5.40	5.00	5.00	4.90
	Total	**100**	**100**	**100**	**100**

NB: Sum of constituent parts may not equal total due to rounding.

Source: **Statistics Norway.**

All other categories also showed a rise in expenditure between 1999-2000 and 2000-2001. 'Technological objectives' increased by 21.2 % from GBP 308 million to GBP 373 million, 'Research financed from GUF' rose by 10.3 % from GBP 1 157 million to GBP 1 276 million and 'Non-oriented research' increased by GBP 88.8 million (12.7 %). 'Other Civil Research' and Agriculture increased by 8.5 % and 2.3 % respectively in the same period.

1.4.9. Iceland

In the Table 1.10. the development of chosen NABS groups are shown in % from 1998 to 2001. It should be noted that all years but 2001 are reported from the final budget. In 2001, data from the provisional budget are reported. These usually increase by about 20 % by the time they become final budgets.

The objective 'Social Structures and relationships' increases markedly after 1997. Generally speaking it can be stated that most objectives are rather stable but the objective of 'Protection and improvement of human health' is clearly increasing, as can be seen in the R&D statistics.

1.4.10. Norway

Specific developments in GBAORD in Norway — 1999-2001

Net Government Budget Appropriations or Outlays for R&D (GBAORD) in the provisional budget for 2001 amounted to NOK 10.1 billion. In current prices this was an increase of NOK 436 million from the final budget for 2000, or 4.5 %. In real terms, this means less than 1 % growth, and a deterioration in the GBAORD trend compared to the development between the final budgets from 1999 to 2000, with a growth of 7.8 (current) and 2.5 % (fixed) respectively. The relatively weak 2001 budget proposal occurred despite the Government goal of lifting the level of the Norwegian R&D expenditure as a share of GDP to the OECD average by 2005. This ambitious plan involves increase and reallocation of GBAORD, including the build-up of a new foundation for research and innovation. The chances of reaching the goal also seem hampered by an extraordinarily strong GDP growth in Norway, courtesy of increased oil revenue

As shown in Table 1.11., 37 % of net Norwegian GBAORD in 2001 was allocated through 'General University Funds (GUF)'. Universities are thus by far the most prominent recipients of Government R&D funding, though the ratio seems to be on the decrease over the past couple of years. Largely, this decrease is due to finalisation of a few large building projects. At the same time there is an increase in the share of funds for 'Technological objectives', which account for one fifth of total GBAORD. The growth is largely explained by the introduction of a new funding instrument for industrial R&D and innovation (FUNN). The overall technology share largely equals the 'human and social objectives' share, which has been relatively stable over the period. Stability also applies to R&D with agricultural objectives. The slight decline in the 'Defence' share of total GBAORD is consistent with general foreign policy trends of recent years. The slight increase in the share of 'Non-oriented research' is mainly attributable to the build-up of the new foundation for research and innovation, mentioned above, the dividend of which is allocated via the Research Council of Norway.

Chapter 2
R&D expenditure and personnel

2.1. Introduction

R&D activities are often considered a catalyst for economic growth. They 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 ([1]). The basic statistical variables are R&D expenditure and R&D personnel, which are measured annually or else every two years, both at national and regional levels ([2]).

Two manuals are used as methodological reference works for R&D surveys: the *Frascati Manual* and the *Regional Manual* ([3]). They provide a model for obtaining comparable statistics between countries.

R&D expenditure corresponds to the measurement of 'intramural' expenditure, i.e. all expenditure on R&D within a statistical unit or sector of the economy, whatever the source of funds — *Frascati Manual*, paragraph 335.

Data on R&D personnel relate to the quantity of human resources directly devoted to R&D activities plus those who provide services directly related to R&D — ibid. paragraph 279. They are measured in terms of full-time equivalent (FTE) and head count (HC).

Intramural R&D expenditure and R&D personnel are broken down by institutional sector, i.e. by sector engaged in R&D. In this publication, four sectors are used to calculate indicators of R&D activity: the business enterprise sector, the government sector, the higher education sector and the private non-profit sector. However, given the minor role played by the latter sector in all countries save Portugal, it has not been systematically included in all the analyses in this chapter, nor in the Tables in Part 3.

New indicators were introduced last year in the field of R&D statistics, such as R&D personnel by profession and by sex. These data series have been expanded, as have the European aggregates for researchers. Not all of these series appear systematically in this publication, but they are available on the CD-ROM and on the *NewCronos* database.

From a methodological viewpoint, one minor change has been made in the monetary units for R&D expenditure as constant ECU/EUR at 1995 exchange rates and prices have been replaced by PPS — purchasing power standard, also at constant 1995 exchange rates and prices.

([1]) *Standard method for surveys on research and experimental development — Frascati Manual*, OECD, 1993.

([2]) For the first time this year, the R&D data include those of Luxembourg.

([3]) *The regional dimension of R&D statistics and of innovation — Regional Manual*, Eurostat, 1996.

([4]) The data for the European aggregates are estimated.

Finally, this Chapter is divided into three main parts: R&D activities in Europe compared to the USA and Japan — two other main poles of the world economy; current trends in R&D activities within the European Economic Area; and R&D in Europe's regions. The analysis pertains to the period 1991-2001.

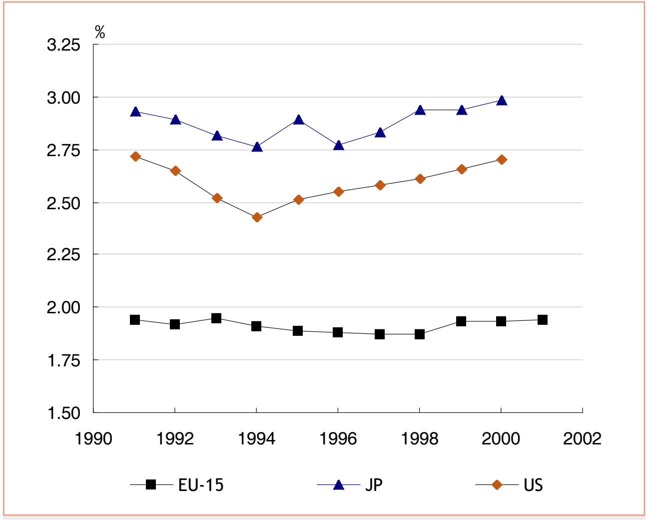
2.2. Future prospects for R&D at the international level

The gap between Europe and the United States and Japan is still there

2.2.1 R&D expenditure

In 2001, the EU-15 spent 1.94 % of its GDP on R&D ([4]). Despite being up slightly on the previous year, the gap which separated Europe's performance in 2000 from those of Japan (2.98 %) and the USA (2.70 %) grew wider. Over the last decade, this proportion of R&D expenditure in GDP has remained relatively stable for the European Union, fluctuating within a narrow band of between 1.87 and 1.95 %, with 2001 seeing the EU-15 on the way back up to its maximum level of expenditure in terms of % of GDP recorded in 1993. At a higher level of expenditure in % of GDP, the United States are in exactly the same situation with expenditure virtually the same as the level recorded in 1991, before the figures fell in the period up to 1994. Japan, on the other hand, bucks this trend because, as in 1998 and 1999, it recorded levels of expenditure in terms of % of GDP, which it had never achieved before. The trend in both Japan and the United States shows a steady and positive increase in expenditure as % of GDP over the second half of the decade — Figure 2.1.

Figure 2.1. **R&D expenditure as a % of GDP all sectors EU-15, Japan and USA — 1991-2001**



Sources: Eurostat, OECD (JP, US).

The lower proportion of GDP allocated by the EU-15 to R&D expenditure is mainly explained, at a more detailed level, by the significant gap observed in the business sector where 0.8 points separate the European Union from the United States and Japan. In this sector, the percentages are 1.26 % for the EU-15, as against 2.04 % for the USA and 2.11 % for Japan ([5]).

In the joint public sector made up of government and higher education, the EU-15, Japan and the USA devote an identical proportion of GDP to R&D expenditure. The trend is stable, or even slightly downwards, over the last decade — Figure 2.2.

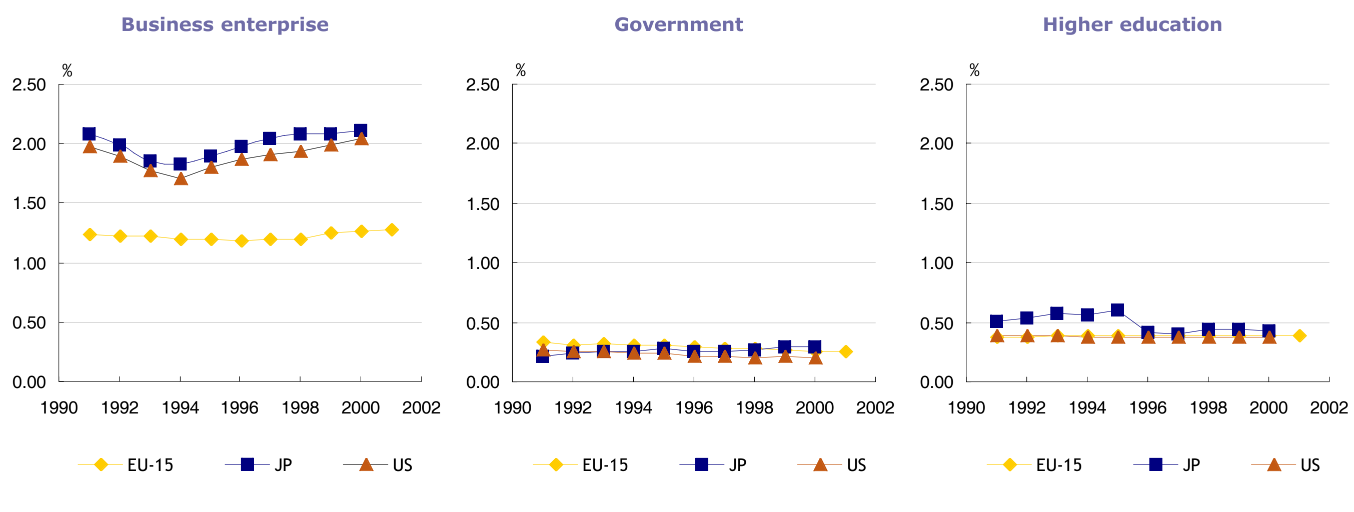
In volume terms, the European Union spent EUR 171 billion on R&D in 2001, as against 287 billion for the USA and 154 billion for Japan in 2000. The general trend for each entity is up on the previous year. R&D expenditure rose by 2.9 % for the EU-15, by 3.9 % for Japan and by 6 % for the USA (measured in real terms).

There are different driving forces behind these increases. For the EU-15 and the USA, the main factor behind this increase is the business sector where expenditure rose by 3.6 % and 6.9 % respectively. In Japan, on the other hand, the bulk of this increase was attributable to the Government and higher education sectors (4.2 % in each sector).

Most R&D activities are conducted in the enterprise sector, which accounted for 75 % of the expenditure (in current EUR) in the USA in 2000. This proportion is lower in Japan (71 %) and only reaches 66 % in the EU-15 — Figure 2.3.

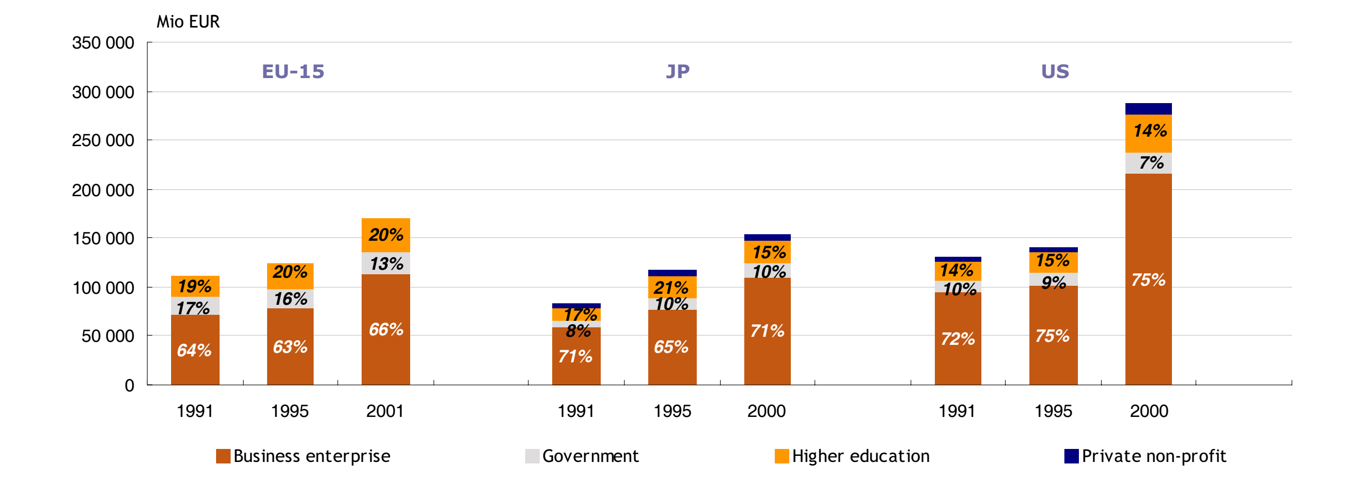
([5]) One of the objectives announced at the Barcelona Council was to raise R&D expenditure in the EU to 3 % of GDP by 2010 — European Commission, March 2002.

Figure 2.2. **R&D expenditure as a % of GDP by institutional sector, EU-15, Japan and USA — 1991-2001**



Sources: Eurostat, OECD (JP, US).

Figure 2.3. **R&D expenditure in millions of EUR by institutional sector, EU-15, Japan and USA — 1991, 1995 and 2001**



Sources: Eurostat, OECD (JP, US).

2.2.2 R&D personnel

Further increase for EU-15

In 2001, almost 1.8 million people expressed in full-time equivalent units (FTE) worked in the field of research in Europe, all sectors combined, which represents a volume increase of 1.58 % over the previous year. This increase continues the upward trend which began in 1997 — Figure 2.4.

Measured in terms of head count (HC), R&D personnel in EU-15 topped the 2.4 million mark for the first time in 2001, accounting for 1.41 % of the labour force, as against 1.38 % in 2000.

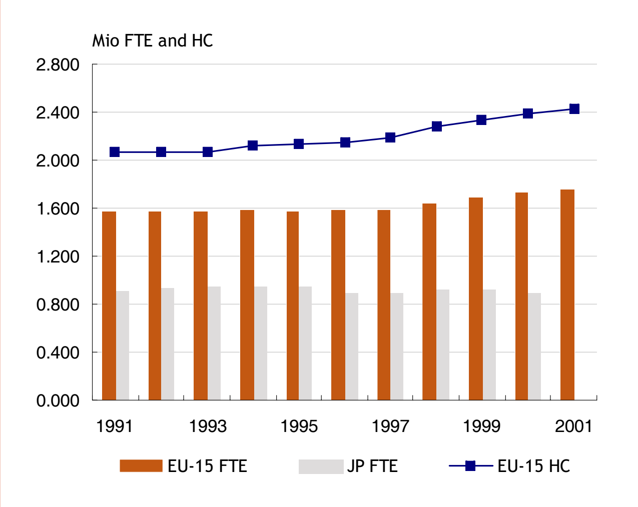
Japan recorded a slight dip in employment in 2000, with 897 000 people being employed in R&D, as opposed to 919 000 in 1999. This fall contrasted with the increase in R&D expenditure, which rose by almost 3 % over the same period.

The number of researchers continued to rise in the European Union in 2001 to reach a total of 960 000 (FTE). In volume terms, this works out at an increase of over 100 000 researchers (FTE) in the course of the last 5 years. This proportion is still nonetheless lower than that observed in the United States where 1.1 million researchers (FTE) were recorded in 1997. The 13 % rise in the number of researchers (FTE) between 1995 and 1997 in the USA is higher than in Europe. In Japan, on the other hand, the number of researchers has been relatively stable at around 650 000 over the last 3 years — Figure 2.5.

Broken down by institutional sector, the USA differs from the EU-15 and Japan due to the predominance of researchers (FTE) in the business enterprise sector. In the USA, this sector accounted for 82 % of all researchers in 1997 as against 65 % in Japan in 2000 and 50 % in EU-15 in 2001. The breakdown of total personnel also varies from one entity to the next, with, for example, 72 % of all R&D personnel (FTE) in the business enterprise sector in Japan being researchers, as against 50 % for EU-15. For total R&D personnel, no data are available for the USA.

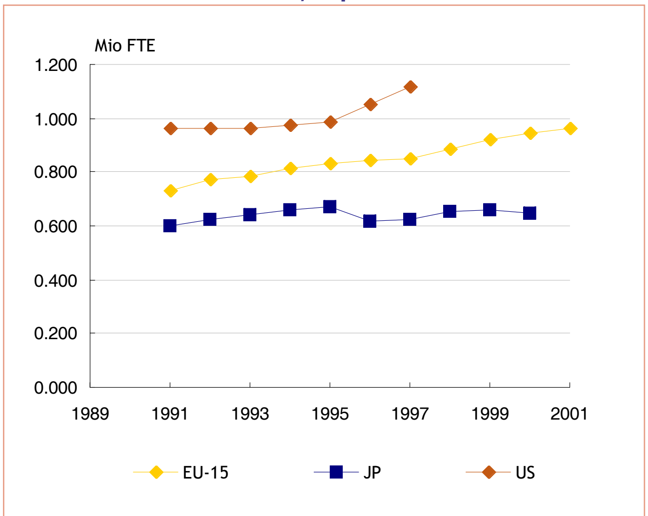
The proportion of researchers in the public sector is higher in Europe than in Japan and the United States — Figure 2.6.

Figure 2.4. **R&D personnel in FTE and HC all sectors EU-15 and Japan — 1991-2001**



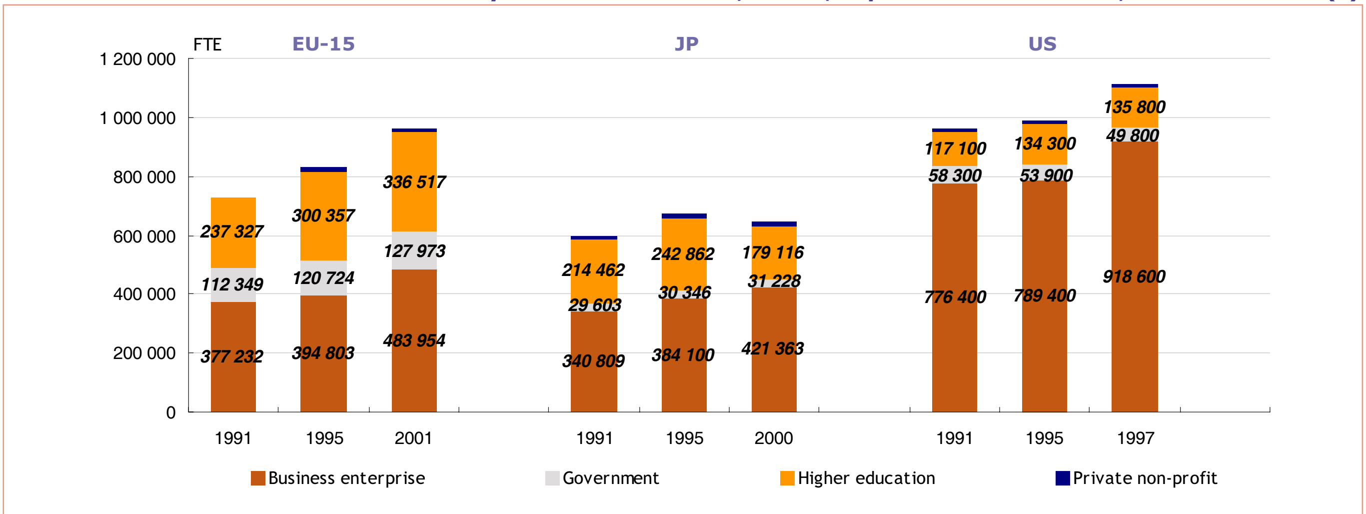
Sources: Eurostat, OECD (JP).

Figure 2.5. **Researchers in FTE all sectors EU-15, Japan and USA — 1991-2001**



Sources: Eurostat, OECD (JP, US).

Figure 2.6. **Researchers in FTE by institutional sector, EU-15, Japan and USA — 1991, 1995 and 2001 (1)**



(1) Exceptions to the 2001 reference year — JP: 2000 and US: 1997.

Sources: Eurostat, OECD (JP, US).

2.3. R&D activity in Europe

2.3.1 R&D expenditure

The Nordic countries step up their efforts

In 2001, Finland and Sweden — with 3.67 and 3.78 % respectively — spent the largest proportions of their GDP on R&D expenditure in Europe, all sectors combined. These figures were both increases, especially for Finland which was 0.3 points up on the previous year.

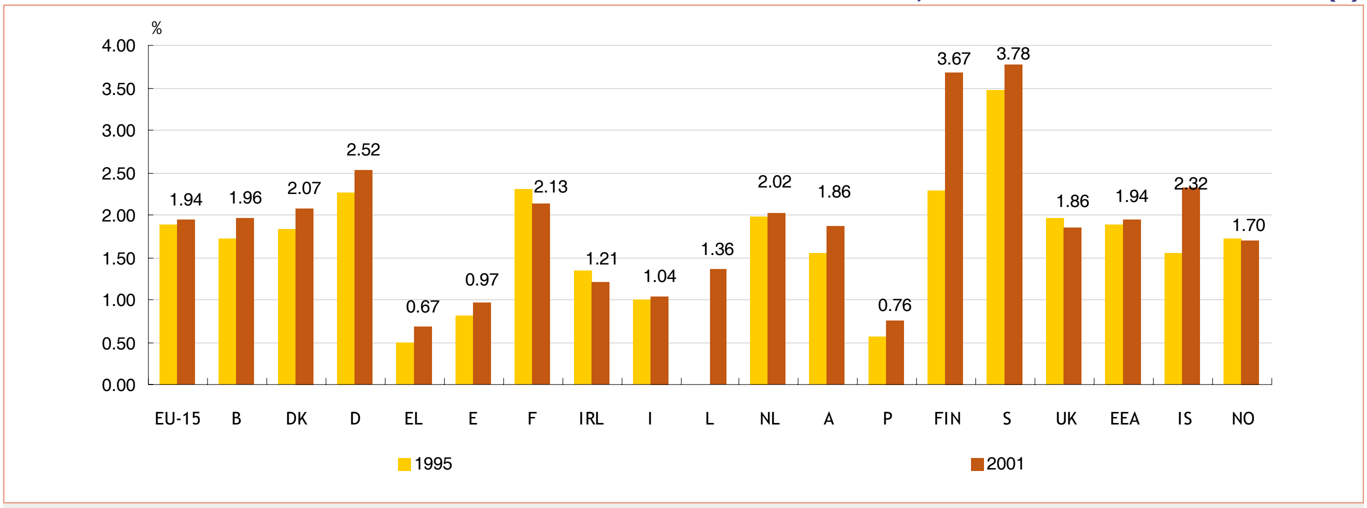
Generally speaking, the majority of European countries have recorded an increase in R&D intensity (i.e. the % of GDP devoted to R&D expenditure), with the figures for Iceland, for example, rising by over 0.2 percentage points. France, Ireland, United Kingdom and Norway are the only exceptions to this trend. Substantial difference do, however, remain among the different EEA countries, despite the increases recorded by the low R&D intensity countries, as there are still over 3 points separating Sweden from Greece and Portugal. The latter two countries, along with Spain, Ireland or Italy are still well below the Community average (1.94 %).

Of those countries with the highest volumes of R&D expenditure, Germany alone increased its R&D intensity, compared both to the previous year and over the last 6 years. France and the United Kingdom, on the other hand, saw their shares of GDP devoted to R&D expenditure stabilise or even drop — Figure 2.7.

These same trends can be found in the business enterprise sector, which generally accounts for two-thirds of total R&D expenditure by volume. Sweden and Finland are again at the top of the table with respective figures of 2.84 % and 2.68 %, which are higher than those for the United States and Japan. It is also in Finland, as well as in Iceland, that the highest increases — of over 0.25 points — have been recorded.

The disparities in this sector remain substantial, with four countries — Greece, Spain, Italy and Portugal — still over 0.75 points short of the Community average for R&D intensity — Figure 2.8.

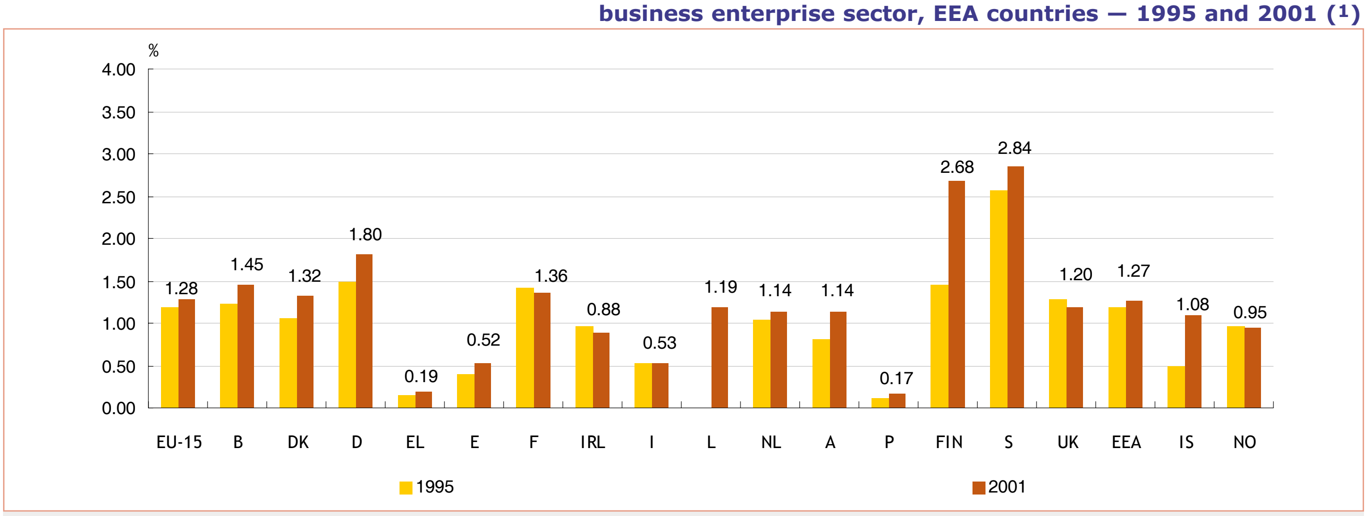
Figure 2.7. **R&D expenditure as a % of GDP all sectors, EEA countries — 1995 and 2001 (1)**



(1) Provisional data.
Estimated data: EU-15, EEA, B, DK, D, EL, E, F, IRL and A.
Exceptions to the 2001 reference year — UK: 2002; DK and F: 2000; B, EL, IRL, I, NL, P, S, IS and NO: 1999.

Source: Eurostat.

Figure 2.8. **R&D expenditure as a % of GDP business enterprise sector, EEA countries — 1995 and 2001 (1)**



(1) Provisional data: L and US.
Estimated data: EU-15, EEA, B, DK, D, E and F.
Exceptions to the 2001 reference year — UK: 2002; B, DK and F: 2000; EL, IRL, NL, P, S, IS and NO: 1999; A: 1998.
Exceptions to the 1995 reference year — A: 1993.

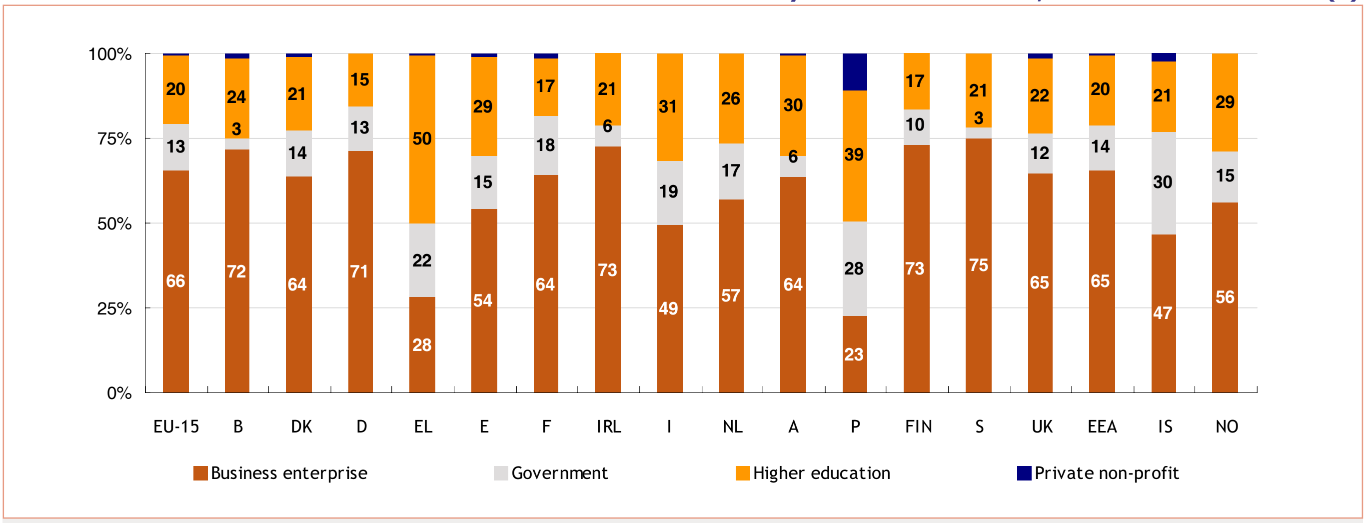
Source: Eurostat.

Germany, with EUR 52 billion, the United Kingdom (31 billion) and France (30 billion), record the highest volumes of R&D expenditure in Europe, accounting for almost two-thirds of the EU-15's total expenditure in 2001 — Table 2.1. Their expenditure was up on the previous year, but at a lower rate than that observed for the European Union where the annual growth rate (AGR) for 2001 was 2.9 %.

Looking at all sectors combined, the most notable growth rates, both annually and over the period from 1995-2001, were seen in Iceland and Finland, and also in Portugal and Greece where the average annual growth rate (AAGR) between 1995 and 2001 was over 10 % — Table 2.2.

The volume of expenditure is not broken down in the same way among the different institutional sectors in the different countries, and the extreme values lie very far apart. Thus, for example, whereas the business enterprise sector accounts for over 60 % of expenditure in a majority of countries, this figure is 23 % of total R&D expenditure in Portugal and 75 % in Sweden (current EUR). Greece and Portugal stand out in particular for the substantial proportion of public sector spending on R&D compared to other EEA countries — Figure 2.9.

Figure 2.9. **R&D expenditure as a % of total expenditure by institutional sector, EEA countries — 2001 (1)**



(1) Exceptions to the 2001 reference year
UK: 2002; DK and F: 2000; B, EL, IRL, I, NL, P, S, IS and NO: 1999; A 1998.
Calculations in EUR.

Sources: Eurostat, OECD (JP, US).

Table 2.1. R&D expenditure in million EUR and in millions of constant 1995 PPS by institutional sector, EEA countries, Japan and USA — 2001 (1)

	EU-15	B	DK	D	EL	E	F	IRL	I	NL	A	P	FIN	S	UK	EEA	IS	NO	JP	US
In millions EUR																				
All sectors	**170 792 s**	4 618 e	3 604 e	52 074 e	795 e	6 275 e	30 152 e	1 075 e	11 524	7 563	3 921 e	815	4 960 f	8 608	31 207 f	**174 162 s**	188	2 445	153 852	287 266 p
Business enterprise	**112 150 s**	3 605 f	2 299 e	37 200 e	227	3 406 e	19 307 e	784	6 442	4 263	2 146	185	3 615 f	6 466	20 138 f	**114 045 s**	88	1 368	109 176	216 384 p
Government	**23 025 s**	153 e	496	6 818 e	173	970 e	5 357 e	68 e	2 411	1 250	218	228	515 f	289	3 768 f	**23 543 s**	57	377	15 216	21 485 p
Higher education	**34 448 s**	1 103 e	770	8 055 e	394	1 846 e	5 040 e	228 e	3 628	1 983	1 003	314	829 f	1 842	6 879 f	**35 403 s**	39	700	22 352	38 928 p
In millions of constant 1995 PPS																				
All sectors	**144 369 s**	4 362	2 573	43 988	931	6 471	26 437	1 030	11 597	6 984	3 344	1 087	4 136	6 752	22 203	**146 419 s**	151	1 778	84 220	225 223
Business enterprise	**94 180 s**	3 360	1 641	31 424	265	3 513	16 929	751	6 183	3 937	1 911	247	3 015	5 072	14 327	**95 329 s**	71	995	59 763	169 651
Government	**19 694 s**	145	354	5 760	202	1 001	4 697	63	2 314	1 155	194	304	430	227	2 681	**20 016 s**	46	274	8 329	16 845
Higher education	**29 496 s**	1 042	549	6 805	461	1 904	4 419	219	3 650	1 831	893	419	691	1 445	4 894	**30 072 s**	32	509	12 236	30 521

(1) Exceptions to the 2001 reference period
B (BES), DK, D, F, IRL (GOV), JP and US: 2000;
B (excluding BES), EL, IRL (excluding GOV), I (All sectors and HES), NL, P, S, IS and NO:1999;
A: 1998.

Sources: **Eurostat, OECD (JP, US).**

Table 2.2. Annual growth rate and annual average growth rate for R&D expenditure by institutional sector, EEA countries, Japan and USA — 1995-2001 (1)

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	EEA	IS	NO	JP	US
All sectors																					
AGR 2001 (%)	**2.9**	6.7	2.3	2.2	:	5.6	1.4	6.3	-1.0	:	8.2	4.5	:	**9.8**	5.5	1.5	**2.9**	**19.1**	:	3.9	6.0
AAGR 1995-2001 (%)	**3.3**	6.0	5.2	3.5	12.0	6.7	1.0	6.7	2.6	:	4.2	5.4	11.5	**12.9**	5.1	1.7	**3.3**	**16.1**	3.0	2.0	5.7
Business enterprise sector																					
AGR 2001 (%)	**3.6**	7.5	3.0	3.2	:	6.8	2.7	7.8	5.9	:	12.6	:	:	**12.9**	4.1	1.1	**3.6**	**51.8**	:	4.2	6.9
AAGR 1995-2001 (%)	**4.1**	6.4	7.4	4.8	11.1	8.8	2.0	7.2	1.7	:	6.2	9.2	13.8	**15.6**	5.4	1.6	**4.1**	**27.8**	2.7	3.8	6.8
Government sector																					
AGR 2001 (%)	**1.3**	2.8	-7.3	0.8	:	**3.2**	-0.7	2.8	-2.4	24.0	-4.2	:	:	1.4	2.5	-1.8	**1.3**	-3.5	:	**4.2**	2.7
AAGR 1995-2001 (%)	**0.3**	5.0	0.8	0.7	7.6	3.4	-2.3	-1.5	0.8	:	1.9	-0.2	**12.5**	3.7	2.2	-0.8	**0.3**	**10.1**	0.1	2.5	0.9
Higher education sector																					
AGR 2001 (%)	**2.0**	4.7	7.8	-1.0	:	4.9	-1.3	7.5	-0.8	-83.0	4.5	:	:	2.8	**11.3**	5.0	**2.0**	-0.2	:	1.7	**3.2**
AAGR 1995-2001 (%)	**3.1**	6.0	2.3	0.8	**15.2**	5.2	1.0	9.1	8.2	:	1.8	3.0	12.7	10.0	4.5	3.9	**3.1**	**8.4**	5.5	-5.0	3.3

NB: AGR — annual growth rate;
AAGR — annual average growth rate over the period 1995-2001;
Calculations in PPS — Purchasing Power Standards — at 1995 constant prices.

(1) **Exceptions to the 2001 reference period**
B (BES), DK, D, F, IRL (GOV), JP and US: 2000;
B (excluding BES), EL, IRL (excluding GOV), I (All sectors and HES), NL, P, S, IS and NO:1999;
A: 1998.
Exceptions to the 1995-2001 reference period
B (BES), DK, F, IRL (GOV), JP and US: 1995-2000;
B (except for BES), EL, IRL (BES), I (All sectors), NL, P, S, IS and NO: 1995-99;
UK: 1995-2002;
A (except for All sectors): 1993-98.

Sources: **Eurostat, OECD (JP, US).**

2.3.2 R&D personnel

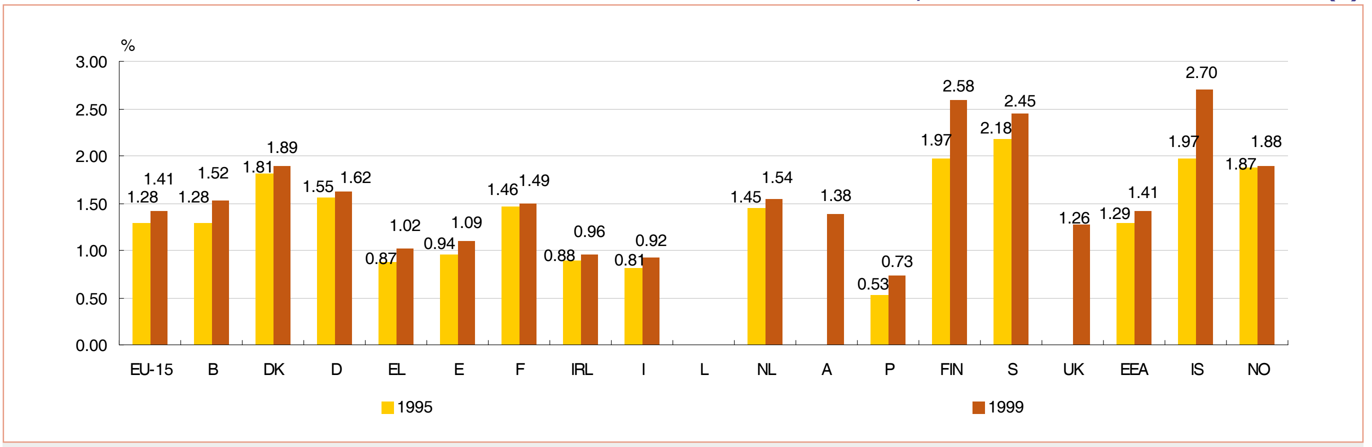
All sectors combined, the Nordic countries employed the highest proportion of R&D personnel as a percentage of the labour force in the European Economic Area in 1999, often one percentage point higher than the European average (1.4 %). Iceland tops the table with 2.7 % of its labour force employed in R&D, ahead of Finland (2.6 %) and Sweden (2.4 %). These countries also recorded the highest increases over the last 5 years, Iceland being up 0.7 points over the period from 1995-99, Finland adding 0.6 and Sweden 0.3.

Large disparities persist between the extremes in Europe. Four countries — Greece, Spain, Ireland and Italy — post figures of around 1 % for R&D personnel as a percentage of the labour force, whereas the proportion for Portugal is only 0.7 %.

These countries are, however, similar to all other European countries in that they did record positive medium-term growth between 1995 and 1999. These upward trends mirror those for R&D expenditure other than in France, Ireland and, to a lesser extent, Norway, where R&D expenditure as a % of GDP was down over the same period — Figure 2.10.

In terms of volume, 3 countries account for three-quarters of the R&D personnel working in Europe: Germany employs the most with 488 000 workers in FTE, followed by France with 307 000 and the United Kingdom with 278 000 — Figure 2.11. The year-on-year trend is up for all EEA countries in FTE, with the exception of Sweden where numbers were down slightly on 1998. These developments, as noted earlier, are along the same lines as those observed for R&D expenditure by volume, including the case of Italy, which, however, saw a fall in its number of R&D personnel and expenditure.

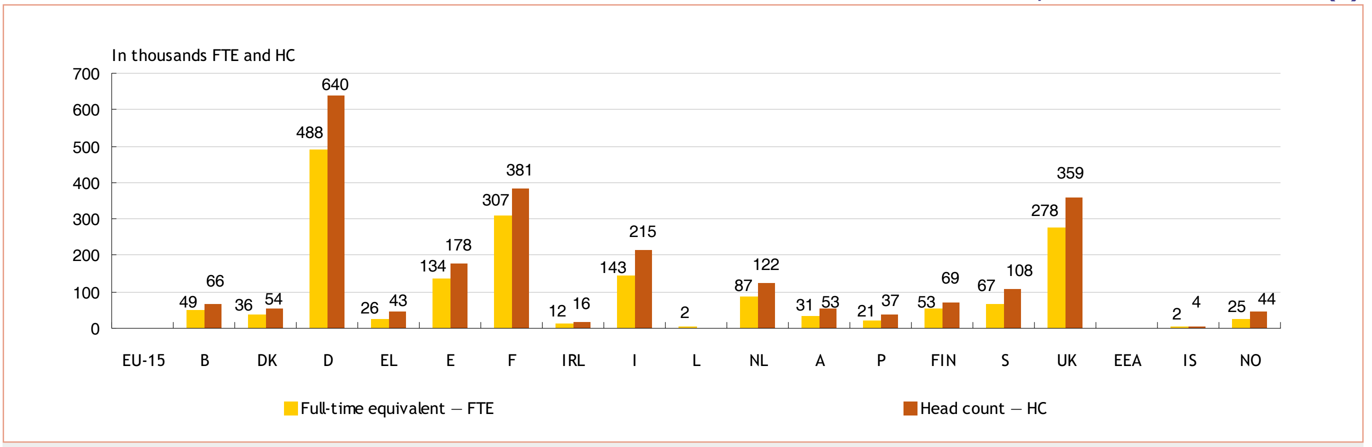
Figure 2.10. **R&D personnel as a % of the labour force all sectors, EEA countries — 1995 and 1999 (1)**



(1) Exceptions to the 1999 reference year
EU-15 and EEA: 2001; D and FIN: 2000; F and A: 1998; EL: 1997; UK: 1993.

Source: Eurostat.

Figure 2.11. **R&D personnel in FTE and HC all sectors, EEA countries — 1999 (1)**



(1) Exceptions to the 1999 reference year
FTE: E and L: 2001; D and FIN: 2000, F and A: 1998; UK: 1993;
HC: D and FIN: 2000, F and A: 1998; EL: 1997; UK: 1993.

Source: Eurostat.

Researchers in Europe: increase in numbers

In 1999, Germany, with almost 260 000 FTE researchers, was home to over one-quarter of all researchers in the EEA, all sectors combined, as against 18 % in both France and the United Kingdom. This predominance is exactly the same in the business enterprise sector — Table 2.3. In trend terms, the number of FTE researchers was up on the previous year in all the EEA countries in 1999, for all sectors combined and for the business enterprise sector. The United Kingdom was the sole exception for the latter sector.

The proportion of researchers in the total R&D personnel figure varies by over 30 percentage points across the different EEA countries. All sectors combined, it swings from 76 % for Portugal in 1999 to 46 % for Italy. A similar pattern can be observed in the business enterprise sector.

All sectors combined, this percentage is lowest in those countries with the largest number of researchers (by volume) in Europe. Germany, France and the United Kingdom, therefore, have a lower ratio than the 55 % recorded for the EU-15. This remains true for the business enterprise sector except in the United Kingdom — Figure 2.12.

These findings are reversed when it comes to research support staff — i.e. technicians and administrative staff.

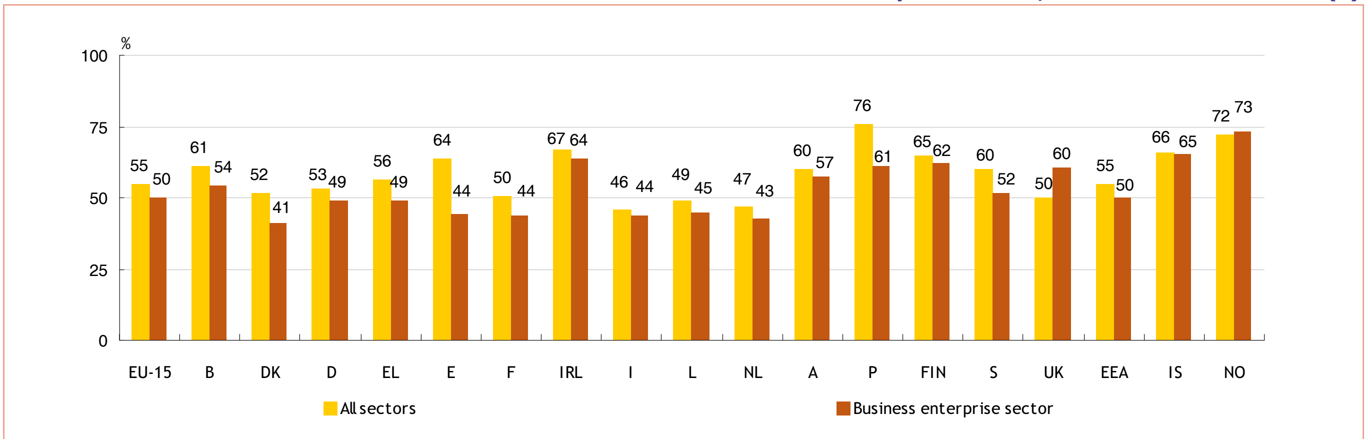
Table 2.3. **Researchers in FTE all sectors and business enterprise sector, EEA countries — 1999 (1)**

EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	EEA	IS	NO
All sectors																		
959 949 s	30 219 e	18 439	259 214 e	14 828	76 670 e	155 006	8 217 e	64 886	1 188	40 639	18 715	15 752	32 677	39 921	158 586 e	980 570 s	1 577 e	18 295
Business enterprise sector																		
483 954 s	18 031 f	8 575	153 210	2 235	20 869 e	75 310	5 291	26 192	909	19 359	11 716	1 994	17 309	22 822	88 000 f	494 798 s	626	9 737

(1) Exceptions to the 1999 reference year
All sectors — UK: 2002; EU-15 and EEA: 2001; D and E: 2000; IRL: 1999; F, A and UK: 1998;
Business enterprise sector — UK: 2002; EU-15 and EEA: 2001; B, D, E and UK: 2000; IRL: 1999; A: 1998.

Source: Eurostat.

Figure 2.12. **Proportion of researchers in FTE all sectors and business enterprise sector, EEA countries — 1999 (1)**



(1) Exceptions to the 1999 reference year
All sectors — EU-15, EEA and L: 2001; D and E: 2000, F and A: 1998; UK: 1993;
Business enterprise sector — UK: 2002; EU-15, EEA and L: 2001; B, D and E: 2000; A: 1998.

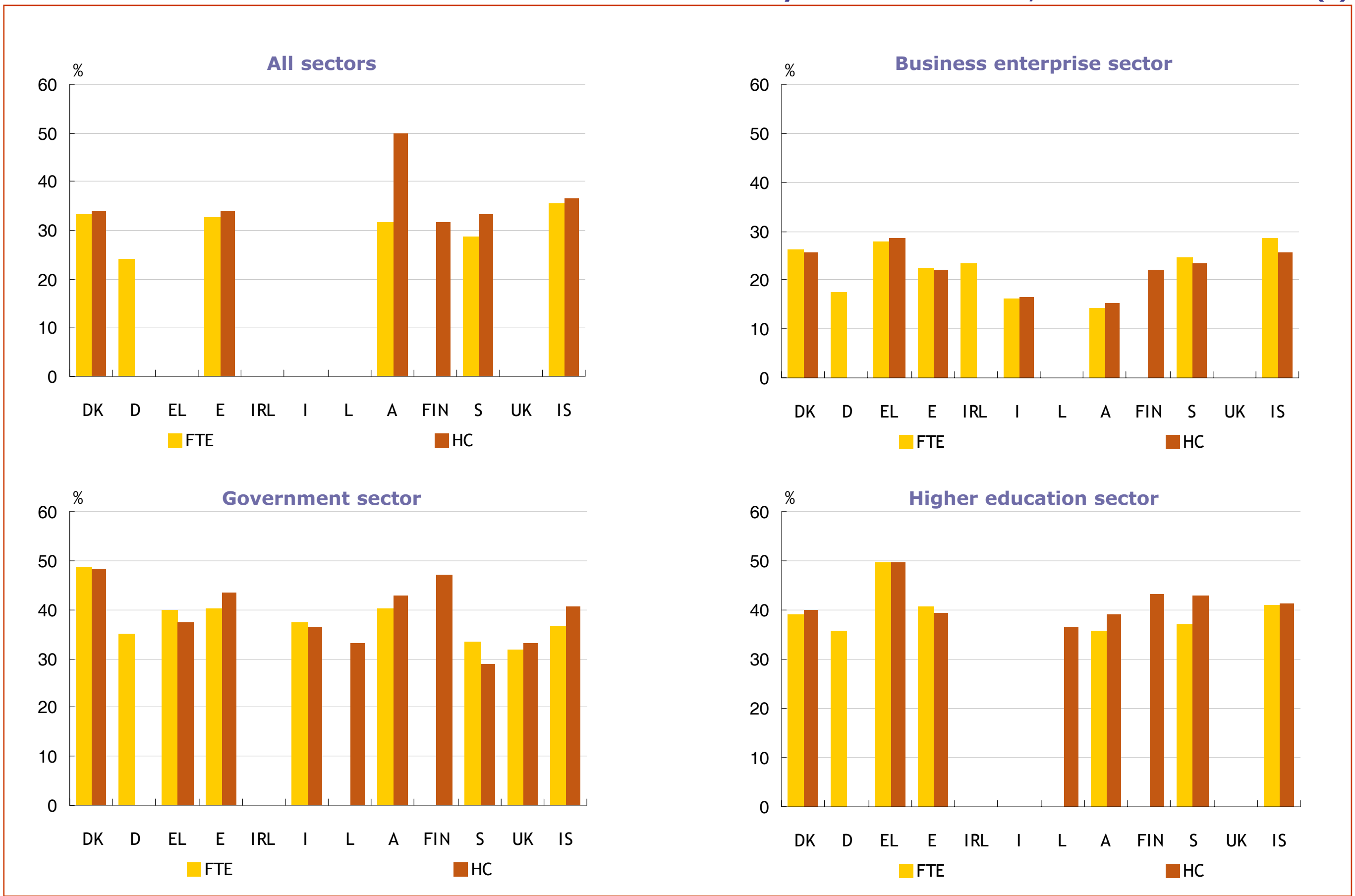
Source: Eurostat.

Female R&D personnel: seeking a balance

Women are generally under-represented in the field of R&D, both in terms of total personnel — Figure 2.13. — and as researchers — Table 2.4. In the first case, the proportion of female staff is, with the exception of Austria, below 40 % of the total for all sectors combined (FTE and HC). This score falls to less than 30 % in the business enterprise sector, plunging to its lowest level in Austria, Italy and Germany where it does not get above 20 %. The imbalance is less pronounced in the public sector, where values range between 30 and 50 %. Gender equality is almost reached in the Government sector where Denmark, Finland and Spain in descending order exceed 44 % (FTE) and in the higher education sector by Greece, Finland and Sweden.

Amongst researchers, the trends are similar by institutional sector, with women being generally under-represented. The only countries to stand out are Portugal in the Government sector (54 %) and in the higher education sector (46 %) and Greece in the higher education sector (45 %).

Figure 2.13. **Female staff as a % of total R&D personnel, calculated in FTE and HC by institutional sector, EEA countries — 1999 (1)**



(1) **Exceptions to the 1999 reference year for FTE**
All sectors — A: 1998;
BES — I and A: 1998;
GOV — UK: 2002; DK and E: 2000; I and A: 1998;
HES — DK and E: 2000; A: 1998.

Exceptions to the 1999 reference year for HC
All sectors — FIN: 2000; A: 1998;
BES — I and A: 1998;
GOV — L: 2001; DK, E and UK: 2000; I and A: 1998;
HES — L: 2001; DK, E and FIN: 2000; A: 1998.

Source: Eurostat.

Table 2.4. **Female staff as a % of researchers, calculated in FTE and HC by institutional sector, EEA countries — 1999 (1)**

	Unit	DK	D	EL	E	IRL	I	L	A	P	FIN	S	UK	IS	NO
All sectors	FTE	26	14	40	32	:	:	:	14	:	:	:	:	32	:
Business enterprise sector	FTE	21	10	24	20	21	:	:	8	:	:	:	:	26	:
Government sector	FTE	35	22	33	38	:	36	:	30	54	:	:	22	32	:
Higher education sector	FTE	29	21	45	39	:	:	:	23	46	:	31	:	37	:
All sectors	HC	26	:	41	33	:	:	:	19	:	29	:	:	33	28
Business enterprise sector	HC	20	:	24	19	:	:	:	9	:	18	:	:	23	20
Government sector	HC	35	:	37	39	:	38	30	32	55	38	:	23	37	33
Higher education sector	HC	28	:	44	36	:	:	36	26	45	37	33	:	35	34

NB: Ratio calculated on the basis of R&D personnel (women + men) and not of total personnel.

(1) **Exceptions to the 1999 reference year for FTE**
All sectors — A: 1998; EL: Eurostat estimation;
BES — A: 1998;
GOV — UK: 2002; DK and E: 2000; I and A: 1998;
HES — DK and E: 2000; A: 1998.

Exceptions to the 1999 reference year for HC
All sectors — A: 1998; EL: Eurostat estimation;
BES — A: 1998;
GOV — L: 2001; DK, E and UK: 2000; I and A: 1998;
HES — L: 2001; DK and E: 2000; A: 1998.

Source: Eurostat.

2.4 R&D activity in the regions

2.4.1 R&D expenditure

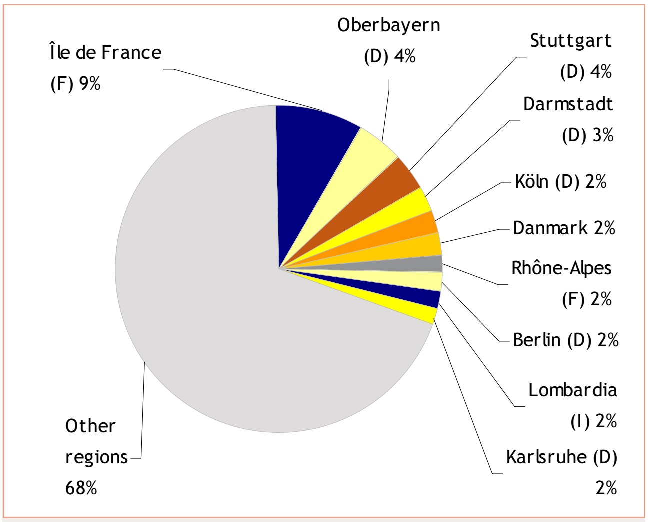
Inequalities still exist

Looking at all sectors together, the most intense levels of R&D activity in Europe are still found in the German regions in 1999. In absolute terms (current EUR), 6 German regions, headed by Oberbayern, featured among Europe's top 10. Between them, they accounted for 16 % of total R&D expenditure in Europe — Figure 2.14. The only other regions to feature in this ranking are two French regions, one Italian and Denmark, which is classified as a single region (6).

The regional disparities — both within countries and within Europe — seemed to have increased since the previous year, with over 6 points separating the level of research intensity in Europe's leading region, Braunschweig (D), from its weakest regions. Within the Community, significant imbalances are also in evidence, with the gaps between the leading regions in each country varying from 2 to 5 points. At the other end of the scale, with the exception of Itä-Suomi (FIN), regions with a low level of research intensity are grouped together in a narrow bracket of 0.5 points — Table 2.5.

(6) The ranking for the Île de France should be weighted to take account of the significant number of head offices of large firms to which R&D activities are attributed.

Figure 2.14. **Proportion of R&D expenditure accounted for by the top 10 EEA regions all sectors — 1999**



NB: Calculated in current EUR.

Source: Eurostat.

Table 2.5. **Disparities in R&D expenditure as a % of GDP by region all sectors — 1999**

	Regions with high R&D intensity					Regions with low R&D intensity				
Country	Region	% of GDP	Current EUR Mio	Constant 1995 PPS Mio	Constant 1995 PPS %	Region	% of GDP	Current EUR Mio	Constant 1995 PPS Mio	Constant 1995 PPS %
	EU-15 — 1999	**1.93**	**154 237**	**135 390**	**100.00**					
DK	Danmark	2.09	3 406	2 514	1.86					
D	Braunschweig	6.34	2 484	2 117	1.56	Weser-Ems	0.53	265	225	0.17
	Stuttgart	4.84	5 643	4 808	3.55	Niederbayern	0.44	117	99	0.07
EL	Kriti	1.03	65	76	0.06	Dytiki Makedonia	0.08	3	3	0.00
	Attiki	0.97	419	490	0.36	Notio Aigaio	0.06	2	2	0.00
E	Comunidad de Madrid	1.62	1 589	1 762	1.30	Baleares	0.25	33	36	0.03
	Pais Vasco	1.15	414	459	0.34	Ceuta y Melilla (ES)	0.00	0	0	0.00
F	Midi-Pyrénées	3.73	1 866	1 648	1.22	Champagne-Ardennes	0.49	142	125	0.09
	Île de France	3.53	13 426	11 860	8.76	Corse	0.40	19	17	0.01
I	Lazio	1.96	2 228	2 242	1.66	Molise	0.29	14	14	0.01
	Piemonte	1.63	1 564	1 574	1.16	Calabria	0.27	65	66	0.05
NL	Noord-Brabant	2.67	1 466	1 354	1.00	Drenthe	0.62	54	50	0.04
	Limburg (NL)	2.38	553	511	0.38	Friesland	0.59	71	66	0.05
A	Wien — 1998	3.24	1 639	1 459	1.14	Niederösterreich — 1998	0.64	196	174	0.14
	Steiermark — 1998	2.53	596	531	0.41	Burgenland — 1998	0.19	8	7	0.01
P	Acores (PT)	2.61	48	64	0.05	Algarve	0.44	16	22	0.02
	Lisboa e Vale do Tejo	0.88	437	583	0.43	Madeira (PT)	0.38	10	13	0.01
FIN	Pohjois-Suomi	4.29	474	417	0.31	Itä-Suomi	1.47	174	153	0.11
	Uusimaa (Suuralue)	4.09	1 804	1 586	1.17	Åland	0.06	1	0	0.00
UK	Eastern	3.56	4 595	3 743	2.76	Yorkshire and Humber	0.92	940	765	0.57
	South East	2.94	6 021	4 904	3.62	Northern Ireland	0.88	266	216	0.16
IS	Iceland	2.32	188	151	0.11					
NO	Trøndelag — 1997	4.18	346	256	0.21	Nord-Norge — 1997	1.08	105	77	0.06
	Hedmark og Oppland — 1997	3.16	216	160	0.13	Sør-Østlandet — 1997	0.33	60	45	0.04

NB: The nomenclature of territorial units for statistics (NUTS) classifies Denmark and Iceland at NUTS level 2. The UK regions are classified at NUTS level 1.

Source: Eurostat.

The top 10 European regions with high research intensity: German regions are well placed

When all sectors are considered together, 5 German regions feature amongst Europe's leading ten in 1999. Braunschweig (D) is the chart-topper with 6.3 % of GDP devoted to R&D expenditure, an increase of over 1.5 points between 1997 and 1999. The top 10 rankings are otherwise unchanged apart from one new entry in the form of Tröndelag (NO). Overall, the levels of research intensity for all the regions presented in the classification are higher than the previous year. Taking all 4 sectors presented together, there are 10 countries represented in the regional rankings for research intensity.

Braunschweig's strong performance is primarily due to its substantial increase in the business enterprise sector where its R&D expenditure as a percentage of GDP rose from 2.9 % in 1997 to 4.6 % in 1999. In volume terms (EUR), however, it only stands at a third of that of the second region, Stuttgart.

It is also in the business enterprise sector, as well as the Government sector, that Europe's leading regions in terms of research intensity account for the most R&D expenditure by volume, at over 22 % (constant PPS) as opposed to just 6 % for the higher education sector.

The German regions are also well represented in the Government sector, with 5 regions headed by Berlin. The highest levels of research intensity are, however, notched up by Açores (P) with 2.12 %, Flevoland (NL) with 2.08 % and Midi-Pyrénées (F) with 1.50 %. The gaps between the leading regions and the chasing pack are also much wider in this sector and in the higher education sector when compared to the situation observed in the business enterprise sector.

The ranking in the higher education sector is more diversified, with six countries being represented as opposed to just three in the business enterprise sector. Tröndelag (NO) heads the list with a research intensity of 1.63 %, followed by Groningen (NL) on 1.40 %. The United Kingdom, for which regional data at NUTS level 2 are again available, has 2 regions included in this classification.

Table 2.6. **Regions with a high level of R&D expenditure as a % of GDP by institutional sector, EEA countries — 1999**

All sectors

Country	Region	% of GDP	Current EUR Mio	Constant 1995 PPS Mio	Constant 1995 PPS %
	EU-15 — 1999	**1.93**	**154 237**	**135 390**	**100.00**
D	Braunschweig	6.34	2 484	2 117	1.56
D	Stuttgart	4.84	5 643	4 808	3.55
D	Oberbayern	4.76	6 548	5 579	4.12
FIN	Pohjois-Suomi	4.29	474	417	0.31
D	Tübingen	4.23	1 835	1 564	1.15
NO	Trøndelag — 1997	4.18	346	256	0.21
FIN	Uusimaa (Suuralue)	4.09	1 804	1 586	1.17
F	Midi-Pyrénées	3.73	1 866	1 648	1.22
D	Berlin	3.62	2 765	2 356	1.74
UK	Eastern — NUTS 1	3.56	4 595	3 743	2.76

Business enterprise sector

Country	Region	% of GDP	Current EUR Mio	Constant 1995 PPS Mio	Constant 1995 PPS %
	EU-15 — 1999	**1.25**	**100 066**	**87 049**	**100.00**
D	Braunschweig	4.60	1 799	1 533	1.76
D	Stuttgart	4.38	5 104	4 349	5.00
S	Västsverige	4.22	1 685	1 322	1.52
S	Stockholm	4.10	2 483	1 947	2.24
D	Oberbayern	3.75	5 155	4 392	5.05
D	Tübingen	3.48	1 511	1 287	1.48
FIN	Pohjois-Suomi	3.14	347	305	0.35
S	Sydsverige	3.02	884	693	0.80
UK	Eastern — NUTS 1	3.01	3 885	3 164	3.64
D	Rheinhessen-Pfalz	2.76	1 283	1 093	1.26

Government sector

Country	Region	% of GDP	Current EUR Mio	Constant 1995 PPS Mio	Constant 1995 PPS %
	EU-15 — 1999	**0.27**	**21 555**	**19 188**	**100.00**
P	Acores (P)	2.12	39	52	0.27
NL	Flevoland — 1998	2.08	100	94	0.49
F	Midi-Pyrénées	1.50	748	661	3.44
D	Berlin	1.00	762	649	3.38
D	Karlsruhe	0.98	724	616	3.21
D	Dresden	0.97	271	231	1.20
D	Braunschweig	0.97	379	323	1.68
I	Lazio	0.96	1 087	1 094	5.70
F	Languedoc-Roussillon	0.95	380	336	1.75
D	Brandenburg	0.78	323	275	1.43

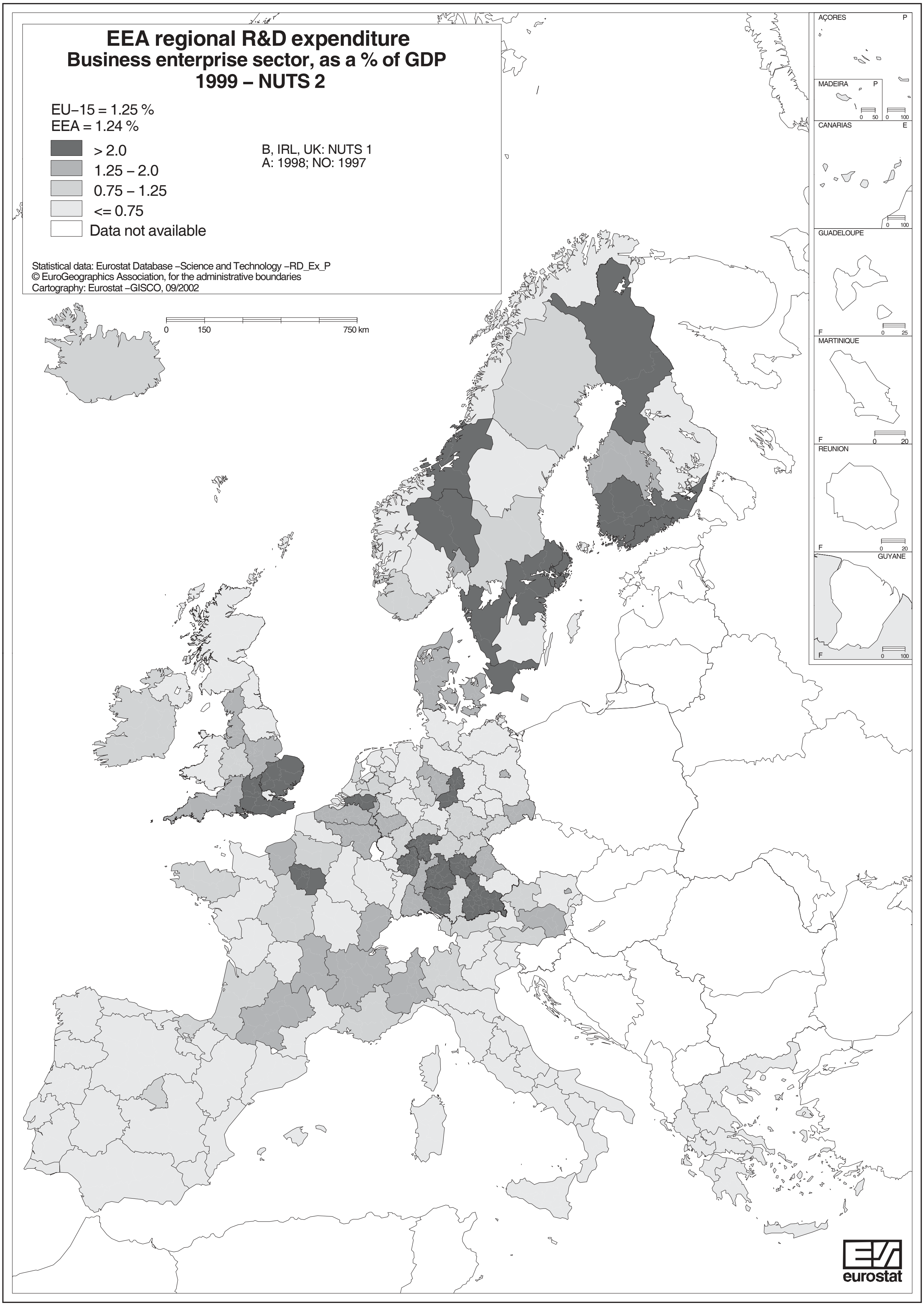
Higher education sector

Country	Region	% of GDP	Current EUR Mio	Constant 1995 PPS Mio	Constant 1995 PPS %
	EU-15 — 1999	**0.39**	**31 555**	**28 191**	**100.00**
NO	Trøndelag — 1997	1.63	135	100	0.38
NL	Groningen	1.40	204	188	0.67
A	Wien — 1998	1.11	562	501	1.84
D	Giessen	0.91	209	178	0.63
A	Steiermark — 1998	0.91	214	190	0.70
UK	Eastern Scotland	0.83	410	304	0.01
FIN	Pohjois-Suomi	0.82	91	80	0.28
D	Halle	0.82	115	98	0.35
UK	Inner London	0.80	1 408	1 043	0.04
NL	Utrecht	0.79	262	242	0.86

NB: The regional classifications have been carried out on the basis of the intensity of research calculated with the latest figures available for GDP at regional level, which are those for 1999. Regional GDP for the UK is estimated.

Source: Eurostat.

Map 2.1.


EEA regional R&D expenditure
Business enterprise sector, as a % of GDP
1999 – NUTS 2
EU–15 = 1.25 %
EEA = 1.24 %
> 2.0
1.25 – 2.0
0.75 – 1.25
<= 0.75
Data not available
B, IRL, UK: NUTS 1
A: 1998; NO: 1997
Statistical data: Eurostat Database –Science and Technology –RD_Ex_P
© EuroGeographics Association, for the administrative boundaries
Cartography: Eurostat –GISCO, 09/2002
0
150
750 km
AÇORES
P
MADEIRA
CANARIAS
E
GUADELOUPE
F
MARTINIQUE
REUNION
GUYANE
eurostat

2.4.2. R&D personnel

8 regions are home to one-quarter of R&D personnel — FTE — in Europe

There are relative similarities in presenting regional R&D from the angles of R&D personnel and R&D expenditure in relation to the labour force and GDP respectively when the analysis is focussed on the best-performing regions. For this reason, Table 2.7. highlights European regions where it is possible to observe the highest concentrations, in volume terms, of R&D personnel in Europe in 1999.

There is a significant regional concentration of R&D personnel in Europe. Across all the sectors, 9 regions, led by Île de France (F), employed 25 % of the total R&D personnel in EU-15 in 1999. On a sectoral basis, this trend is most in evidence in the business enterprise sector where 3 German regions, two French and Denmark, which is classified as a NUTS level 2 region, are also home to one quarter of those working in R&D. This concentration is less pronounced in higher education where the leading 10 regions only account for 20 % of the total. It is in this sector too that the disparities between the extremes are the least pronounced. Leaving aside the Île de France, the second and tenth regions are separated by just 0.5 points, which is a much smaller margin than in the other two sectors.

In terms of volume, whereas the Île de France tops the list of European regions when it comes to the employment of R&D personnel regardless of the sector in question, it is the German regions, led by Oberbayern, which generally dominate R&D. The dominance of the German regions is particularly great in the business enterprise sector, whereas in the Government sector Lazio (I) and Comunidad de Madrid (E) edge them out. The higher education sector is notable for the presence of Spanish regions like Cataluna, French regions like Rhône-Alpes alongside Île de France, as well as regions from Portugal (Lisboa de Vale do Tejo) and Italy (Lombardia).

Four regions stand out in particular as intersectoral research centres with high R&D human resource potential: these are Île de France (F) and Köln (D) which are present in the four institutional sectors, and Oberbayern (D) and Rhône-Alpes (F) which appear in both the public and private sectors.

Table 2.7. **Regions with a high concentration of R&D personnel in FTE by institutional sector — 1999**

All sectors				Business enterprise sector			
Country	Region	FTE	%	Country	Region	FTE	%
	EU-15 — 1999	1 692 702	100.00		EU-15 — 1999	934 980	100.00
F	Île de France – 1998	126 696	7.48	F	Île de France – 1998	75 699	8.39
D	Oberbayern	59 855	3.54	D	Oberbayern	45 240	4.84
D	Stuttgart	44 469	2.63	D	Stuttgart	38 362	4.10
D	Darmstadt	38 703	2.29	D	Darmstadt	32 964	3.53
DK	Danmark	35 652	2.11	DK	Danmark	21 023	2.25
E	Comunidad de Madrid – 2000	33 766	1.95	F	Rhône-Alpes – 1998	19 039	2.11
D	Köln	33 448	1.98	I	Lombardia	18 301	1.96
F	Rhône-Alpes – 1998	31 975	1.94	D	Köln	16 289	1.74
I	Lombardia	30 684	1.81	S	Stockholm	14 726	1.58
D	Berlin	29 270	1.73	D	Düsseldorf	14 229	1.52
Government sector				**Higher education sector**			
Country	Region	FTE	%	Country	Region	FTE	%
	EU-15 — 1999	253 325	100.00		EU-15 — 1999	485 366	100.00
F	Île de France – 1998	18 154	7.22	F	Île de France – 1998	31 016	6.56
I	Lazio	14 376	5.67	E	Cataluòa –2000	9 490	1.89
E	Comunidad de Madrid – 2000	11 393	4.50	F	Rhône-Alpes – 1998	9 198	1.94
D	Köln	9 156	3.61	E	Comunidad de Madrid – 2000	8 454	1.69
D	Berlin	9 068	3.58	P	Lisboa e Vale do Tejo	8 294	1.71
P	Lisboa e Vale do Tejo	9 014	3.56	I	Lombardia	8 228	1.70
D	Oberbayern	8 254	3.26	D	Köln	8 003	1.65
D	Karlsruhe	7 049	2.78	DK	Danmark – 2000	7 958	1.59
NL	Zuid-Holland – 1998	7 033	2.80	E	Andalucia – 2000	7 147	1.43
DK	Danmark – 2000	5 715	2.26	D	Berlin	6 731	1.39

Source: Eurostat.

2.5. Specific developments in the EEA — Country reports

The following reports have been drawn up by the national statistical institutes. The analyses are based on the countries' own data. These data can differ from those presented elsewhere in this publication and in the *NewCronos* database, particularly with regard to calculating derived indicators or growth rates, for example. The origin of these differences is mainly to be found in the methodologies employed in the different countries.

More detailed information on these methodologies is available from the national statistical institutes and from Eurostat.

2.5.1. Belgium

Trend in R&D expenditure

In 1999, gross domestic expenditure on R&D in Belgium amounted to 1.98 % of GDP. This proportion, which represents around EUR 4 618 million (at current prices) had risen by almost 0.3 % since 1993.

With 72 % of total R&D activity, the business enterprise sector is the main sector carrying out R&D. It is also the leader in terms of financing R&D, accounting for 67 % in 1999.

The federal and regional authorities financed around 23 % of Belgium's R&D. Despite the fact that services account for over 70 % of GDP, over 80 % of the R&D is conducted in the industrial sector. The chemicals and pharmaceuticals sectors are the focus of over one-third of R&D carried out by enterprises.

At international level, Belgium's efforts in the field of R&D are currently well above the European Union average of 1.85 %, but still far short of the figures obtained by those countries carrying out the most R&D.

Trend in R&D personnel

Total R&D personnel is an indicator of the importance of human resources directly allocated to R&D activities. In 1999, total R&D personnel made up 1.13 % of the labour force in Belgium, having risen substantially during the period 1993-99 at an average annual growth rate of 5.1 %. This performance is due in part to the revision of the statistical methodology used in the business enterprise sector which is the main sector for employment in R&D, with its share of close to 62 %. Researchers make up 61 % of total R&D personnel, all sectors combined, and 54 % in the business enterprise sector.

Together with the higher education sector, businesses are responsible for the steady growth in total R&D personnel. In the business enterprise sector, employment in R&D makes up 0.77 % of total domestic employment. At sectoral level, over half of the R&D personnel working in the business employment sector are employed in the electrical equipment and electronics, computing, chemicals and pharmaceuticals sectors. In addition, at least 12 % of employment in these sectors is in R&D work. Even though services account for over 70 % of total employment in Belgium, less than 1 % of employment in this sector is in the field of R&D activities.

At international level, Belgium lies above the European Union average with regard to R&D personnel. R&D personnel indicators as a proportion of the labour force show that Belgium has continued to consolidate its position over the last decade.

2.5.2. Greece

R&D trends at the national level

Total R&D

In 1999 GERD in Greece amounted to EUR 760 million. If compared with GERD in 1997 (EUR 492 million) an increase of 54 % in nominal terms and 43 % in real terms is observed. Over the entire period under review, 1995-1999, an increase of 96 % in nominal terms and 56 % in real terms has been recorded for the GERD — in 1995 the GERD amounted to EUR 389 million. GERD expressed as a percentage of GDP has been improving constantly rising from 0.49 % in 1995 to 0.51 % in 1997 and 0.68 % in 1999.

Table 2.8. shows that in 1999 the greater part of Greece's R&D expenditure was financed by the state — government sector plus General University Fund, GUF, with a contribution of 51 % in 1999, followed by the business enterprise sector (24 %) and the EU-Framework Programme plus Structural Funds — 24 %.

The importance of the inflow of funds coming from abroad especially through the Framework Programme proves the 'openness' of the Greek RTD system via intensified international co-operations at all levels.

In terms of research performance, the higher education sector comes first with a contribution in the total R&D expenditure of 49.5 % in 1999, followed by the business enterprise sector (28.5 %) and the government sector (21.7 %).

During the period 1997-99, the share of the business enterprise sector in GERD has increased both in terms of financing and in terms of performing — Table 2.9.

Table 2.8. **Distribution of R&D expenditure by source of financing in % Greece — 1997 and 1999**

	State	BES	Funds from abroad			PNP	Total
			European Union		Other funds		
			FP	SF			
1997	55.6	21.6	12.4	9.6	0.5	0.2	100
1999	50.8	24.2	10.2	13.6	0.8	0.3	100

NB: Country — includes GOV and GUF;
FP: Framework Programme;
SF: Structural Funds.

Source: GSRT.

Table 2.9. **Distribution of R&D expenditure by sector of performance in % Greece — 1997 and 1999**

	GOV	BES	HES	PNP	Total
1997	23.4	25.6	50.6	0.4	100
1999	21.7	28.5	49.5	0.3	100

Source: GSRT.

Total R&D personnel

In 1999, total R&D personnel rose by 32 % from 43 252 persons in 1997 to 57 108. There was a slighter increase (31 %) of R&D personnel expressed in FTE which rose from 20 158 in 1997 to 26 382 in 1999 — Table 2.10. This trend is the result of different developments of R&D personnel in the three main institutional sectors which will be examined in the next paragraphs.

Table 2.10. R&D personnel in FTE and HC all sectors Greece — 1997 and 1999

Full-time equivalent — FTE		Head count — HC	
1997	1999	1997	1999
20 158	26 383	43 252	57 108

Source: GSRT.

New R&D policy measures

An evaluation of the research centres supervised by the General Secretariat for Research and Technology — GSRT — has been implemented in 2000. 27 projects aiming to upgrade the already existing research units into centres of excellence have already been approved under the Operation Programme — OP — 'Competitiveness'. A broad range of financial schemes under the O.P. 'Competitiveness' are addressed to the public research centres.

New legislation

The new Law 2919/2001, which partly amends the Law 1514/1985 'on the development of the scientific and technological research' gives emphasis to the linkage of research and production. It constitutes the basis for the 2000-2006 planning period of the GSRT. It provides incentives for the exploitation of new knowledge and research results, and establishes financial incentives for the construction of technology parks and high-tech firm incubators. The new law also foresees the creation/reorganisation of four research/technological agencies. Finally it has provisions for the reorganisation of the research framework in the defence sector.

Analysis of R&D trends

Expenditure on R&D of the government sector institutions rose to EUR 165 million in 1999 compared with EUR 115 million in 1997 — a relative increase of 43 % in nominal terms and 32 % in real terms — and with EUR 99 million in 1995 — a relative increase of 66.6 and 32.5 % respectively.

The ratio GOVERD/GDP climbs to 0.15 % in 1999 from 0.12 % in 1997 and 0.13 % in 1995.

In 1999 there was a decrease in comparison with 1997 of the R&D personnel of the government sector — expressed in HC, head count — from 9 773 persons in 1997 to 7 911 persons in 1999 (- 19.1 %). There was also a marginal decrease of - 1.1 % of R&D personnel expressed in FTE — 4 431 in 1999 compared with 4 481 in 1997.

Between 1995 and 1999, the number of R&D personnel in HC decreased by 2 348 persons (- 22.84 %). As for the FTE, it shrank to a far lesser degree — 477 persons or - 9.72 %.

This is primarily due to the change of methodology in the estimations of R&D expenditure and R&D personnel in the Ministry of Culture, Department of Archaeology.

Finally the percentage of FTE in the total labour force of the country amounts to 0.12 % in 1995, 0.11 % in 1997 and 0.10 % in 1999. Expressed in HC, the respective figures are 0.24, 0.23 and 0.18 %.

In regional terms, the R&D expenditure of the government sector remains highly concentrated, with 89.7 % in 1999 of the total expenditure being spent in three regions which are, by order of relative weight: Attiki, Kriti and Kentriki Makedonia — compared with 87.5 % in 1995. Especially Attiki increases its share in the total R&D government expenditure from 56 % in 1995 to 63 % in 1999.

There is a similar regional distribution of R&D personnel; the share of the above three regions in total R&D personnel, expressed in FTE, amounts to 87 % in 1999. The concentration of R&D personnel, expressed in HC, in these same regions is slightly less pronounced (72 %).

Higher Education sector

New R&D policy measures

A broad range of financial schemes under the OP 'Competitiveness' are addressed to the universities.

The Operational Programme 'Education' under the 3rd Community support frameworks — CSF — will also fund university research through post-graduate studies by EUR 100 million from 2002 to 2008.

New legislation

The GSRT has adopted a new Presidential Decree, 17/2001, for the financial support of research spin-offs. A new Law, 2916/2001, was introduced by the Ministry of Education aiming at restructuring the Higher Education sector by upgrading the Technical Educational Institutions and bringing them to the level of universities. In the future, this might have indirect implications in the research activities of the sector.

The Ministry of Education is elaborating a new law for graduate studies and research which has not been adopted yet.

Analysis of R&D trends

The R&D expenditure of the higher education institutions — HEI — amounted to EUR 376 million in 1999, compared to EUR 249 million in 1997, registering an increase of 51 % in nominal terms and 40 % in real terms.

Between 1995 and 1997, the rise was more gentle and the respective ratios were 45 and 24 %. In the overall period 1995-99, the higher education sector registered an increase of 119 % in nominal terms and 74 % in real terms.

This upward trend in the Higher education sector is also confirmed by HERD expressed as a percentage of GDP, which reached 0.33 % in 1999, from 0.26 % in 1997 and 0.22 % in 1995.

R&D personnel rose by 47 % to 40 414 persons in HC in 1999 from 27 572 in 1997. There was a slightly lower increase (41 %) of R&D personnel expressed in FTE which rose from 12 294 persons in 1997 to 17 294 in 1999.

During the overall period 1995-99, the number of R&D personnel expressed in HC increased by 19 756 persons (96 %) and expressed in FTE by 7 879 person (84 %). This increase is primarily due to the rise of the number of contracted collaborators in the universities as well as the engagement of permanent staff in new or already existing university departments.

As to the percentage of FTE in the total labour force of the country, this ratio amounted to 0.22 % in 1995, 0.29 % in 1997 and 0.39 % in 1999. The percentage of R&D personnel in HC in the total labour force was 0.49, 0.65 and 0.91 % respectively.

The regional distribution of R&D expenditure of the HEI reflects their geographical distribution, in relation to their size. First comes Attiki with a constantly decreasing share in the overall HERD during the period under review — 46 % in 1995, and 42 % in 1999. Second in importance is Kentriki Makedonia with an also decreasing share during the same period — 25 % in 1995 — and 23 % in 1999. Then follow the regions of Dytiki Ellada and Kriti with respective shares of 12 and 7 % in 1999. In the above four regions, 83 % of total research activities of HEI was performed in 1999 compared to 87 % in 1995.

Business Enterprise sector

New R&D policy measures

R&D support to business enterprises is provided in the new OP 'Competitiveness' as well as in the new OP for 'Information Society' which are both financed by the 3rd Community Support Framework.

New schemes have been introduced which focus on strengthening research in enterprises and creating the necessary infrastructure for the exploitation of research results.

Some characteristic programmes under the OP 'Competitiveness' are mentioned below:

PAVET industrial research projects,

HERON employment of research personnel in enterprises,

PEPER demonstration projects,

PRAXE development of spin-offs by research institutions, universities or researchers,

ELEFTHO creation of technology parks, science parks and spin-off incubators.

Developments in the legal framework

- Presidential Decree 274/2000, *Conditions, Prerequisites and Financial Support for Projects and Programmes applied for by Industrial and other Productive Units*. It aims to readjust the legal framework for financial aid of the enterprises by the GSRT.
- Law 2843/2000, Article 28: Establishment of the *Fund for the Development of the New Economy* which aims to support financially venture capital companies, investing in early stage ventures and to strengthen prototype development programmes.
- Presidential Decree, 17/2001, for the financial support of new knowledge intensity enterprises (spin-off).
- Law 2992/2002,Article 10, which provides that research and development expenses are considered as deductible expenses (at a rate of 50 %) for the estimation of taxable profits of Greek enterprises.

Analysis of R&D trends

In the business enterprise sector, the R&D expenditure in 1999 amounted to EUR 216 million, which was 72 % higher than 1997, in nominal terms. In real terms after a decrease of - 5.5 % in 1997 compared with 1995, BERD presented a considerable increase in 1999, 59 % in comparison with 1997.

As for BERD's share to GDP, the increase for 1999 compared with 1997 is important (46 %), following a decrease of - 13.3 % in the 1995-97 period.

Total R&D personnel, in FTE, increased considerably in 1999, 39 % compared with 1997. Similarly, total R&D personnel as a percentage of the labour force increased in the same period by 33 %.

In head count, total R&D personnel increased by 8.6 % in the 1995-97 period while it increased by 50 % in the 1997-99 period.

Analysis of R&D activity at the regional level

BERD at current prices continues to be highly concentrated in Attiki (63.4 % in 1999, 64.8 % in 1997, 62.9 % in 1995). In real terms (at 1995 prices) Attiki's expenditure evolved from EUR 72 million in 1995 to 70.2 in 1997 and EUR 109.2 million in 1999 — it increased by 56 % between 1997 and 1999, while total BERD increased by 59 %.

Attiki, Kentriki Makedonia, Sterea Ellada and Peloponnisos sum 86 % in 1995, 87 % in 1997 and 91 % in 1999 of total BERD.

Total R&D personnel, in FTE, in the above four regions sum 86, 89 and 88 % in 1995, 1997 and 1999 respectively. Attiki's share in R&D personnel, in FTE, during the same period remains 64 % between 1995 and 1999 with an exception in 1997 (71 %).

Table 2.11. **Evolution of R&D expenditure and personnel, business enterprise sector Greece — 1995, 1997 and 1999**

Unit	1995	1997	1999
BERD at current prices in Mio EUR	114.6	125.8	216.5
BERD at constant prices in Mio EUR	114.6	108.3	172.1
BERD as a % of GDP	0.15	0.13	0.19
Total R&D personnel in FTE	3 100	3 291	4 577
Total R&D personnel in FTE as a % of labour force	0.07	0.08	0.10
Total R&D personnel in HC	5 285	5 739	8 611

Source: GSRT.

Private Non-Profit sector

This sector continues to play a minor role in the R&D activity of the country.

In 1999, the private non-profit institutions spent EUR 2.32 million to R&D. Their R&D expenditure expressed as a percentage of the GDP was only 0.002 %. The R&D personnel of the sector counted in 1999 for 172 persons (HC) or if expressed in FTE, for 80 persons.

Bibliography

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- Operational Programme for 'Competitiveness' 2000-2006, Official Document.

2.5.3. France

R&D in the French regions in 2000

R&D potential is concentrated in Île-de-France — 45.1 % of gross domestic expenditure on R&D — GERD — and one or two other regions, and there has been little change in the regional ranking.

In 2000, the Île de France had a predominant share with a GERD of EUR 13 474 million. Enterprises carry out 47.7 % of the R&D work. Publicly funded research plays a slightly smaller part with just 40.2 % of GERD.

For publicly funded research, the breakdown between public bodies and universities is quite different, with universities contributing to a lower concentration of R&D expenditure: 30.4 % of university expenditure is in the Île de France as against 44.6 % of expenditure in EPSTs — Public science and technology establishments — (47 % in the CNRS) and 43.7 % in EPICs — industrial and commercial public undertakings — in 2000.

22.8 % of all R&D expenditure — a GERD of EUR 6 803 million — was concentrated in three regions in 2000: Rhône-Alpes with EUR 3 281 million (11.0 % of the GERD), followed by Provence-Alpes-Côte d'Azur on EUR 1 807 million (6.0 %) and Midi-Pyrénées on EUR 1 715 million (5.7 %). The fall in Midi-Pyrénées compared to 1999 does not reflect a downward trend in research expenditure, but is the result of improvements in the way CNES — French Space Agency — contracts with enterprises are accounted for regionally.

Five other regions are responsible for 14.9 % of the GERD, or some EUR 4 455 million: Bretagne, Aquitaine, Languedoc-Roussillon, Centre and Pays de la Loire account for totals ranging from EUR 700 to EUR 1 000 million. The other 13 regions together spent EUR 5 149 million, or 17.2 % of total GERD.

The business enterprise sector's contribution to R&D is not identical across the regions, being lower than that of the public administrations in some regions: Languedoc-Roussillon, Provence-Alpes-Côte d'Azur, Midi-Pyrénées, Nord-Pas-de-Calais, Lorraine, Alsace and Poitou-Charentes.

The characteristics of the regional breakdown of R&D personnel are very different from those of the GERD distribution. Whilst the figures here do also show a higher concentration in the Île de France for businesses, this region's share of the total has fallen, both for the business enterprise sector and for publicly funded research. The predominance of the Île de France started to wane in the 1990s, following decentralisation measures undertaken by the public bodies.

2.5.4. United Kingdom

In 2000, GBP 11.5 billion was spent on R&D performed within UK businesses — a rise of 2 % at current prices compared with the 1999 total. In real terms, using the GDP deflator, expenditure remained at GBP 11.5 billion and in 2000 represented approximately 1.2 % of GDP.

The South East continued to be the area with the largest R&D expenditure, with 26 % of the UK total of GBP 11.5 billion. The second largest region was Eastern with 24 % of the UK total. In comparison the area with the smallest R&D expenditure in England was the North East which had 1 % of the UK total.

The product group with the largest R&D expenditure was pharmaceuticals: expenditure in 2000 was GBP 2 846 million, nearly 25 % of all spending. Other major product groups were aerospace accounting for GBP 1 091 million (9 %) and radio and television and communication equipment, GBP 1 024 million (9 %).

Funding of R&D in UK businesses by the EU Commission through its schemes to support R&D in the European Union amounted to GBP 101 million in 2000. Other funding from overseas — i.e. excluding funds from the EU Commission — was GBP 2 369 million. Funding from the UK Government was GBP 1 013 million. Funding of R&D from businesses own funds was GBP 7 244 million in 2000, 63 % of the total.

Detailed final results of the survey of expenditure and employment relating to Business Enterprise Research and Development — R&D — in 2000 were published in January 2002 on the internet at: www.statistics.gov.uk.

During the financial year 2000-2001 the UK government introduced tax credits for R&D performed by small and medium sized companies. As a consequence the size of the sample for the BERD survey was increased from 2000 to 4000 forms in order to monitor the impact of these incentives. At this stage a significant impact on the figures is unlikely.

2.5.5. Iceland

Latest survey data on R&D expenditures and personnel is from 1999, but the survey for 2001 was realised in spring of 2002. The development of R&D personnel is not as drastic as the development of expenditures.

The development of R&D expenditure from 1993 to 2001 — last two years are estimated — is as follows.

The increase in expenditures from 1997 to 1999 was about 45 % and mostly due to emerging new companies in the field of biotechnology research. It is expected that the increase of total R&D expenditures from 1999 to 2001 will be almost 30 % due to the same reasons as for the previous period. It is estimated that R&D expenditures as a share of GDP will reach 2.85 % in 2001. It is expected that other sectors than the business enterprise sector will not increase much. Rather stable development of expenditures is expected.

Table 2.12. R&D expenditure in thousand EUR by institutional sector Iceland 1993, 1995, 1997 and 1999-2001

	GOV	BES	HES	PNP	All sectors
1993	398.3	537.9	373.6	53.7	1 363.5
1995	551.3	562.8	530.2	49.7	1 694.0
1997	833.7	625.6	656.3	33.7	2 149.3
1999	960.8	644.6	712.3	72.7	2 390.4
2000	:	:	:	:	2 450.2
2001	:	:	:	:	2 511.4

Source: The Statistical Bureau of Iceland.

Some additional data on R&D in Iceland can be found at the web site of the Icelandic Research Council: http://www.rannis.is/Hagtolur/Tolfraedi/Statistics/statistics_r&d.htm.

Chapter 3
Patenting activities in the EEA, Japan and the USA

3.1. Introduction

Patents reflect part of a countries' inventive activity. Patents also show the country's capacity to exploit knowledge and translate it into potential economic gains. In this context, indicators based on patent statistics are widely used to assess the inventive performance of the country or regions, despite the ongoing discussion concerning their adequacy ([1]).

The grounds for the assumption that a patent represents a codification of inventive activity rely on the novelty, utility and inventiveness that an invention requires to be subject to be patented. On the basis of this assumption, Eurostat collects patent statistics to build up indicators of R&D output.

This chapter analyses the structure and evolution of patenting in the EEA, Japan and the USA, by looking at patent applications to the European Patent Office — EPO — and patents granted by the United States Patent and Trademark Office — USPTO. The analysis covers the period from 1990 to 2000, 2000 data being provisional.

Patents statistics are very sensitive to the type of data collected and to the method used to count the patents. Therefore, data should be interpreted with caution, taking the following remarks into account:

The data presented in this chapter originate from two sources. On the one hand, data on patent applications to the EPO were extracted from the EPO's database and have been processed by Eurostat. On the other hand, data on patents granted by the USPTO have been extracted from the USPTO's database and treated by the Fraunhofer ISI — FhG-ISI.

It should be noticed that EPO data refer to patent applications by year of filing, whereas USPTO data concern patents granted by year of publication only. Although not all applications are granted, each application still represents technical effort by the inventor and therefore patent applications can be considered as an appropriate indicator of inventive potential. It takes on average just over four years for a patent to be granted at the EPO. In an effort to provide timely data therefore, Eurostat has chosen patent applications over patents granted. In the USA, however, only information on granted patents is published and therefore it is not possible to obtain data on applications. In the USPTO, patents take from two to five years to be granted.

When interpreting the data at the international level, the reader should bear in mind that due to a 'home' advantage, European countries may be prevailing in the European patent system, whereas the USA may be dominant in the US patent system. On the other hand, figures may also be influenced by the countries' industrial structures, as different industries have a different propensity to patent.

Due to methodological differences in the manner of processing the data, no cross sectional comparisons are advisable between the EPO and USPTO data. Differences in the data processing methods aside, it may be argued whether the position of EU Member States in the USA and Japan is comparable to that of the USA or Japan in the EU. This is directly linked to the complexity of the European patenting scenario, where the European patenting system ([2]) coexists with those of the Member States.

This has implications on the cost of patenting for European inventors, which has been proved to be three to five times more expensive than in the USA or Japan. The Commission estimated that whilst the overall cost of a European patent including translation costs and other fees is around EUR 49 900, Japanese and US patents cost on average EUR 16 450 and EUR 10 330 respectively ([3]).

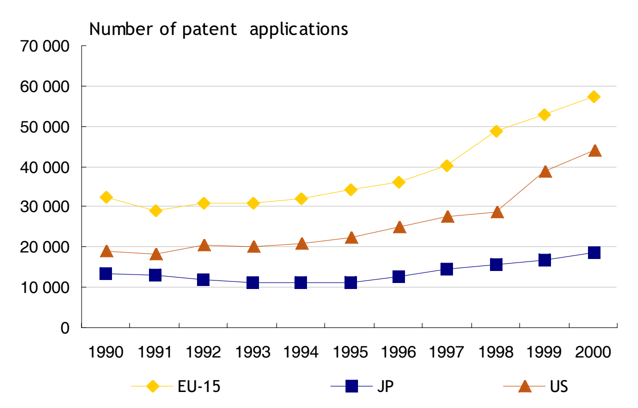
For further explanations on the methodology used, please refer to Part 2.

(1) See advantages and drawbacks of patents indicators in the methodological notes included in Part 2.

(2) Please note that a European patent does not necessarily imply protection in the entire EU territory, but only at the designated states. This is not the case for US or Japanese patents, where one patent always covers the whole country.

(3) See *Proposal for a Council Regulation of the Community patent*, Commission of the European Communities, Brussels 1.8.2000, COM(2000)412 final.

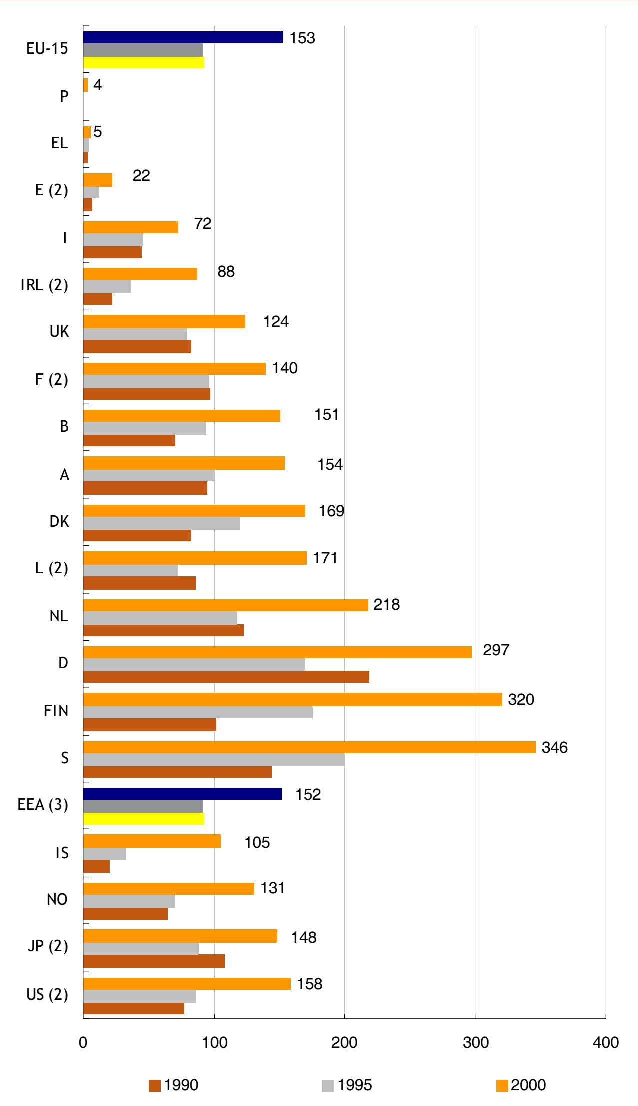
Figure 3.1. Evolution of patent applications to the EPO from EU-15, JP and the USA 1990-2000 (1)



(1) 2000 provisional data.

Source: Eurostat, data — EPO.

Figure 3.2. Evolution of patent applications to the EPO per million inhabitants from EEA countries, Japan and the USA 1990, 1995 and 2000 (1)



(1) 2000 provisional data.
(2) 2000 population data for E, F, IRL and L have been estimated by Eurostat. 2000 population data for JP and US: Source UN.
(3) In 2000, EEA excludes LI.

Source: Eurostat, data — EPO.

3.2. Patent applications to the EPO by year of filing

3.2.1. Total patent applications

Patent applications to the EPO at the national level

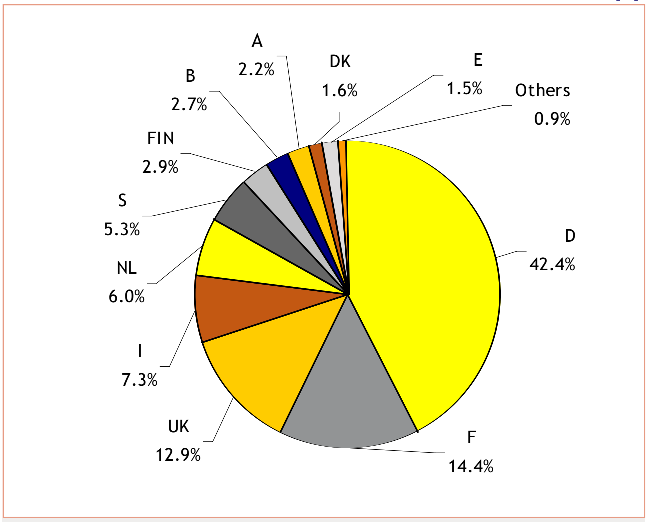
In 2000, the EPO received 57 473 patent applications from inventors resident in the EU, 43 761 from inventors resident in the USA and 18 780 from Japanese inventors. As shown in Figure 3.1., patent applications to the EPO from these three blocks have been growing steadily during the second part of the nineties. For the period 1995 to 2000, the USA registered the highest annual average growth rate (14.3 %). Meanwhile, Japanese and European patent applications to the EPO grew at rates of 11.1 and 10.9 % respectively.

Despite being ahead in absolute terms, the EU's position with regard to its competitors differs when patents are counted as a proportion of population and differences across the three blocks become smaller. In 2000, the USA registered 158 patent applications per million inhabitants, compared to 153 in the EU and 148 in Japan – Figure 3.2. Patent applications to the EPO from the three blocks increased from 1990 to 2000.

Within the EU and in absolute terms, the dominance of Germany is clear, as in 2000 it accounted for 42.4 % of total EU patent applications to the EPO. Following Germany were France and the UK, which accounted for 14.4 % and 12.9 % of the total EU respectively. Together they comprise more than two thirds of the union total, showing therefore that innovative performance is skewed towards the large European Economies – Figure 3.3.

Figure 3.2. shows that in 2000, the country with the highest number of patent applications per million inhabitants was Sweden (346) followed by Finland (320). Both countries outperformed Germany, France and the UK in relative terms and their ratios more than doubled the EU and US ones. The ratios for all European countries grew during the 1990-2000 period, with the noticeable performance of Sweden and Finland.

Figure 3.3. Distribution of patent applications to the EPO from EU-15 by Member State 2000 (1)



(1) 2000 provisional data.

Source: Eurostat, data — EPO.

PART 1 — PATENTS

Map 3.1.

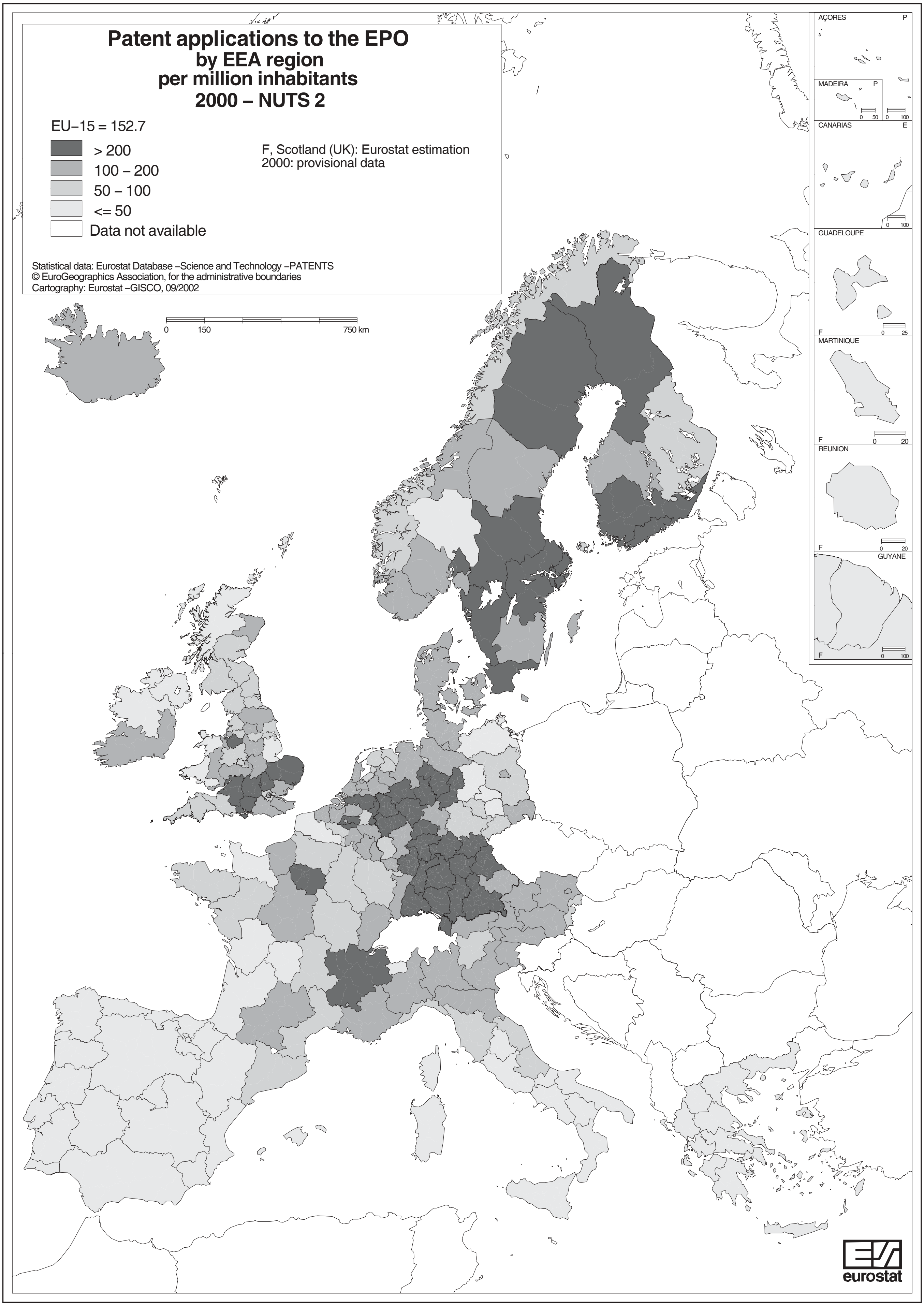

Patent applications to the EPO
by EEA region
per million inhabitants
2000 – NUTS 2
EU–15 = 152.7
> 200
100 – 200
50 – 100
<= 50
Data not available
F, Scotland (UK): Eurostat estimation
2000: provisional data
Statistical data: Eurostat Database –Science and Technology –PATENTS
© EuroGeographics Association, for the administrative boundaries
Cartography: Eurostat –GISCO, 09/2002
0
150
750 km
AÇORES
MADEIRA
CANARIAS
GUADELOUPE
MARTINIQUE
REUNION
GUYANE
eurostat

Table 3.1. shows the distribution of patent applications to the EPO by IPC section. Although different countries specialise in different sections, a general trend for a higher proportion of applications can be observed in 'performing operations; transporting' — which are related to automated activities formerly performed by human beings, such as hulling, husking etc., 'Human necessities' — mainly related to the daily life activities, such as agriculture, fishing, clothing, furniture, hand tools, etc., 'Electricity' — which includes telephonic, digital or pictorial communication — and 'Physics' — which comprises photography or computing. This could indicate either a high concentration of the related industries in European countries or a higher propensity to patent in such industries.

Patent applications to the EPO at the regional level

At the regional level, inventors from the French capital region of Île de France applied for most patents in absolute terms (3 424 patent applications), followed by those from the southern German regions of Oberbayern (3 092) and Stuttgart (2 533).

Map 3.1. gives an overview of the inventive performance of the European regions, at the NUTS 2 level, in terms of patent applications to the EPO per million inhabitants. It can be seen that southern German regions lead in total patenting.

In 2000, Oberbayern was the region with the highest proportion of patent applications per million inhabitants (767) in the EU. Some Dutch, Finnish, Swedish and Belgian regions also showed high patenting intensities.

Table 3.2. shows the leading patenting European regions in relative terms and the distribution of their applications to the EPO by IPC section. A higher degree of specialisation is noticeable in the leading European regions. In this sense, Dutch region Noord-Brabant and Finnish Uusimaa applied for almost half of their patents in the 'electricity' section, whereas Belgian Brabant Wallon and German Rheinhessen-Pfalz requested nearly half of their patents in the 'Chemistry; metallurgy' section.

Table 3.1. Patent applications to the EPO by IPC section in 2000 (1)

	Distribution of patent applications by IPC section in % (2)								Absolute
	A	B	C	D	E	F	G	H	total number
EU-15	**15.4**	**20.1**	**14.5**	**2.1**	**4.5**	**10.0**	**14.9**	**18.6**	**57 473**
B	15.6	16.5	31.2	3.9	3.3	5.6	12.1	11.8	1 548
DK	24.8	13.2	18.0	1.9	5.6	7.8	14.1	14.7	903
D	12.2	22.7	14.4	2.0	4.5	12.9	14.0	17.4	24 385
EL	33.3	23.0	9.7	0.0	11.0	2.8	14.5	5.6	55
E	24.2	22.9	13.9	1.6	7.5	6.8	10.0	12.9	872
F	18.5	19.2	14.5	1.3	3.9	8.7	15.2	18.6	8 272
IRL	22.5	11.2	8.7	0.0	3.7	3.4	26.7	23.8	331
I	20.7	28.1	10.6	3.4	5.7	10.0	9.9	11.5	4 172
L	5.1	32.1	21.2	1.3	0.5	18.7	11.8	9.3	74
NL	13.9	14.1	15.6	0.8	4.1	5.3	20.1	26.2	3 453
A	15.6	22.5	12.5	1.9	9.4	13.6	11.5	13.1	1 248
P	16.7	26.8	16.3	2.5	5.1	10.4	8.4	13.8	39
FIN	8.5	12.1	8.2	8.1	2.1	4.0	14.5	42.5	1 656
S	15.6	17.8	8.2	3.1	3.5	7.6	13.1	31.1	3 070
UK	19.4	14.5	17.1	1.2	4.8	7.4	19.7	15.8	7 394
EEA	**15.5**	**20.1**	**14.4**	**2.1**	**4.6**	**10.0**	**14.9**	**18.5**	**58 118**
IS	25.3	9.0	16.8	0.0	0.0	10.2	23.9	14.7	29
LI	29.8	29.8	19.8	0.0	8.8	8.8	1.8	1.2	29
NO	22.4	19.1	13.0	1.1	9.3	10.3	16.2	8.6	588
JP	9.3	15.3	16.5	1.3	0.8	7.8	21.9	27.1	18 780
US	19.0	11.7	18.0	1.0	1.8	4.7	23.8	19.9	43 761

(1) 2000 provisional data.
(2) See meaning of IPC sections on page 173.

Source: Eurostat, data — EPO.

Table 3.2. Top ten European regions in patenting relative to population in 2000 (1)

Ranking	Country	Region	Patent applications per million inhabitants	Distribution of patent applications by IPC section in % (2) A	B	C	D	E	F	G	H	Absolute total number
1	D	Oberbayern	767	8.7	14.7	8.6	0.8	2.5	8.8	22.3	33.7	3 092
2	NL	Noord-Brabant	673	6.7	7.1	4.7	0.5	1.0	3.4	30.6	46.1	1 585
3	D	Stuttgart	647	4.3	26.7	2.9	2.5	4.0	28.4	13.6	17.6	2 533
4	FIN	Uusimaa (Suuralue)	584	7.9	11.3	9.7	3.9	1.3	3.0	14.5	48.6	806
5	SE	Stockholm	575	16.6	10.6	7.8	1.5	2.3	5.0	13.2	43.1	1 038
6	D	Mittelfranken	510	12.4	15.1	6.1	0.4	1.9	15.4	19.7	29.0	859
7	B	Brabant Wallon	506	27.6	7.0	47.6	3.4	0.3	2.2	7.5	4.4	177
8	D	Freiburg	470	15.1	18.6	16.1	1.2	4.7	12.9	18.4	13.1	999
9	D	Rheinhessen-Pfalz	466	14.6	17.5	45.7	1.5	1.7	3.9	6.4	8.7	933
10	D	Darmstadt	453	16.2	24.2	22.8	2.6	2.6	8.5	11.0	12.1	1 684
		EU-15	**153**	**15.4**	**20.1**	**14.5**	**2.1**	**4.5**	**10.0**	**14.9**	**18.6**	**57 473**

(1) 2000 provisional data.
(2) See meaning of IPC sections on page 173.

Source: Eurostat, data — EPO.

3.2.2. High tech patent applications

Patent applications to the EPO have been growing steadily during the second part of the nineties. However, this growth relates especially to the high technology fields. The definition of high tech followed by Eurostat is that of the *Trilateral Statistical Report*, a joint publication of the EPO, the JPO and the USPTO ([4]). Here, the following six technical fields are defined as high technology: computer and automated business equipment, micro-organism and genetic engineering, aviation, communication technology, semi-conductors and lasers. Each group is constructed by aggregating a list of IPC subclasses, which can be found in the methodological notes in Part 2.

High tech patent applications to the EPO at the national level

During the nineties, high tech patent applications to the EPO grew at annual average growth rates that for many countries doubled those of total patent applications. Throughout the period 1995-2000, high tech patent applications in Europe grew at an annual average growth rate of 22.0 %, compared to 10.9 % of patent applications overall — Table 3.3.

In 2000, 18.2 % of the patent applications to the EPO from the EU were made for high tech fields. This rate was below that of the USA and Japan, whose high tech patent applications amounted to 31.3 % and 24.6 % of their total applications respectively. In any case, the proportion of high tech patent applications from the EU has been on an upward trend since 1990 and almost doubled since then — Figure 3.4.

([4]) See the 2000 report at:
http://www.european-patent-office.org/tws/tsr_2000/index.html.

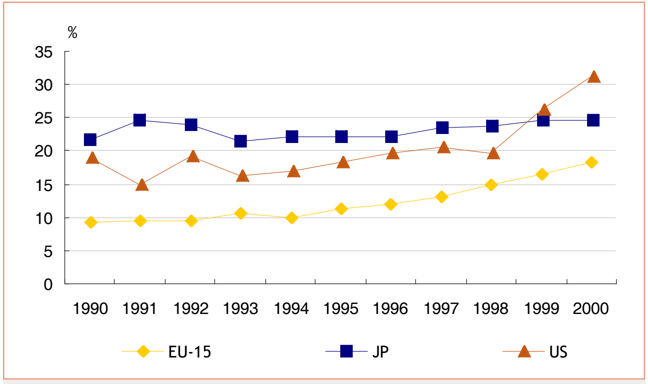
Table 3.3. **Annual average growth rates of high tech patent applications compared to the growth of patents overall ([1])**

	Annual average growth rates of high tech patents 1990-95	1995-2000	of total patents 1990-95	1995-2000
EU-15	**5.3**	**22.0**	**1.1**	**10.9**
B	19.8	15.3	6.4	10.2
DK	9.1	19.1	8.1	7.6
D	0.7	26.5	0.2	12.0
EL	-	5.9	8.1	5.1
E	29.3	23.9	11.1	12.9
F	3.8	17.4	0.3	8.2
IRL	15.4	31.4	11.2	20.1
I	7.0	9.1	0.9	9.6
L	-	45.1	-2.2	20.4
NL	4.1	23.8	-0.3	13.8
A	16.7	16.6	2.1	9.1
P	-17.7	120.2	24.4	19.6
FIN	39.4	25.8	12.2	13.2
S	18.4	29.3	7.4	11.8
UK	3.2	18.2	-0.5	9.9
EEA	**5.2**	**22.0**	**1.1**	**11.0**
IS	22.5	26.6	11.2	28.1
NO	-2.9	31.6	2.0	14.0
JP	-3.3	13.4	-3.8	11.1
US	2.6	27.2	3.3	14.3

([1]) 2000 provisional data.

Source: Eurostat, data — EPO.

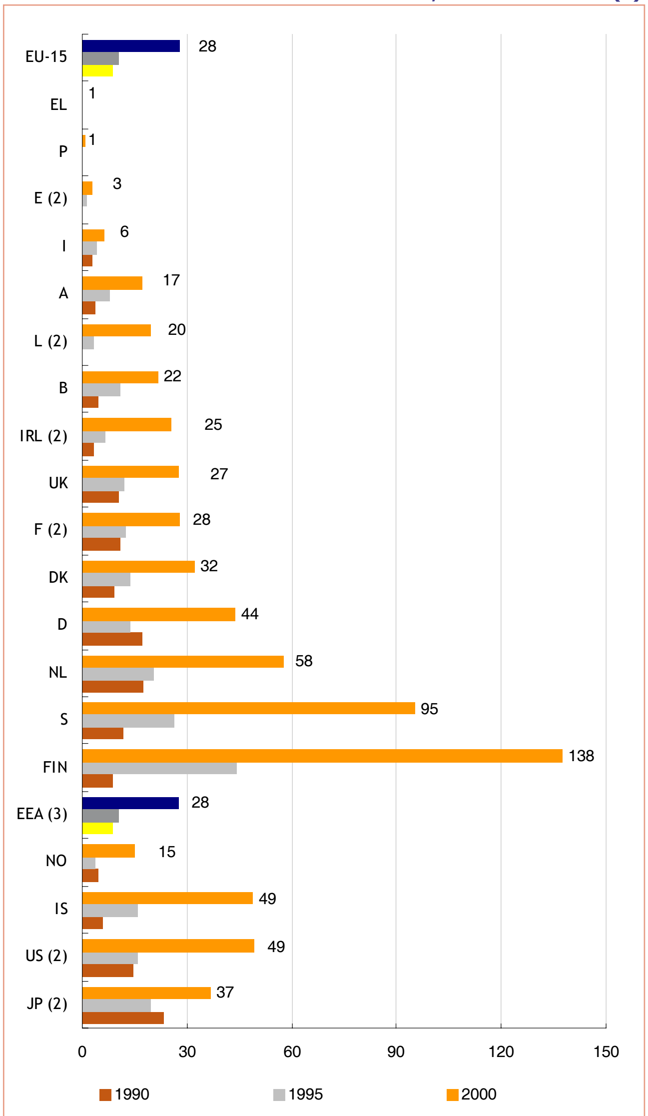
Figure 3.4. **Evolution of the % of high tech patent applications to the EPO from EU-15, Japan and the USA 1990-2000 ([1])**



([1]) 2000 provisional data.

Source: Eurostat, data — EPO.

Figure 3.5. **Evolution of high tech patent applications to the EPO per million inhabitants from EEA, Japan and the USA 1990, 1995 and 2000 ([1])**



([1]) 2000 provisional data.
([2]) 2000 population data for E, F, IRL and L have been estimated by Eurostat.
2000 population data for JP and US: Source UN.
([3]) In 2000, EEA excludes LI.

Source: Eurostat, data — EPO.

In absolute terms, high tech patent applications to the EPO from EU Member States amounted to 10 488 in 2000. This was ahead of Japan (4 629) but behind the USA (13 683). During the 1995-2000 period, high tech patent applications to the EPO from the USA grew the fastest (27.2 % per annum), followed by the EU (22.0 %) and Japan (13.4 %).

Figure 3.5. shows that, in relative terms, the EU recorded 27.8 high tech patent applications per million inhabitants in 2000, being outperformed by both the USA (49.5) and Japan (36.6).

Within the EU and in absolute terms, Germany (34.3 %), France (15.7 %) and the UK (15.6 %) accounted for a large amount of the total; however, the concentration of patenting in Germany seems to be less striking in high tech patenting than in patents overall.

As for total patenting, the dominance of the northern countries in Europe is confirmed when data are observed as a proportion of the population. In 2000, Finland was the country that retained the highest ratio (137.6 high tech patent applications per million inhabitants), followed by Sweden (95.1) and the Netherlands (57.9).

In any case, high tech patent applications have been growing at a faster rate than total patent applications in all the European Member States with the exception of Italy, suggesting an increasing importance of high tech industries in Europe.

Concerning the composition of high tech patent applications, Table 3.4. shows that on average, the European Union and Japan applied for most high tech patents in the communication technology field. Micro-organism and genetic engineering was the largest high tech group for some countries like Denmark, Greece and Portugal, whereas computer and automated business equipment was the largest for Luxembourg, as it was for the USA.

A high level of specialisation may be observed in the high tech patenting top European countries, Finland and Sweden, where patent applications in the field of communication technology accounted for 80.2 % and 70.0 % of total high tech patent applications respectively. This may be explained by the strong presence of the mobile phone industry in these countries.

Table 3.4.

Distribution of high tech patent applications to the EPO by high tech group EEA, Japan and the USA in 2000 (1)

	High tech group in % (2)						
	AVI	CAB	CTE	LSR	MGE	SMC	Absolute total number
EU-15	**1.4**	**25.5**	**48.1**	**1.4**	**13.6**	**10.0**	**10 480**
B	0.7	19.9	35.6	0.7	34.5	8.6	224
DK	0.2	22.5	33.3	1.2	39.4	3.4	172
D	1.5	23.3	45.4	1.3	13.1	15.4	3 593
EL	0.0	33.6	19.4	0.0	39.2	7.8	6
E	5.6	28.6	35.2	0.0	24.7	6.0	121
F	1.8	29.9	42.6	2.4	13.6	9.7	1 647
IRL	0.0	40.9	46.6	2.8	6.7	3.0	96
I	2.0	33.6	34.4	4.1	10.3	15.7	356
L	0.0	46.3	46.2	0.0	7.4	0.0	9
NL	0.1	28.0	49.5	0.1	10.0	12.3	918
A	1.6	24.6	44.8	3.4	17.1	8.6	138
P	0.0	0.0	5.7	3.0	54.1	37.2	9
FIN	0.4	14.6	80.2	0.0	3.8	1.1	711
S	0.5	17.1	70.0	1.2	5.2	6.1	843
UK	2.3	31.8	41.2	1.2	19.8	3.7	1 638
EEA	**1.4**	**25.5**	**48.1**	**1.4**	**13.7**	**10.0**	**10 562**
IS	0.0	36.5	31.5	0.0	31.9	0.0	14
NO	3.3	25.2	51.0	0.0	20.5	0.0	68
JP	0.2	31.5	38.4	2.5	8.9	18.5	4 629
US	0.7	40.1	33.5	1.6	15.7	8.4	13 683

(1) 2000 provisional data.
(2) Technical fields defined as high technology:
- Aviation — AVI;
- Computer and automated business equipment — CAB;
- Communication technology — CTE;
- Lasers — LSR;
- Micro-organism and genetic engineering — MGE;
- Semi-conductors — SMC.

Source: Eurostat, data — EPO.

High tech patent applications to the EPO at the regional level

In 2000, the European regions with the highest number of patent applications in the high tech fields were the southern German region of Oberbayern (1 132), the French capital region of Île de France (854) and the Dutch region of Noord-Brabant (633).

As a proportion of each region's population, the Finnish region of Uusimaa, where Helsinki is located, was leading with 301.2 high tech patent applications per million inhabitants. Following Uusimaa were Stockholm (230.7) in Sweden and Noord-Brabant (268.6) in the Netherlands.

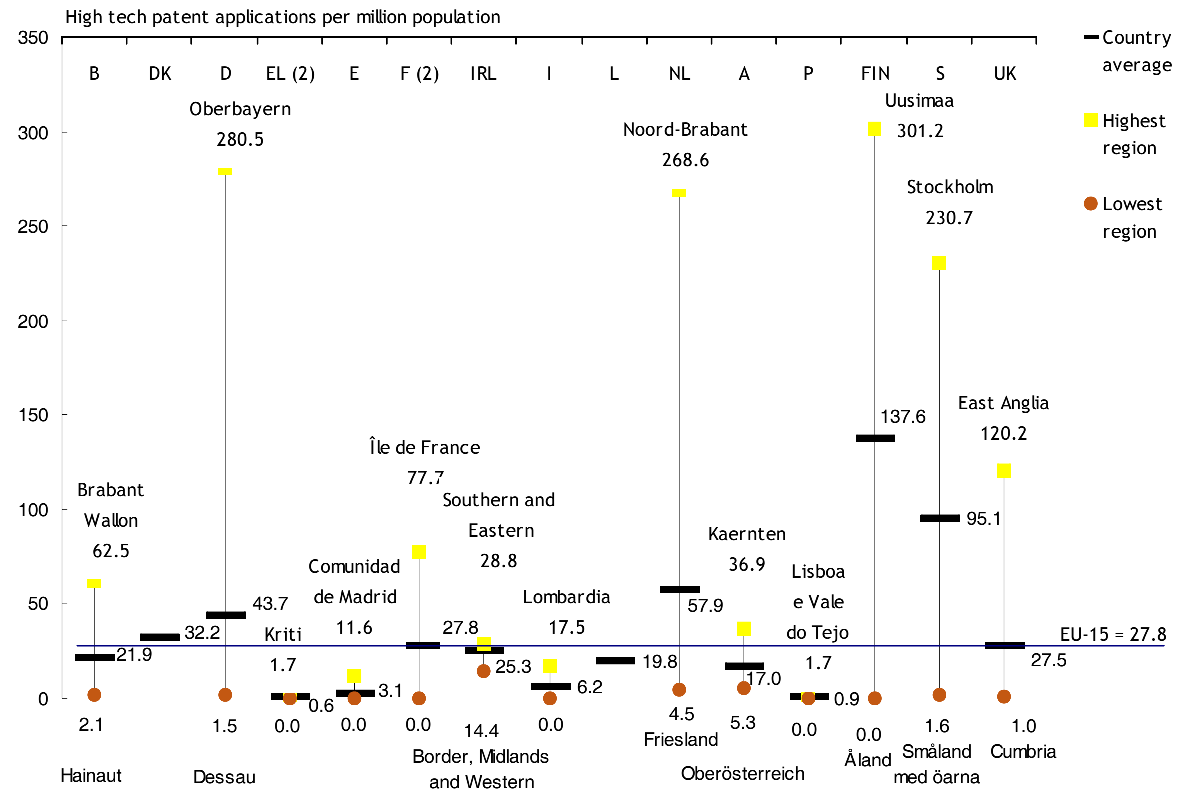
Figure 3.6. shows the national averages and regional extremes of high tech patent applications as a proportion of the population for each EU Member State. It can be seen that large disparities exist in Europe in terms of high tech patenting, not only at the Member State level, but also within regions of the same country.

As shown in Figure 3.6., in 2000, ten EU countries had at least one region above the EU average: Brabant Wallon (B), Denmark, Oberbayern (D), Île de France (F), Southern and Eastern (IRL), Noord-Brabant (NL), Kaernten (A), Uusimaa (FIN), Stockholm (S) and East Anglia (UK).

Regional disparities are more noticeable in the leading European countries. This is the case of Finland, where the highest region registered 301.2 high tech patent applications per million inhabitants (Uusimaa) and the lowest region applied for none (Åland). Similar disparities can also be seen in Germany, the Netherlands and Sweden.

Greek, Spanish, Italian and Portuguese regions seem to be still lagging with respect to the rest of Europe, as their region with highest high tech patenting intensity in 2000 was still below the EU average. The lowest region for each of these countries did not apply for any high tech patents that year.

Figure 3.6. **High tech patent applications to the EPO per million inhabitants in the EU National averages and regional extremes at NUTS 2 level — 2000 (1)**



(1) 2000 provisional data.
(2) 2000 regional population data for EL and F have been estimated by Eurostat.
NB: For EL, E, F, I and P, the regions with lowest value are various.
For all of them the number of high tech patent applications per million population in 2000 was equal to zero.
These regions were:
- **EL**: Kentriki Makedonia, Dytiki Makedonia, Dytiki Ellada, Peloponnisos, Anatoliki Makedonia-Thraki, Thessalia, Ionia Nisia, Sterea Ellada, Voreio Aigaio, Notio Aigaio;
- **E**: Cantabria, La Rioja, Baleares, Murcia, Canarias, Extremadura, Ceuta y Melilla;
- **F**: Guyane, Corse, Martinique;
- **I**: Umbria, Molise;
- **P**: Alentejo, Açores, Madeira.

Source: **Eurostat, data — EPO.**

Table 3.5. shows the situation and composition of high tech patenting in the top three regions of each country, ranked according to their patenting activities in absolute terms.

It can be seen that the first region of most countries is quite ahead of the second one. See for example the great differences between the first and the second region in Germany, France or the Netherlands. Differences also remain in relative terms, although for many countries the gap is smaller.

Concerning the composition of high tech patent applications to the EPO from the top three regions of each country, there are five countries whose top three regions are most specialised in the communication technology field: Germany, Austria, Finland, Sweden and the UK. The level of specialisation is particularly high in the top regions of Finland and Sweden.

The technical fields of aviation and lasers seem to be the smallest for all the top European regions in high tech patenting.

Table 3.5. **Top regions in high tech patenting in absolute terms by Member State — 2000 (1)**

Country	Ranking in EU-15	Region	High tech patent applications to the EPO: Absolute number	Per million inhabitants	% of total applications	Distribution by high tech group in % (2): AVI	CAB	CTE	LSR	MGE	SMC
B	41	Antwerpen	56	34	21.1	0.0	22.6	58.2	0.0	15.0	4.1
	29	Vlaams Brabant	44	43	15.9	0.0	19.1	25.6	0.0	32.0	23.3
	45	Oost-Vlaanderen	43	32	21.6	0.0	12.4	29.7	0.8	52.2	4.9
DK	44	Denmark	172	32	19.0	0.2	22.5	33.3	1.2	39.4	3.4
D	2	Oberbayern	1 132	281	36.6	0.6	26.4	48.7	0.6	6.8	16.9
	12	Stuttgart	315	80	12.4	1.0	23.4	52.2	2.2	4.5	16.6
	20	Köln	224	52	14.5	0.0	23.1	46.5	2.0	17.7	10.7
EL	166	Attiki	5	2	14.6	0.0	41.3	23.8	0.0	25.3	9.5
	160	Kriti	1	2	50.0	0.0	0.0	0.0	0.0	100.0	0.0
	178	Ipeiros	0	1	100.0	0.0	0.0	0.0	0.0	100.0	0.0
E	89	Comunidad de Madrid	59	12	29.4	10.5	9.4	51.7	0.0	17.8	10.6
	128	Cataluna	37	6	12.0	0.0	66.6	15.1	0.0	18.4	0.0
	159	Comunidad Valenciana	7	2	6.2	0.0	27.2	40.9	0.0	28.5	3.4
F	14	Ile de France	854	78	24.9	0.7	27.5	51.3	3.5	12.8	4.2
	28	Rhône-Alpes	246	43	18.6	0.0	30.0	22.1	1.9	16.2	29.8
	32	Provence-Alpes-Côte d'Azur	182	40	37.6	3.2	54.3	25.9	0.3	4.1	12.2
IRL	48	Southern and Eastern	80	29	27.8	0.0	48.8	37.7	3.4	6.5	3.6
	75	Border, Midlands and Western	14	14	35.4	0.0	0.0	100.0	0.0	0.0	0.0
I	72	Lombardia	159	17	11.6	2.4	31.4	35.2	4.7	7.0	19.3
	110	Piemonte	33	8	6.8	1.2	42.5	39.5	6.4	2.8	7.5
	125	Sicilia	32	6	45.6	0.0	46.2	10.6	3.2	3.1	36.9
L	66	Luxembourg	9	20	11.6	0.0	46.3	46.2	0.0	7.4	0.0
NL	3	Noord-Brabant	633	269	39.9	0.0	29.9	54.1	0.2	0.8	15.1
	63	Zuid-Holland	70	21	14.3	0.8	16.3	39.6	0.0	40.0	3.3
	60	Noord-Holland	53	21	16.6	0.6	33.6	35.4	0.0	19.8	10.6
A	39	Wien	57	35	23.8	1.8	18.6	52.9	1.8	23.9	1.2
	74	Niederösterreich	24	15	11.8	0.0	27.4	40.4	7.0	23.0	2.1
	36	Kaernten	21	37	24.9	0.0	8.8	60.5	0.0	0.0	30.7
P	162	Lisboa e Vale do Tejo	6	2	30.7	0.0	0.0	0.0	0.0	64.7	35.3
	174	Norte	3	1	23.7	0.0	0.0	17.7	9.2	35.1	37.9
	176	Algarve	0	1	66.7	0.0	0.0	0.0	0.0	0.0	100.0
FIN	1	Uusimaa (Suuralue)	416	301	51.6	0.0	14.1	80.9	0.0	3.8	1.2
	8	Etelä-Suomi	188	103	37.3	1.1	14.9	80.4	0.0	3.5	0.1
	6	Pohjois-Suomi	86	154	54.4	0.0	13.6	81.7	0.0	3.2	1.5
S	4	Stockholm	416	231	40.1	0.2	11.2	76.2	1.9	4.9	5.5
	5	Sydsverige	199	157	34.9	0.5	23.3	71.3	0.0	3.6	1.2
	19	Östra Mellansverige	88	59	20.4	2.2	23.5	45.2	0.0	11.9	17.2
UK	7	East Anglia	265	120	38.8	0.1	24.9	48.0	0.9	18.0	8.1
	10	Gloucestershire, Wiltshire and North Somerset	197	90	39.1	5.1	35.8	48.9	0.4	7.7	2.0
	11	Hampshire and Isle of Wight	156	88	43.3	0.0	42.7	52.5	0.6	3.4	0.8
EU-15			**10 480**	**28**	**18.2**	**1.4**	**25.5**	**48.1**	**1.4**	**13.6**	**10.0**

(1) 2000 provisional data.
The top three regions of each country refer to the leading regions in absolute terms;
the column ranking in EU-15 gives the position of that particular region in the EU in relative terms — as a proportion of population — in a total of 198 regions.

(2) Technical fields defined as high technology:

- Aviation — AVI;
- Computer and automated business equipment — CAB;
- Communication technology — CTE;
- Lasers — LSR;
- Micro-organism and genetic engineering — MGE;
- Semi-conductors — SMC.

Source: Eurostat, data — EPO.

3.3. Patents granted by the USPTO by year of publication

Figure 3.7. shows the evolution of patents granted by the USPTO to the EU, Japan and the USA. In 2000, the USPTO published 86 563 patents granted to US inventors, 31 643 patents granted to Japanese inventors and 27 783 patents granted to inventors resident in the EU.

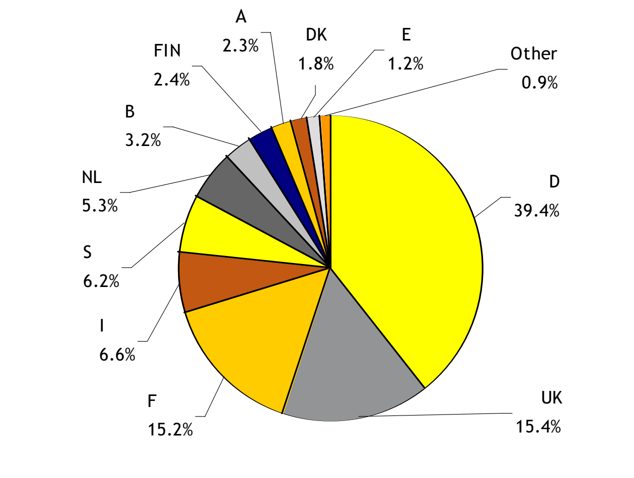
The United States dominance at home prevails even when population is taken into account, as in 2000 it retained the highest ratio (313.0 patents granted per million inhabitants). Japan registered a ratio of 250.1 patents granted per million inhabitants, whereas that of the EU equalled 73.8 — Figure 3.8.

Although the EU is lagging with respect to its competitors, patents granted by the USPTO to the EU have been growing increasingly since 1995. In fact, during the 1995 period, patents granted by the USPTO to EU inventors grew at an annual average growth rate of 9.9 %, whereas those of Japanese and US inventors grew at 7.6 and 9.0 % respectively.

Within the EU, Germany accounted for 39.4 % of the total patents granted, the UK for 15.4 % and France for 15.2 % — Figure 3.9. As was the case at the EPO, patenting in the USPTO is also largely skewed towards the large European Economies.

The number of patents granted by the USPTO to EU inventors has been growing in all Member States, especially during the second part of the nineties. When taking population into consideration, as shown in Figure 3.8., in 2000, Sweden was leading — 195.6 patents granted per million inhabitants, followed by Germany (133.4) and Luxembourg (133.1).

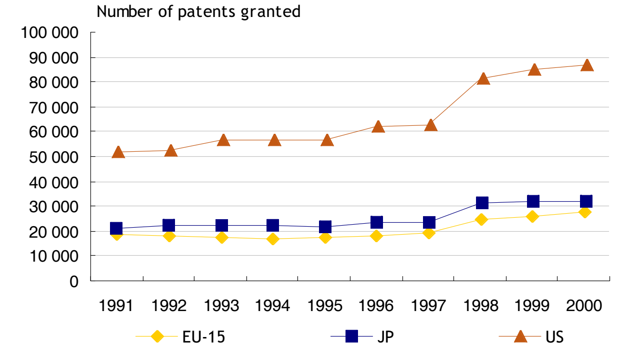
Figure 3.9. **Distribution of patents granted by the USPTO to EU-15 by Member State in 2000 (1)**



(1) 2000 provisional data.

Source: Eurostat, data — USPTO.

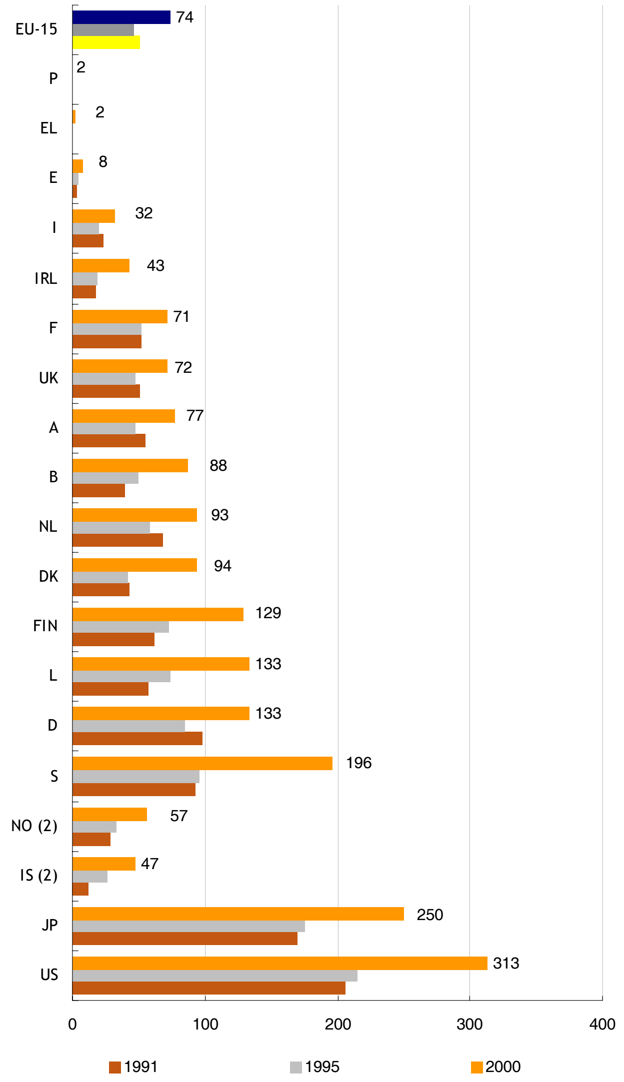
Figure 3.7. **Evolution of patents granted by the USPTO to EU-15, JP and the USA 1991-2000 (1)**



(1) 2000 provisional data.

Source: Eurostat, data — USPTO.

Figure 3.8. **Evolution of patents granted by the USPTO per million inhabitants to EEA countries, Japan and the USA 1990, 1995 and 2000 (1)**



(1) 2000 provisional data.
(2) Exceptions to the reference year 2000
IS and NO: 1999.

Source: Eurostat, data — USPTO.

PART 2

DEFINITIONS AND METHODOLOGICAL NOTES

Part 2 — Chapter 1
Government budget appropriations or outlays on Research and Development — GBAORD

Government budget appropriations or outlays for R&D are all appropriations allocated to R&D in central government or federal budgets and therefore refer to budget provisions, not to actual expenditure. Provincial or state government should be included where the contribution is significant. Unless otherwise stated, data include both current and capital expenditure and cover not only government-financed R&D performed in government establishments, but also government-financed R&D in the business enterprise, private non-profit and higher education sectors, as well as abroad (i.e. in international organisations). Data on actual R&D expenditure, which are not available in their final form until some time after the end of the budget year concerned, may well differ from the original budget provisions. This and further methodological information can be found in the *Frascati Manual*, OECD, 2002.

1.1. General methodology

1.1.1. Sources

GBAORD data are provided to Eurostat in national currency directly by the Member States of the European Union and the countries of the European Economic Area. Data for Japan and the United States are sent to Eurostat by the OECD.

The **exchange rates** applied to convert national currencies into current EUR are obtained from Eurostat's reference database *NewCronos*:

- Theme 2_Economy and Finance,
- Domain Exchange rates and interest rates,
- Collection Exchange rates,
- Group Euro/ECU exchange rates,
- Table Euro/ECU exchange rates – Annual data,
- Observation type Average type.

Where **lacking**, data were **completed** using *NewCronos*:

- Theme 2_Economy and Finance,
- Domain Auxiliary indicators (Population, employment and exchange rates),
- Table Auxiliary indicators (Euro exchange rates, PPP),
- Observation type eur_nac EUR.

The data used for the conversion into **current PPS** are obtained from the following *NewCronos* sources:

- Theme 2_Economy and Finance,
- Domain Auxiliary indicators (Population, employment and exchange rates),
- Table Auxiliary indicators (Euro exchange rates, PPP),
- Observation type pps_nac PPS.

GDP data are obtained from the following *NewCronos* sources:

- Theme 2_Economy and Finance,
- Domain National accounts – Aggregates Annual data,
- Collection GDP and main aggregates,
- Table GDP and main components – Current prices.

Where **lacking**, data were **completed** using *NewCronos*:

- Theme 2_Economy and Finance,
- Domain National accounts historical data (ESA 79),
- Collection National accounts – Aggregates Annual data (ESA 79),
- Group ESA aggregates at current prices,
- Table ESA aggregates at current prices – in ECU,
- Indicator Gross domestic product at market prices (GDPmp) (N1).

Data for the **GDP deflator** are obtained from *NewCronos*:

- Theme 2_Economy and Finance,
- Domain National accounts – Aggregates Annual data,
- Collection GDP and main aggregates,
- Table GDP and main components – Price indices,
- Indicator Gross domestic product at market prices (GDPmp) (N1).

Where **lacking**, data were **completed** using *NewCronos*:

- Theme 2_Economy and Finance,
- Domain National accounts historical data (ESA 79),
- Collection National accounts – Aggregates Annual data (ESA 79),
- Group ESA aggregates at current prices,
- Table ESA aggregates – value indices.

Population data are obtained from *NewCronos*:

- Theme 3_Population and Social Conditions,
- Domain Labour force survey,
- Collection Population and households,
- Table Population by sex, age groups and marital status (unit thousand persons).

Data on **total general government expenditure** are obtained from *NewCronos*:

- Theme 2_Economy and Finance,
- Domain Government sector,
- Collection Main aggregates of general government, including total revenue and expenditure,
- Table Full table (t+8).

1.1.2. Reference Unit

The reference unit for the GBAORD database is the national currency – including 'EUR fixed' series for Eurozone countries.

1.1.3. Indicators

Current EUR values are obtained for the Eurozone by recalculating former national currency values on the basis of the fixed exchange rate and then applying the average exchange rate for the year in question. Current EUR values for non-Eurozone countries are obtained by directly applying the average exchange rate for the year in question.

Data quoted in current PPS are obtained by applying the average exchange rate of the year in question to the national currency value.

Data measured in constant 1995 PPS are corrected for inflation using the GDP deflator — a Paasche index with 1995 = 100 as a base — of the country in question. The GDP deflator in general conforms to the 1995 European System of Accounts — ESA 95, available on *NewCronos*, Theme 2. The adjusted GDP deflator provided following ESA 79 was used in the case of incomplete series. Appropriate caution should be exercised when interpreting the results in such cases.

As with the GDP deflator, time series on GDP are built up using the two systems of European accounts. Where GDP data using ESA 95 were missing, the year on year growth rates of GDP in the ESA 79 system were applied retrospectively to the years for which data were missing in the ESA 95 national accounts database.

Data measured in per capita EUR and in per capita constant 1995 PPS are obtained by dividing the respective data measured in current EUR and in constant 1995 PPS by the population of the country in question for the year in question.

Data on total general government expenditure include all the aggregations listed in the following table.

Code in NewCronos	Section
p2	Intermediate consumption,
d1pay	Compensation of employees, payable,
d29pay	Other taxes on production, payable,
d3pay	Subsidies, payable,
d4pay	Property income, payable,
d5pay	Current taxes on income, wealth, etc., payable,
d62pay	Social benefits other than social transfers in kind, payable,
d6311_d63121_d63131pay	Social transfers in kind = expenditure on products supplied to households via market producers,
d7pay	Other current transfers, payable,
d8	Adjustment for the change in net equity of households in pension funds reserves,
d9pay	Capital transfers, payable,
p5	Gross capital formation,
k2	Acquisitions less disposals of non-financial non-produced assets.

1.1.4. Classifications

GBAORD data are built up using the guidelines laid out in the *Proposed standard practice for surveys of research and experimental development — Frascati Manual*, OECD, 2002.

The main classification used in the GBAORD database is the NABS — *Nomenclature for the analysis and comparison of scientific programmes and budgets*, Eurostat, 1994.

The 1983 version of NABS applies to all the figures up until the 1992 final budgets and the 1993 provisional budgets. The 1993 version applies from the 1993 final and the 1994 provisional budgets onwards.

As a result of the revision of NABS, exact comparability between certain 1- and 2-digit NABS headings cannot be achieved. The greatest differences are to be found in chapters 1, 3, 5, 7, 10 and 11 of NABS.

These NABS chapters cover the following fields:

- Chapter 1: Exploration and exploitation of the Earth,
- Chapter 3: Control and care of the environment,
- Chapter 5: Production, distribution and rational utilisation of energy,
- Chapter 7: Industrial production and technology,
- Chapter 10: Research financed from General University Funds (GUF),
- Chapter 11: Non-oriented research.

Not all countries collect the data directly by NABS: some follow other compatible classifications — OECD, Nordforsk, which are then converted to the NABS classification — see Table 8.2., p. 115 of the *Frascati Manual*, 2002.

1.1.5. Time series

Eurostat's GBAORD database contains data from 1980 onwards, though availability differs according to country.

For the following countries, data for 2001 are provisional: Austria, Belgium, Finland, France, Germany, Greece, Iceland, Italy, the Netherlands, Norway, Portugal and the United Kingdom.

1.1.6. Geographical coverage

Data on GBAORD are available for Austria, Belgium, Denmark, France, Finland, Germany, Greece, Iceland, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, the UK and the US. Data are also available for European Commission budgets, Commission of the European Communities.

No GBAORD data exist for Luxembourg and therefore EU-15 totals exclude Luxembourg.

No GBAORD data exist for Liechtenstein and therefore EEA totals exclude Liechtenstein and Luxembourg.

1.1.7. Reliability of the data

Because of national revisions, some of the data shown for government R&D appropriations deviate from the figures in previous issues of this publication. Even in the case of derived indicators there are differences compared with previous issues, since the values of the reference parameters, such as the GDP deflator, have been revised.

1.1.8. Comparability of the data

Despite all efforts, the concepts and methods used by the individual Member States of the EU, the United States and Japan for collecting data on government R&D appropriations are not completely harmonised.

In interpreting the tables, some (national) peculiarities still have to be borne in mind, and the most important of these are indicated in the section 'Country specific notes'.

1.2. Country specific notes

1.2.1. Belgium

Belgium's federal structures — which arose from the reforms of 1980, 1988, and 1993 — give primary responsibility for basic and university research to the Communities, while the Regions are primarily responsible for supporting industrial and technological research. The Federal Government has particular responsibility for the federal scientific and cultural establishments, for space research, nuclear research, a broad area of agricultural research and Belgian participation in the activities of international research bodies.

The share of Research in the universities' total operating budgets was set at 43 % of total GBAORD between 1989 and 1992. This percentage had been applied to the Belgium system using the results of a Dutch study dating from the beginning of the 1980s. However, this approach did not take into account the peculiarities of both financing and the organisation of research in Belgium. Research has since been undertaken in order to determine a proportion which is closer to the reality of the Belgian system. The conclusion was that a rate of 25 % should be applied instead of 43 %. As a result, all the GBAORD data from 1989 onwards have been revised.

There were only minor variations by NABS objective or group between 1996 and 2000.

No data are available for sub-chapters of NABS.

No data are available for the breakdowns on biotechnology, information technology and developing countries.

No data are available for the other multilateral actions or grants to enterprises.

1.2.2. Denmark

Up until 1992, GBAORD data contained some non-government resources, but not thereafter. The effects of this methodological change are not known, but comparison of the data for the period before 1992 with the data from 1993 should be made with caution.

The way of funding PhDs was changed from 1993 to 1994, which makes it more difficult to compare objective 10 — Research financed from GUF — for 1993 and 1994.

The Ministry of Education has changed the way it estimates capital investment related to R&D for 1994 and the following years.

Some differences arise in the calculation of GBAORD by groups of objectives in both 1995 and 1996 compared to previous years.

In calculating the total for GBAORD, all external funds (non-general funds) at the level of institutions have been excluded. This is done to avoid double counting of funds originating from other sources within central government. As it is not possible in all cases to distinguish between external funds from private and public sources, the exclusion of external funds also means that all funds from private sources are in effect excluded.

GBAORD on biotechnology, information technology, and on developing countries are underestimated as it is not always possible to separate all funds — often part of larger programmes — devoted to these objectives.

Data are collected according to the Nordforsk chapters — Nordic Industrial Fund — and converted to NABS chapters. Therefore, the data cannot be classified according to the NABS sub-chapters.

1.2.3. Germany

As a result of unification and the restructuring of the research landscape thereafter, there are breaks in the time series between 1990 and 1991 (final budgets) as well as between 1991 and 1992 (provisional budgets).

Another break in series occurs between 1995 and 1996 (final budgets) and 1996 and 1997 (provisional budgets). This relates mainly to methodological improvements in the allocation of funds to and within NABS Chapters 7, 10, and 12.

The negative value in NABS chapter 12 — Other civil research — in 1997 is explained by a technical budgetary adjustment.

1.2.4. Greece

With regard to the breakdown of appropriations for funding biotechnology and information technology, the absence of data for the '*Research financed from General University Funds — GUF*' objective — NABS 10 — is due to the special methodological aspects used in estimating the 'GUF'. This methodology results in an underestimation of their importance in total GBAORD.

1.2.5. Spain

Up until 1993, 'Research financed from general university funds' was estimated by applying a figure of 16 % of total university budgets. This factor has been adapted in several steps to bring it closer to reality: 20 % in 1994, 25 % in 1995.

For 1997, 'Production, distribution and rational utilisation of energy' includes the Spanish contributions to CERN.

The reductions in 'Non-oriented research' and 'Other civil research' between 1996 and 1997 are partly a result of improvements in the way the allocation of resources are recorded, with these two objectives previously tending to be a catch-all for R&D funding.

The 'Defence' figures for 1997 and 1998 are marked by the incorporation into the 'Defence' budget of large sums from the Ministry of Industry and Energy with a substantial industrial R&D content corresponding to the 'Promotion and Industrial Strategies for Defence' programmes, which accounts for the increase of almost 300 % in the 'Defence' budget over the three-year period.

1.2.6. France

There is a break in series between 1991 and 1992. The figures for the period up until 1991 are not fully comparable with those of the following years for two reasons: an improved methodology for compiling GBAORD data has been introduced and the legal status of the *France-Télécom* and *GIAT industries* has been changed.

1.2.7. Ireland

A new methodology was introduced in 1992, which results in only government funds being included in the analysis. Note that in Ireland the definition of government funds includes money received from the EU Community Support Framework in support of R&D activities. It is estimated that in 1997 one third of government funds for R&D come from the CSF, with Chapter 7 of the NABS — Industrial production and technology — significantly affected by the allocation of these funds.

1.2.8. Italy

The amount for 'Defence' is estimated for the 1998 final and 1999 provisional data.

In 2000, the figure for 'Research financed from general university funds' is the same as for 1999, due to an ongoing methodological review.

The National Statistical Institute — which conducts the R&D surveys of universities — has revised the data collection methodology for 1997, 1998 and 1999. These variations cause breaks in the historical series. For 2000 and 2001, the National Research Council's IRDS has estimated provisional data for the 'Research financed from General University Funds (GUF)' objective.

1.2.9. Netherlands

An effort has been made to harmonise the funding (GBAORD) and performance (Statistical Office) figures on university research. This results in higher figures for general university funds as part of GBAORD from 1996 (final budget) and 1997 (provisional budget) onwards.

1.2.10. Austria

No methodological changes were made over the period 1998-2002, thus ensuring that the data are comparable.

The classification of data by NABS Chapter is the result of converting data broken down using a national system to the OECD breakdown of data by socio-economic objective — Thanks to the use of appropriate tables of correspondence — the latter being equivalent to the NABS breakdown.

1.2.11. Finland

As a result of changes in methodology, there are breaks in the time series for Finland between 1990 and 1991 — due to the inclusion of pension contributions in the labour costs, and between 1994 and 1995: since 1995, universities and research organisations have to pay a rent for government buildings which was not the case before.

As data on R&D appropriations are collected according to the OECD classification and converted to NABS, the data cannot be divided into NABS sub-chapters.

1.2.12. Sweden

The methodology for measuring government R&D appropriations in Sweden has been subject to numerous changes in the '90s — in 1991, 1992, 1993 and 1995.

Up until 1994, the Swedish budgetary year ran from July to June. In 1995/96, the budgetary year was changed to the calendar year (January — December). Due to this change, the budgets for 1995 and 1996 are estimates based on the budget for the period July 1995 until December 1996.

No data are available for 1997.

As data on R&D appropriations are collected according to the NORDFORSK — Nordic Industrial Fund — classification and converted to NABS, the data cannot be divided into NABS sub-chapters.

1.2.13. United Kingdom

In 1995/96, a new methodology was used to calculate GUF figures, in respect of the Higher Education Funding Councils. Values have been revised for one year only (1993-94).

From 1995-96, the increase in 'human and social objectives' is due in part to the fact that UK National Health Service figures have been obtained from the Department of Health and the Scottish Office on the basis of the Culyer directive, which for the first time confirmed the extent of R&D spending in the NHS.

The budgetary year for central government differs from the calendar year.

1.2.14. Iceland

The data collection methodology has remained virtually unchanged since 1995. No data are available for sub-chapters of NABS. Further data on R&D in Iceland are accessible on the Icelandic Research Council web-site.

1.2.15. Norway

Data on R&D appropriations are collected according to the Nordforsk — Nordic Industrial Fund — classification and converted to NABS. The GBAORD analysis is not performed at a sufficient level of detail to allow information on the NABS sub-chapters.

The increase in technological objectives is largely due to the introduction of a new instrument for financing industrial R&D and innovation (FUNN).

1.2.16. United States

US data exclude the socio-economic objectives 'research financed from general university funds' and 'other civil research' and are therefore systematically underestimated. Comparisons with other countries should be made with caution.

US data concern federal or central government budgets only and exclude most or all capital expenditure. Data for total GBAORD are only available for 1999 and 2000. These data are provisional.

1.2.17. Japan

The figures for Japan are estimates made by the OECD Secretariat and recognised as official data by the Japanese Government. They include R&D in the social sciences and humanities and are thus only to some extent comparable with the data for other countries.

The R&D portion of military contracts is excluded.

1.2.18. Commission of the European Communities

The European Commission's budgets for R&D do not include the European Development Fund's resources for technological research. These funds are shown in the national budgets of the Member States of the EU.

There is a break between 1989 and 1990 in the time series for the final budgets of the European Commission, since from 1990 onwards the pro rata administrative costs are no longer included in the data.

An improved methodology has been adopted for the Fourth Framework Programme (1994-98) data which allows for the distribution by NABS sub-chapter of data previously included in Chapter 12 — 'Other civil research' — and the sub-chapters for 'General Research'.

Part 2 — Chapter 2
R&D expenditure and personnel

2.1. R&D expenditure and personnel as S&T indicators — General information

The basic methodological recommendations for R&D statistics are given in the *Proposed Standard Practice for Surveys of Research and Experimental Development — Frascati Manual*, OECD, 1994.

The regional aspects of R&D and innovation statistics are covered by *The Regional Dimension of R&D and Innovation Statistics — Regional Manual*, Eurostat, 1996.

The following definitions are mainly derived from these manuals. In principle, the R&D data in this publication are collected in line with these recommendations.

2.1.1. Research and experimental development — R&D

Research and experimental development — R&D — comprises 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 — *Frascati Manual*, § 57.

This term covers three activities: basic research, applied research, and experimental development.

2.1.2. Research and development input indicators

At the national level

Intramural expenditures

Intramural expenditures are all expenditures for R&D performed within a statistical unit or sector of the economy, whatever the source of funds. Expenditures made outside the statistical unit or sector but in support of intramural R&D (e.g. purchase of supplies for R&D) are included. Both current and capital expenditures are included.

R&D personnel

All persons employed directly on R&D should be counted, as well as those providing direct services such as R&D managers, administrators, and clerical staff.

For the purposes of regional statistics, these R&D definitions have been adapted to the region. See The *Regional Dimension of R&D and Innovation Statistics — Regional Manual*, Eurostat, 1996, Part C: First-Priority Indicators.

In accordance with international recommendations, figures for R&D personnel are indicated not only in full-time equivalent but also in head count.

R&D personnel by occupation

The standard international classification in this field is the *International Standard Classification of Occupation* — ISCO, 110, 1968, ILO, 1990.

- Researchers — RSE
  Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods, and systems, and in the management of the projects concerned.
- Technicians and equivalent staff
  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 performs the corresponding R&D tasks under the supervision of researchers in the social sciences and humanities.
- Other supporting staff
  Other supporting staff include skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects or directly associated with such projects.

At the regional level

Intramural expenditure on R&D at the regional level — Regional Manual, § 134

Regional intramural expenditures are all expenditures for R&D performed within a statistical unit or a sector in a region, whatever the source of funds

R&D personnel at the regional level — Regional Manual, § 151

All persons employed directly in R&D in a region should be counted, as well as those providing direct services such as R&D managers, administrators and clerical staff. Those providing an indirect service, such as canteen and security staff, should be excluded, even though their wages and salaries are included as an overhead cost in the measurement of R&D expenditure.

2.1.3. Regional classification

The economic territory of each Member State of the EU has been divided according to a five-level hierarchical classification (three regional levels and two local levels) named the *Nomenclature of Territorial Units for Statistics* — NUTS. NUTS serves as a reference for the collection, development and harmonisation of Community regional statistics, for the socio-economic analysis of the regions and for drawing up Community regional policies. The NUTS is the territorial classification for R&D and innovation statistics at the regional level.

In general, NUTS sub-divides each Member State into a number of NUTS 1 regions, which are in turn subdivided into a number of NUTS 2 regions, and so on.

- NUTS 1 is the first level of disaggregation and is of major importance in Germany, where it equates to the *Länder*, and to a lesser extent in the UK, where it is equivalent to standard English regions or the countries of Scotland, Wales and Northern Ireland.

- NUTS 2 is the secondary level, with 206 regions within Europe. Denmark, Ireland and Luxembourg are level 1 and level 2 regions at the same time. For some countries, this tier corresponds to an effective form of regional government.
- NUTS 3 is the smallest regional level for which R&D or patent data are available. There are over 1 000 regions, usually conforming to a genuine administrative unit.

It is important to note that several regions can be classified at different NUTS levels at the same time: 8 regions are classified at the NUTS levels 1, 2 and 3; 17 regions at both NUTS 1 and 2 levels and 22 regions at NUTS levels 2 and 3.

The data presented in this Chapter correspond to level 2 of the NUTS nomenclature. Aggregated data at a higher level (NUTS 1) supplied by the Member States are available in the *NewCronos* database, Theme 9.

2.2. R&D expenditure and personnel — Sources and methods

2.2.1. Sources

R&D basic data are provided to Eurostat directly by the Member States of the European Union and the countries of the European Economic Area: National Statistical Offices, Research Councils, and Ministries responsible for R&D. Data for Japan and the United States are supplied to Eurostat by the OECD. The data are then checked, transformed, and the derived indicators are calculated.

The **exchange rates** applied to convert national currencies into current EUR are obtained from Eurostat's *NewCronos* reference database:

- Theme: 2_Economy and Finance,
- Domain: Exchange rates and interest rates,
- Collection: Exchange rates,
- Group: ECU/Euro exchange rates,
- Table: ECU/Euro exchange rates — Annual data,
- Observation type: Average type.

Where **lacking**, data were **completed** using *NewCronos*:

- Theme: 2_Economy and Finance,
- Domain: Auxiliary indicators (Population, employment and exchange rates),
- Table: Auxiliary indicators (Euro exchange rates, PPP),
- Observation type: eur_nac EUR.

PPS data are taken from *NewCronos*:

- Theme: 2_Economy and Finance,
- Domain: Auxiliary indicators (Population, employment and exchange rates),
- Table: Auxiliary indicators (Euro exchange rates, PPP),
- Observation type: pps_nac PPS.

Where **lacking**, data were **completed** using *NewCronos*:

- Theme: 2_Economy and Finance,
- Domain: National accounts historical data (ESA79) Annual data,
- Collection: National accounts — Aggregates Annual data (ESA 79),
- Group: Economic and social indicators,
- Table: Economic and social indicators associated to ESA aggregates,
- Indicator: 1 PPS = ...national currencies.

GDP data are obtained from the following *NewCronos* sources:

- Theme: 2_Economy and Finance,
- Domain: National accounts — Aggregates Annual data,
- Collection: GDP and main aggregates,
- Table: GDP and main components — Current prices.

Where **lacking**, data were **completed** using *NewCronos*:

- Theme: 2_Economy and Finance,
- Domain: National accounts historical data (ESA79),
- Collection: National accounts — Aggregates Annual data (ESA 79),
- Group: ESA aggregates at current prices,
- Table: ESA aggregates at current prices — in ECU,
- Indicator: Gross domestic product at market prices (GDPmp) (N1).

For **GDP** at the regional level the source is:

- Theme: 1_General statistics,
- Domain: Regional statistics,
- Collection: Economic accounts,
- Group: Economic accounts — ESA95,
- Subject: Gross domestic product indicators — ESA95,
- Table: Gross domestic product (GDP) at NUTS level 2 — ESA95,
- Currency: Millions of EURO (from 1.1.1999)/ Millions of ECU (up to 31.12.1998).

Where **lacking**, data were **completed** using *NewCronos*:

- Theme: 1_General statistics,
- Domain: Regional statistics,
- Collection: Economic accounts,
- Group: Economic accounts — ESA79,
- Subject: Gross domestic product indicators — ESA79,
- Table: Gross domestic product (GDP) at NUTS level 2 — ESA79,
- Currency: Millions of EURO (from 1.1.1999)/ Millions of ECU (up to 31.12.1998).

Data for the **GDP deflator** are taken from *NewCronos*:

- Theme: 2_Economy and Finance,
- Domain: National accounts — Aggregates Annual data,
- Collection: GDP and main aggregates,
- Table: GDP and main components — Price indices,
- Indicator: Gross domestic product at market prices (GDPmp) (N1).

Where **lacking**, data were **completed** using *NewCronos*

- Theme 2_Economy and Finance,
- Domain National accounts historical data (ESA 79),
- Collection National accounts — Aggregates Annual data (ESA 79),
- Group ESA aggregates at current prices,
- Table ESA aggregates — value indices.

Labour force data have been taken from *NewCronos*:

- Theme 1_General Statistics,
- Domain Regional statistics,
- Collection Community labour force survey,
- Table Active population by age and sex.

2.2.2. Reference Unit

The reference unit for the R&D expenditure database is the national currency — NAC.

The reference units for the R&D personnel database are full-time equivalent (FTE) and head count (HC).

- **Full-time equivalent — FTE**
  Full-time equivalent corresponds to one year's work by one person. Thus, someone who normally devotes 40 % of his/her time to R&D and the rest to other activities (e.g. teaching, university administration or counselling) should be counted as only 0.4 FTE.

- **Personnel in head count — HC**
  Personnel in head count — HC: The number of individuals who are employed mainly or partly on R&D. For purposes of comparison between different regions and periods, this indicator is often used in conjunction with employment or population variables.

In this publication, HC data are used to calculate the more comparable derived indicator 'R&D personnel as a percentage of the labour force'.

2.2.3. Indicators

- **Current EUR**
  Current EUR values are obtained for the Eurozone by recalculating former national currency values on the basis of the fixed exchange rate and then applying the average exchange rate for the year in question. As a result, the values for Eurozone countries appearing in tables quoted in national currencies, where the respective fixed national exchange rates have been applied, differ from those quoted in current EUR for years before 1999, except in the case of Greece (2001).

  Current EUR values for non-Eurozone countries are obtained by directly applying the average exchange rate for the year in question.

- **Purchasing power standards — PPS**
  Purchasing power parities are based on comparisons of the prices of representative and comparable goods or services recorded in the national currency of the country in question on a specific date. As a result, monetary aggregates can be expressed in purchasing power standards — PPS — rather than EUR based on exchange rates. The figures published in this text are based on current purchasing power standards.

- **Current PPS**
  Data quoted in current PPS are obtained by applying the average exchange rate for the year in question to the national currency value.

- **Constant 1995 PPS**
  Data measured in constant 1995 PPS are first corrected for inflation using the GDP deflator — a Paasche index based on 1995 = 100 — of the country in question before applying the 1995 PPS exchange rate. The GDP deflator broadly correlates with the 1995 European System of Accounts (ESA 95) available on *NewCronos*, Theme 2. The adjusted GDP deflator provided for by ESA 79 was used in the case of incomplete series. In this case, it is important to take the normal precautions when interpreting the results.

- **GDP**
  As with the GDP deflator, time series on GDP are built up using the two systems of European accounts. Where GDP data using ESA 95 were missing, the year on year growth rates of GDP in the ESA 79 system were applied retrospectively to the years for which data were missing in the ESA 95 national accounts database.

  Two different sources are used: the GDP from Theme 2 — Economy and Finance — is used to calculate R&D intensity at national level whilst the GDP from Theme 1 — General Statistics — is used at regional level — please refer to the section on '*Sources*'.

- **R&D personnel as a percentage of the labour force**
  As recommended in Eurostat's *Regional Manual*, R&D personnel as a percentage of the labour force is calculated in head count. The labour force comprises all people aged 15 and over who are employed or unemployed but not inactive — inactive people are for example pupils, students, people in compulsory military service and retired people.

- **R&D intensity**
  R&D intensity is calculated by relating R&D expenditure in current EUR to GDP.

- **EU totals**
  EU totals are calculated as the sum of the country data by institutional sector for both R&D expenditure and personnel. If national data are missing, estimates are made for each country, year, institutional sector or R&D variable concerned.

  This method is not applied to calculating R&D personnel in head count (HC).

  At country level, estimates for the R&D personnel in full-time equivalent (FTE) serve as a basis for the HC calculation. For each country, institutional sector and year, an FTE/HC ratio is estimated on the basis of the personnel data available in both FTE and HC. This ratio is then applied to the FTE data, by country, sector and year, to calculate the missing HC data.

  At EU level, an FTE/HC ratio is calculated, by year and by sector, on the basis of an average of the ratios estimated at country level.

  The EEA aggregate does not include Liechtenstein.

2.2.4. Classifications

R&D data are built up using the guidelines laid out in the *Proposed standard practice for surveys of research and experimental development — Frascati Manual*, OECD, 1993, 2002.

Institutional classifications

Internal expenditure and R&D personnel are broken down by institutional sector, i.e. the sector in which the R&D is performed. There are four main sectors: business enterprise, government, higher education and private non-profit institutions.

The business enterprise sector — BES

With regard to R&D, the business enterprise sector includes — *Frascati Manual*, § 145:

- 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 — GOV

In the field of R&D, the government sector includes — *Frascati Manual*, § 168:

- 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 (NPIs) controlled and mainly financed by government.

The higher education sector — HES

This sector is composed of — *Frascati Manual*, § 190:

- 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 — PNP

The fields covered by this sector include — *Frascati Manual*, § 178:

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

With the exception of Portugal, the PNP sector accounts for less than 3 % of total R&D expenditure or personnel. For that reason, there are no tables compiled for the PNP. For some countries, the PNP is included in the GOV. This information can be found in the 'Country specific notes' section.

2.2.5. Time series

Eurostat's R&D database contains data from 1981 onwards, though availability differs according to country. Regional data start from 1985.

2.2.6. Geographical coverage

Data on R&D expenditure and R&D personnel are available for Austria, Belgium, Denmark, France, Finland, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden and the UK. For the USA, only data for researchers in FTE are available.

No R&D data exist for Liechtenstein and therefore EEA totals exclude Liechtenstein.

2.2.7. Reliability of the data

Because of national revisions, some of the data shown for intramural R&D expenditure deviate from the figures in previous issues of this publication. For R&D personnel, for instance, some figures which previously had to be estimated are now available from surveys, while for others it was possible to improve the estimation procedure (by using national conversion factors for the country in question). Even in the case of derived indicators, there are differences compared with previous issues where the values of reference parameters, such as the GDP deflator, have been revised.

2.2.8. Comparability of the data

Although the R&D expenditures and R&D personnel data are collected by surveys, which follow the guidelines and definitions outlined in the Frascati manual and the Regional Manual, the data are not completely comparable. Differences include interpretation of the definitions, different survey methodologies and peculiarities of national R&D systems.

R&D personnel problems occur mainly with calculations of full-time equivalent (FTE). In order to collect the FTE for certain employee groups such as R&D managers or graduate staff, the proportion of work undertaken on R&D has to be estimated for each individual, and the methods of estimation may differ from one country to another.

Particular attention should also be paid to the regional data. The collection of regional data is, in effect, faced with one major difficulty that could affect the comparability between regions and also give a distorted picture of regional R&D: measuring the R&D activity in the territorial unit where it is actually performed. This problem arises particularly in the business enterprise sector where, generally, the reporting unit is the legal entity. When R&D activity is not carried out at the territorial location of the reporting unit, the reporting unit might have problems in breaking down R&D expenditure and personnel over the different regions involved. According to the survey methods applied, the comparability of the data might be affected.

A second point concerns regional data and their comparability and relates to the availability of these data.

When presenting R&D activity at regional level, attention is mainly focused on the disparities between regions when it comes to R&D, and on regions, which are European research centres. Given that this type of analysis uses a classification by order of magnitude, it is important to remember that not all European regions are represented in all institutional sectors, nor for all the variables. The collection of regional data is in fact a difficult exercise that can put Member States under constraints that involve technical and political considerations as well as confidentiality. The classifications presented in *Part 1 — Analyses* should be read bearing this situation in mind.

Lastly, the reference indicator used to establish the ranking is the intensity of research (i.e. R&D expenditure in percentage of GDP) which has the advantage of taking into account the economic weight of each of the regions.

On a general level, some (national) peculiarities still have to be borne in mind when interpreting the tables, and the most important of these are indicated in the 'Country specific notes' section.

2.2.9. Availability of the data

The data used for the analyses of *R&D in Europe — Part 1* are those available in the third quarter of 2002. They may not correspond exactly with those in the tables in Part 3, or in Eurostat's *NewCronos* database, when these have been subsequently updated.

2.2.10. Country specific notes

For R&D expenditure

Belgium

The R&D expenditure of the *Centres Sectoriels de Recherche Collective*, a subsector of the business enterprise sector, could not be disaggregated at the regional level before 1994. It should also be noted that up until 1993, no figures were available for public undertakings in Belgium. However, from 1994 onwards, public enterprises are included in the BES.

Denmark

The delimitation of the government sector in Denmark does not agree entirely with the international methodological recommendations. Not all GOV data can be disaggregated to regions. Moreover, it should be noted that, in the BES, the figures for some regions of Denmark are combined with those of neighbouring regions for data protection reasons.

Germany

Because of German unification, there is a break in the time series between 1990 and 1991. In general, R&D expenditure is broken down in accordance with the location of employment of the R&D personnel. As an exception, the GOV data up until 1991 are broken down by the main location of the research institution. In 1992, a new survey framework, including additional survey units, was introduced in the GOV; therefore, there is another break in series between 1991 and 1992. The total of GOV expenditure includes R&D expenditure of German research institutions located abroad. From 1992 onwards, data for the PNP are included in the GOV. Not all data can be allocated to regions. Due to modifications to the survey method, there is a break in the HES series between 1994 and 1995.

Greece

An analysis of non-responses was introduced for the first time in 1999 in the business enterprise sector.

Spain

The survey unit in the business enterprise sector is the enterprise. If an enterprise has several establishments in at least two different regions, the intramural R&D expenditure of the enterprise is allocated to the regions concerned in accordance with the regional breakdown of the personnel. Only in 1986 was the R&D expenditure of enterprises allocated exclusively to the region in which the head office was situated. Part of the R&D expenditure in Spain cannot be disaggregated to the regional level. For the HES, from 1992 onwards the personnel costs of technicians and other staff are included, and the estimation procedure for other current and capital expenditure has been improved. Both these changes result in a break in the time series.

France

Due to the change of the legal status of *France Télécom* and *GIAT industries*, there is a break in the time series between 1991 and 1992, so that comparisons of the figures for the period before and after 1992 should be treated with caution. Not all of the intramural R&D expenditure — defence sector, some expenditure of the HES — can be disaggregated to the regional level.

Italy

There is a break in the time series for Italy between 1990 and 1991. Until 1990 the figures for BES and GOV represent the sum of intramural and extramural R&D expenditure, but from 1991 onwards only the intramural R&D expenditure. The pre-1991 data for Italy are thus only partly comparable with those of other countries. No data exist for the PNP sector in Italy.

Austria

Not all data can be disaggregated down to the regional level.

Portugal

The 1995 data have been revised. The revision of the data for 1995 is due to the fact that all the private non-profit institutes (PNP), which serve the BES have been reallocated to the BES. Data have thus been revised for the PNP and BES for R&D expenditure and R&D personnel.

Finland

Between 1990 and 1991, there is a break in the GOV and in the HES due to the inclusion of pension fees attached to salaries. PNP data are included in the GOV.

Sweden

The data of GOV and HES before 1997 refer to the fiscal year: July-June.

United Kingdom

Sufficiently reliable regional data can only be produced at the NUTS 1 level. The regional figures for the government sector are estimated on the basis of the data on R&D personnel in the individual regions. National Health Service R&D is included in GOV expenditure since 1995/96. In 1994, a new methodology was introduced in the BES to improve the collection of regional data; therefore, no direct comparisons can be made between data up to and including 1993 and from 1994 onwards. The new methods use grant income as a proxy for expenditure. The grants have been classified into three groups: 'research-oriented grants', 'teaching-oriented grants' and 'other grants'.

Iceland

The method of collecting data has been largely unchanged since 1995. Up until then, an exhaustive survey had been conducted on all institutional sectors. Since 1995, the methodology has changed for the BES sector, where the full census has been abandoned in favour of a sample survey of 1 000 enterprises chosen at random from a population of 4 to 5 thousand enterprises.

Norway

The regional breakdown is based on a national classification. PNP data is included in the GOV.

Japan

The data for Japan are taken from the OECD — *Main Science and Technology Indicators*.

United States

The data for the USA are taken from the OECD — *Main Science and Technology Indicators*. The intramural R&D expenditure is slightly underestimated in comparison to the corresponding figures for other countries as the US methodology is slightly different from the international recommendations. In the business enterprise sector, for instance, depreciation is shown instead of the gross capital expenditure.

For R&D personnel

Belgium

See comments for R&D expenditure.

Denmark

The delimitation of the government sector in Denmark does not correspond entirely with the international methodological recommendations. Some of the R&D personnel in the GOV cannot be allocated to the individual regions.

Germany

See comments for R&D expenditure.

Greece

Though there are no duplications in full-time equivalent, a small number exist in head count data since some non-permanent personnel may be occupied in more than one research institute.

Since 1999, there has been a breakdown by sex for R&D personnel in FTE and HC in the R&D survey.

France

The national and the regional data on R&D personnel refer to the personnel 'remunerated by' the institutional sector. The total for all regions for the GOV and the HES (and hence the total of all sectors) thus differs from the values normally indicated for France as a whole. These data also differ from those in OECD publications — such as *Main Science and Technology Indicators* — where the national totals are indicated as 'working in the institution' even if the personnel is remunerated by another body.

Nor is it possible to break down all personnel data by region, particularly in the defence sector and for some personnel in the HES.

Due to the change of the legal status of *France Télécom* and *GIAT industries*, there is a methodological break in the time series between 1991 and 1992, so that comparisons of the figures for the period before and after 1992 should be made with caution.

Ireland

No regional data are available for Ireland.

Austria

Before 1995, no regional labour force data are available. This means that no percentages of R&D personnel in the total labour force can be calculated.

Finland

There is a break in the series of the HES between 1990 and 1991 due to revised time budget coefficients. PNP data are included in the GOV.

Sweden

Before 1995, no regional labour force data are available. This means that no indicator of R&D personnel in the total labour force can be calculated. Before 1997, the GOV data refer to the fiscal year (July to June). Before 1999, the HES data refer to the academic year (July to June). Not all data can be broken down by region.

United Kingdom

See comments for R&D expenditure.

Iceland

See comments for R&D expenditure.

Norway

The regional breakdown is based on a national classification as there are no official NUTS categories for Norway. No regional labour force data are currently available. This means that no indicator of R&D personnel in the total labour force can be calculated. PNP data are included in the GOV.

Japan

The data for Japan are taken from the OECD — *Main Science and Technology Indicators*.

After 1995, the data provided for R&D personnel are expressed in full-time equivalent and consequently the personnel costs are not overestimated as previously.

Up to and including 1995, data provided for R&D personnel and consequently labour cost data are overestimated by international standards. Data for researchers are expressed in number of persons regularly employed in R&D rather than in full-time equivalent. Studies by some Japanese authorities suggest that in order to calculate FTE, the number of researchers might be reduced by perhaps 40 % in the higher education sector and by about 30 % for the national total. That would reduce HERD by about 25 % and GERD by about 15 %. The OECD calculated, until 1998, the adjusted series for both expenditure and researchers for the higher education sector and the national total, and these data appear in the OECD publications *Main Science and Technology Indicators* and *Basic Science and Technology Statistics*, as well as various studies and analytical reports ([1]).

United States

The data for the USA are taken from the OECD — *Main Science and Technology Indicators*.

([1]) OECD, *R&D Sources and Methods Database*.

Part 2 — Chapter 3
Patents

Eurostat's patent database contains two collections of statistical data that describe the EU and US patenting systems respectively. Each collection originates from a different source and the methodologies used for processing the data are not the same.

These methodological notes are divided into three parts: Part 1 describes the general conceptual framework surrounding patent statistics. Part 2 focuses on Eurostat's patent applications to the EPO database and provides information on the sources, methods, variables, classifications, time series, geographical coverage, reliability and comparability of the data. Finally, Part 3 refers to the methodology applicable to the database on patents granted by the USPTO.

3.1. Patents as a S&T indicator — General information

Patents, as a legal instrument to protect invention, are strongly influenced by the legal system that surrounds them. The European patent framework in particular is rather complex, since national systems co-exist with the European patent and a third system, the Community patent, is currently under regulation. As a result of this, the process of patenting is not straightforward. This section aims to clarify the conceptual and legal frameworks in the field of patents, so as to facilitate understanding of the data contained in Eurostat's database and to provide some basic guidelines for the interpretation of patent data as an indicator of R&D output.

3.1.1. What is a patent and what do indicators based on patents help to illustrate?

A patent is a legal title of industrial property granting its owner the exclusive right to exploit an invention commercially for a limited area and time. The patent confers its owner the right to stop others from, among other things, making, using or selling such invention without authorisation. In return for the exclusive right to exploit it, the technical details of the invention are published.

Technological change and innovation have become two main areas of economic analysis in the industrialised countries, as they are determining factors for the productivity and competitiveness of a nation. S&T activities are crucial for fostering technical innovation, and therefore there is an increasing interest for describing the countries' S&T activities in both quantitative and qualitative terms. In this context, S&T activities are mainly measured by using indirect input, output and impact indicators. It is in the framework of R&D output indicators that patent data are used.

Patentability requires novelty, inventiveness and industrial applicability of the invention. The assumption that a patent represents a codification of inventive activity is made on the basis of these three requirements. Through patent statistics one can see, not only part of a country's inventive activity, but also its capacity to exploit knowledge and to translate it into potential economic gains.

Although patents do not cover all kinds of innovation activity, they do account for a considerable part of it. However, patent indicators should be complemented with other S&T indicators so as to obtain a complete view of the innovation activities of the countries and regions.

There are some good reasons that have made patents one of the most widely used source of data to construct indicators of inventive output. Patents have a close link to invention and cover a broad range of fields. Patent data are readily available from the various patent offices, containing very detailed information for a relatively long time series. Also, being closer to the time of invention, patent statistics can be more accurate than production or trade statistics, which may imply a greater time lag between actual innovation and commercialisation.

However, using patent indicators does also have several shortcomings. Not all inventions are patented and not all patents have the same value. Patent applications are influenced by the different national patent systems, which leads to differences in the propensity to patent across countries. But the propensity to patent varies also across firms and sectors; for example, industries such as aerospace make relatively little use of patents, whereas others such as chemistry and pharmaceuticals are heavy users of patents. Hence, patent statistics might be influenced by the country's industrial structure. A key factor influencing patenting statistics is the patentees' commercial strategy: if the owner of the invention wants to sell the new product on a given market, he will seek for patent protection in that market; if not, protection becomes less important. Consequently, patent applications are heavily influenced by trade flows.

In areas where technology changes rapidly, patent protection may be of little value because inventions quickly become obsolete and it takes a long time to grant a patent. Although patents cover a wide range of fields of technology, not all inventions can apply for patent protection; this is the case, for example, of computer software under the European Patent Convention (Article 52, paragraphs 2c and 3). Nonetheless, in February 2002, the European Commission submitted a proposal for a directive on the patentability of computer-implemented inventions ([1]). In the context of the directive, computer software as such is excluded from patentability. In order to be patentable, the proposal requires that the invention implemented through the execution of software on a computer or similar apparatus, makes a contribution in a technical field that is not obvious to a person of normal skill in that field. Thus in Europe, unlike in the US, computer software will continue being protected by copyrights.

On the other hand, patent statistics have shown to be problematic for world-wide comparisons. This is because patent statistics are heavily influenced by the legal environment that is being taken into consideration. That is, the host country tends to be domineering due to a potential 'home advantage' effect.

In order to overcome comparability problems, the OECD has developed the concept of 'patent family'. A patent family is defined as a set of patents taken in various countries for protecting a single invention. The OECD collects data for the so

([1]) Proposal for a directive of the European Parliament and of the Council on the patentability of computer-implemented inventions, European Commission, Brussels, 20/02/2002, COM(2002)92 final.

PART 2 — METHODOLOGY

called 'triadic families', i.e. a patent is a member of the patent families if and only if it is filed at the European Patent Office — EPO, the Japanese Patent Office — JPO — and is granted by the United States Patent and Trademark Office — USPTO ([2]). The OECD is still conducting research for improving the methodology in the field. One of the aspects for improvement is the fact that, at present, its database does not fully reflect the true patenting activities in Europe — see section below, as it does not take the patents in the national offices of the EU Member States into account. As for the the Patent Co-operation Treaty — PCT and USPTO procedures for granting applications, it may take around five years until information is made available, patents counted by priority date pose a problem in terms of timeliness. As a result, another aspect under study is a method for forecasting patent families that should allow for more up-to-date statistics.

3.1.2. Patent systems in Europe

In the European Union, patent protection is currently provided by two systems: the European patent system and the national patent systems. The former is regulated by the Munich convention adopted in 1973, whereas national patent systems are defined by national laws. Patent protection in Europe can also be obtained via PCT, by filing the application at the World Intellectual Property Organisation — WIPO — and designating a European country or the EPO for protection.

In addition to the existing systems, the European Union is now willing to implement the 1975 Luxembourg agreement on the Community patent. After various attempts of implementation using international tools, the European Commission proposed a council regulation on the Community patent in 2000. Should this regulation be approved, a third system will enter into force: the Community patent system, which aims to establish a unitary and autonomous patent system for the entire European Union, coexisting with the actual European and national patent systems.

European Patent Convention
Munich Convention

The *European Patent Convention* was signed in Munich in October 1973 and entered into force on 1 June 1978. The *Munich Convention* establishes a uniform patenting system for all countries signatory to the Convention, providing applicants with protection in as many of the signatory states as they wish on the basis of a single patent application and a single grant procedure ([3]). Once granted, the European patent is protected under the national law in each of the countries designated in the application. The *Munich Convention* created the European Patent Organisation — the legislative body — and the European Patent Office — the executive body ([4]), establishing a centralised procedure for granting European patents.

At present, 27 countries have ratified the Convention: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Germany, Finland, France, Greece, Hungary, Italy, Ireland, Liechtenstein, Luxembourg, Monaco, the Netherlands, Portugal, Romania, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and the UK. European patent applications and patents can also be extended to countries signing agreements to that effect with the European Patent Organisation. The extension states at present are Albania, Latvia, Lithuania and the former Yugoslav Republic of Macedonia.

Although applying for a European patent is cheaper than applying for the patent in each of the National offices where protection is desired, its cost is still considerably higher than in Japan or the US. Recent figures published on the proposal for a regulation on the Community patent reveal that the cost of a European patent is three to five times higher than that of the American or Japanese one. The Commission estimated that whilst the overall cost of an European patent, including translation costs and other fees, is around EUR 49 900, Japanese and US patents cost on average EUR 16 450 and EUR 10 330 respectively ([5]).

National patent systems

Each European country has its own national patent office, which grants patents that protect their owner within the national territory. These patents are awarded by the corresponding national authority and are ruled by national law. However, the national patent laws of all the Member States of the European Union have been de facto harmonised, as all the Member States are parties of the *Paris Convention* for the Protection of Industrial Property, the *European Patent Convention* and the *Agreement of Trade Related Aspects of Intellectual property Rights* — TRIPS agreement.

Patent Cooperation Treaty — PCT

The Patent Co-operation Treaty was signed in Washington on 19 June 1970 and came into force on 1 June 1978. The PCT allows for a filing of an international application to have the same effect as a national application in each of the contracting countries designated in the application. All the PCT applications are centralised through the World Intellectual Property Organisation — WIPO. At present, one hundred and seventy-nine States are members of the WIPO ([6]), and therefore any applicant can designate for protection in all these states or a in a regional office such as the EPO. In the cases were the EPO is designated, the patent is known as a Euro-PCT patent ([7]).

The Community patent

The Community Patent has its origins in the *Luxembourg convention* signed on 15 December 1975. Although the Convention was amended by an agreement in 1989 ([8]), the *Luxembourg Convention* has not yet entered into force, since only France, Germany, Greece, Denmark, Luxembourg, the United Kingdom and the Netherlands have ratified the Convention. In view of the lack of effectiveness of the international convention and the discussions of the European Council in Lisbon in March 2000, where the importance of introducing a Community patent without delay was underlined, the European Commission proposed a Council regulation on the Community patent in August 2000 ([9]).

(2) For further information on this subject see *Main Science and Technology Indicators*, Volume 2001/2, OECD, Paris, 2001. P 65.

(3) It takes on average just over four years for a patent to be granted. For further information on the European patent granting procedure see methodological notes in Eurostat's reference database *NewCronos* Theme 9, Domain Patents.

(4) See the European Patent Office's (EPO) web site at: http://www.european-patent-office.org/.

(5) See Proposal for a Council Regulation of the Community patent, Commission of the European Communities, Brussels 1.8.2000, COM(2000)412 final.

(6) See the list of members at http://www.wipo.org/members/members/index.html.

(7) For further information on the WIPO's patent granting procedure see methodological notes in Eurostat's reference database *NewCronos*, Theme 9, Domain Patents.

(8) Agreement relating to Community Patents, Luxembourg, 15 December 1989, Official Journal, N. L 401, 30.12.1989, p.1.

(9) Commission of the European Communities, Proposal for a Council Regulation on the Community Patent, Brussels 1.8.2000, COM(2000)412 final.

The difference between the council regulation and the Convention is that once approved, the regulation will be directly applicable to all the Member States, and therefore the Community patent system will enter into force. Also, the regulation tries to overcome the problems that have arisen in the context of the Convention (especially costs and jurisdiction). In this framework, the regulation proposes a Community patent characterised by unity and autonomy that arises from a body of Community patent law, affordable, with appropriate language arrangements and information requirements and that guarantees legal certainty. The Community patent system shall coexist with the national patent systems and the European patent system.

However, the proposal has not been approved yet. In the European Council meeting in Barcelona on 15 and 16 March 2002, the European Council reaffirmed the importance of the Community Patent and invited the Council to reach a common political approach. It was also stressed that the Community Patent must be an efficient and flexible instrument obtainable by businesses at an affordable cost, while complying with the principles of legal certainty and non-discrimination between Member States and ensuring a high level of quality.

The complex framework described above shows that invention owners are provided with multiple possibilities to protect themselves in Europe. Usually, a patent application is initially filed with the national patent office of the country in which the inventor's laboratory or company is located. The patent application is then provisionally protected until examination of the application is complete and the patent is either granted, rejected or withdrawn.

For various reasons, it could also be worthwhile to apply for patent protection in other countries. Within one year, the same invention can also be filed in other countries. This can either be done by filing a patent application in each desired country, by filing a regional application, e.g. with the EPO, for a number of European countries (based on the European Patent Convention), or by filing an international application under the Patent Co-operation Treaty. Besides the possibilities outlined above, direct filing for several countries either under the PCT-route or with the EPO (Euro-direct application) is also possible. In all cases, the protection starts from the date of first filing (priority date). In addition, inventors that are seeking protection outside Europe, can also apply for patents in other offices, such as the United States Patent and Trademark Office – USPTO – and the Japanese Patent Office – JPO.

3.2. Patent applications to the EPO — Sources and methods

3.2.1. Sources

The data contained in Eurostat's patent applications to the EPO database are an extraction from the database of the European Patent Office – EPO. This database excludes patent applications directly made to the National Patent Offices of the European Member States, the USPTO or the JPO.

Although EPO data alone do not give a complete view of the patenting activities in Europe, using data from the EPO guarantees the comparability of the data, as all applications filed with the European Patent Office follow the harmonised procedure of the European Patent Convention. When undertaking international assessments, one has to take into account that the figures may show higher values for the European countries compared to the US or Japan, as they may enjoy 'home advantage'. Nevertheless, the home advantage for the European countries at the EPO may not be as strong as it is for the US or Japan at their respective offices. This is because Europeans face more complicated and expensive options when applying for a patent in Europe (i.e. they may apply first at the national patent office and after at the European Patent Office, and within the EPO, each additional country required for protection will imply additional fees and translation costs) compared to the US residents or the Japanese, who only need to apply for one patent to obtain protection in their entire national territory.

Data on employment and population used for the derived indicators have been obtained from Eurostat's reference database *NewCronos*. More specifically, labour force data to construct the derived indicator 'patents per million labour force' have been taken from the following sources:

For **labour force** data at the **national** level the source is:

- Theme: 3_Population and social conditions,
- Domain: LFS,
- Collection: Working population,
- Table: Active population by age group and marital status.

For **labour force** data at the **regional** level the source is:

- Theme: 1_General Statistics,
- Domain: Regional statistics,
- Collection: Community labour force survey,
- Table: Active population by age and sex.

Population data to construct the derived indicator 'patents per million inhabitants' have been extracted from the following sources:

For **population** data at the **national** level the source is:

- Theme: 3_Population and social conditions,
- Domain: Demography,
- Collection: Population,
- Table: Population by sex and age on 1st January of each year.

For **population** data at the **regional** level the source is:

- Theme: 1_General Statistics,
- Domain: Regional statistics,
- Collection: Demographic statistics,
- Table: Population on 1st January by sex and age group, from 1980.

When not available in *NewCronos*, reference data have been obtained from the *Main Science and Technology Indicators* – MSTI, except for Norway, for which regional population data have been obtained from the statistics Norway database:

http://www.sbs.no.

3.2.2. Reference Unit

The reference unit for this database is patent applications.

Although not all applications are granted, each application still represents technical effort by the inventor and therefore patent applications are considered to be an appropriate indicator of inventive potential. On the other hand, it takes on average just over four years for a patent to be granted at the EPO. In an effort to provide timely data, therefore, patent applications are chosen over patents granted.

3.2.3. Criteria to count patents

Different criteria can be chosen to count patents. Depending on the options made, the obtained indicators will have different value and different meaning. The criteria used by Eurostat for the data extraction from the EPO database refer especially to the regional potential for innovation, which are not necessarily the same as the criteria used by the EPO for its own use. Therefore, the national totals of European patent applications presented in this source may be somewhat different from those presented in the EPO's annual report.

Eurostat counts patent applications to the EPO according to the following criteria:

- **Type of patents covered**
  Patent applications to the EPO include applications filed directly under the European Patent Convention and applications filed under the Patent Co-operation Treaty which designate the EPO for protection (Euro-PCT).

- **Reference year**
  Patent applications to the EPO are counted according to the year in which they were filed at the EPO, since this is closer to the date invention than the year in which they were published. Although the closest date to invention is the priority year, i.e. the year in which the patent was first applied for at any patent office, no complete data are available for the most recent years. In an effort to provide timely and comprehensive data therefore, year of filing has been chosen over year of priority.

- **Geographical assignment of the patent**
  To get an indication of the regional potential for innovation within the EU, the regional distribution of the patent applications is assigned according to the address of the inventor, i.e. the inventor's place of residence. This approach follows the methodological recommendations as given in *The Regional Dimension of R&D and Innovation Statistics — Regional Manual*, European Commission, 1996.

  The assignment by the inventor's place of residence has been chosen in order to measure the inventive capacity of a region in contrast to the regional R&D performance. The regional R&D performance could be indicated by allocating the patents to the region of the institution in which R&D is performed and where inventions are developed. However, for institutions with several branches located in different regions, patent applications are generally filed through the headquarters and, therefore, an overestimation in favour of the region of the headquarters could be expected. The approach used here avoids this. However, some underestimation of the regional potential of innovation is still possible as not every inventor will register under the address where he/she is resident but rather the address of his/her enterprise or institution.

  If one application has more than one inventor, the application is divided equally among all of them and subsequently among their regions, avoiding thus double counting. This might lead to some over- or underestimation of some regions as the different contributions of several inventors may not have the same weight.

- **Assignment to the IPC codes**
  If a patent is assigned to more than one IPC code, the application is equally divided among all the IPC-subclasses (fractional counting). This approach avoids double counting — See further information on the IPC classification below.

3.2.4. Indicators

Data in this database are available only for one statistical variable, i.e. patent applications to the EPO. Then, on the basis of the number of patent applications, Eurostat calculates patent applications per million labour force and patent applications per million inhabitants.

Based on the data on patent applications, Eurostat also calculates data on patent applications in high technology fields. High tech patents are counted following the criteria established by the Trilateral Statistical Report, where the subsequent technical fields are defined as high technology: Computer and automated business equipment; micro-organism and genetic engineering; aviation; communications technology; semiconductors; lasers. The IPC subclasses corresponding to the above high tech fields are listed in the following table.

IPC subclasses considered as high technology by high tech group

IPC sub-class	Definition
Computer and automated business equipment	
• B41J	Typewriters; selective printing mechanisms, i.e. Mechanisms printing otherwise than from a forme; correction of typographical errors,
• G06C	Digital computers in which all the computation is effected mechanically,
• G06D	Digital fluid-pressure computing devices,
• G06E	Optical computing devices,
• G06F	Electric digital data processing,
• G06G	Analogue computers,
• G06J	Hybrid computing arrangements,
• G06K	Recognition of data; presentation of data; record carriers; handling record carriers,
• G06M	Counting mechanisms; counting of objects not otherwise provided for,
• G06N	Computer systems based on specific computational models,
• G06T	Image data processing or generation, in general
• G11C	Static stores.
Aviation	
• B64B	Lighter-than-air aircraft,
• B64C	Aeroplanes; helicopters,
• B64D	Equipment for fitting in or to aircraft; flying suits; parachutes; arrangements or mounting of power plants or propulsion transmissions,
• B64F	Ground or aircraft-carrier-deck installations,
• B64G	Cosmonautics; vehicles or equipment therefor.
Micro-organism and genetic engineering	
• C12M	Apparatus for enzymology or microbiology,
• C12N	Micro-organisms or enzymes; compositions thereof; propagating, preserving or maintaining micro-organisms; mutation or genetic engineering; culture media,
• C12P	Fermentation or enzyme-using processes to synthesise a desired chemical compound or composition or to separate optical isomers from a racemic mixture,
• C12Q	Measuring or testing processes involving enzymes or micro-organisms ; compositions or test papers therefore; processes of preparing such compositions; condition-responsive control in microbiological or enzymological processes.

Lasers

- H01S Devices using stimulated emission.

Semiconductors

- H01L Semiconductor devices; electric solid state devices not otherwise provided for.

Communication technology

- H04B Transmission,
- H04H Broadcast communication,
- H04J Multiplex communication,
- H04K Secret communication; jamming of communication,
- H04L Transmission of digital information, e.g. Telegraphic communication,
- H04M Telephonic communication,
- H04N Pictorial communication, e.g. Television,
- H04Q Selecting,
- H04R Loudspeakers, microphones, gramophone pick-ups or like acoustic electromechanical transducers; deaf-aid sets; public address systems,
- H04S Stereophonic systems.

3.2.5. Classifications

The main classifications used in the patent database are the International Patent Classification – IPC– and the *Nomenclature of Territorial Units for Statistics* – NUTS.

International Patent Classification — IPC

The International Patent Classification – IPC – is based on an international multilateral treaty ([10]) administered by the World Intellectual Property Organisation – WIPO. The IPC is used by the industrial property offices of more than 100 States, four regional offices and the International Bureau of WIPO.

According to the IPC classification, an invention is assigned to an IPC-class by its function or intrinsic nature, or by its field of application. IPC is therefore a combined function-application classification system in which the function takes precedence. A patent may contain several technical objects and therefore be designated to several IPC-classes. The IPC is structured into sections, classes, sub-classes, groups and sub-groups. In its seventh edition, the IPC divides technology into eight sections with approximately 69 000 sub-divisions ([11]). Data are given by IPC section and class at the national level and by section at the regional level. However, data are treated at the subclass level.

Nomenclature of Territorial Units for Statistics — NUTS

Originally assigned by postal code at the EPO, patent data are regionalised by Eurostat according to the *Nomenclature of Territorial Units for Statistics* – NUTS. This nomenclature was established by Eurostat to provide a single uniform breakdown of territorial units for the production of regional statistics for the EU. The most detailed regional level data available is at NUTS level 3 ([12]). Data in Chapter 3 of Part 1 are analysed at the NUTS 2 level.

EEA regions correspond to the statistical territorial units proposed by Eurostat in statistical regions in the EFTA countries and the Candidate Countries (CC), Eurostat, November 2002.

3.2.6. Time series

Eurostat's patent database contains data from 1989 onwards. It should be noticed that for the PCT applications, the data on the country of residence of the applicant(s) and/or the inventor(s) is imputed into the EPO database only after their international publication. This means that these patent applications can only be ascribed to a country or region at least 18 months after the priority date – year in which the patent was first applied for at any patent office. Therefore provisional data may underestimate the real number of patent applications filed the n-1 year.

3.2.7. Geographical coverage

Data on patent applications to the EPO at the national level are available for Austria, Belgium, Bulgaria, Canada, Cyprus, the Czech Republic, Denmark, Estonia, France, Finland, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, the Russian Federation, Slovakia, Slovenia, Spain, Sweden, Turkey, UK and US. Aggregates for EU-15, Eurozone12, EEA and ACC are also available.

Data at the regional level are available for all the Member States of the European Union plus Iceland, Liechtenstein and Norway. Data are available at the NUTS 1, 2 and 3 levels.

When data for any of these regions or countries mentioned above do not appear in the database, it means that the value corresponding to that country or region is equal to a real zero. This is because countries or regions only enter the database once they have applied for a patent to the EPO.

([10]) The Strasbourg Agreement Concerning the International Patent Classification, which was concluded in 1971 and entered into force in 1975.

([11]) For further detail on the IPC classification visit the WIPO web site: http://www.wipo.int.

([12]) For further details refer to *Regions, Nomenclature Territorial Units for Statistics NUTS*, Eurostat, 1998.

3.2.8. Reliability of the data

The data contained in this database are reliable in terms of patenting activities in the framework of the EPO. However, as an indicator of innovative potential of the countries and regions, one has to bear in mind that these data refer only to patent applications to the European Patent Office and that therefore patent applications to the National Patent Offices in Europe are excluded. In this context, some authors ([13]) sustain that looking only at data on patent applications to the EPO may provide an underestimation of the real scope of innovative activities in the European Union.

In the original data received by Eurostat, some patents do not have a postcode assigned, therefore during the regionalisation process these patents are included in a 'Not registered by region' NUTS category. The country total is therefore the sum of all the regions at the NUTS 3 level and the 'Not registered by region' group. In any case, the percentage of not regionalised patents is rather small, for example in 2000 the highest percentage of non regionalised patents in the EU was 1.92 % for the UK.

3.2.9. Comparability of the data

Comparability between years and countries

The European Patent Office follows the harmonised procedure established by the European Patent Convention. As all the data contained in this database originate from the EPO database, comparability of the data is guaranteed both for a cross-country as well as a time series analysis.

Comparability with other sources

The patent applications in this database are counted according to specific criteria designed to measure innovative potential and therefore are not comparable with other sources that use different methods to build up the indicators. This is the case, for example, of the EPO's annual report or the patents granted by the USPTO database.

3.2.10. Availability of the data

The data used for the analyses of *R&D in Europe — Part 1* are those available in the third quarter of 2002. They may not correspond exactly with those in the tables in Part 3, or in Eurostat's *NewCronos* database, when these have been subsequently updated.

([13]) Paul Schwander, *Lies, damned lies, and statistics — Is European innovation really lagging its competitors?*, 2001, http://www.ipmatters.net/statistics/001113_lies.html.

3.3. Patents granted by the USPTO — Source and methods

3.3.1. Source

Data on patents granted by the USPTO have been extracted from the USPTO's database and treated by the Fraunhofer ISI — FhG-ISI — for the European Commission, DG Research.

Please notice that in this database the US is expected to be domineering as figures may be affected by a home advantage effect.

3.3.2. Reference unit

The reference unit for this database is the patent granted.

3.3.3. Criteria to count patents

The methodology used by the FhG-ISI is not harmonised with that of Eurostat and therefore comparisons across the two databases should be interpreted with caution.

USPTO data refer to patents granted as opposed to applications, which is the case of EPO data. Data are recorded by year of publication as opposed to the year of filing for EPO data. This is because patents in the US are only published once they are granted.

As it is done with the EPO data, patents are allocated to the country of inventor, using fractional counting in the case of multiple inventors.

3.3.4. Indicators

Data in this database are available only for one statistical variable, i.e. number of patents granted by the USPTO. Data are also available for patents granted per million inhabitants.

3.3.5. Time series

The patents granted by the USPTO database contains data from 1991 onwards.

3.3.6. Geographical coverage

Data on patents granted by the USPTO are available for the EEA countries, Candidate countries, Argentina, Australia, Brazil, Canada, Chile, China (excluding Hong Kong), Hong Kong (CN), India, Indonesia, Israel, Japan , Korea (Republic of), Malaysia, Mexico, New Zealand, Pakistan, Philippines, Russian Federation, South Africa, Singapore, Taiwan, Thailand, Ukraine, USA, and Venezuela.

For further information on patents granted by the USPTO:

See *Towards a European Research Area. Key Figures 2001 — Special edition. Indicators for benchmarking of national research policies*, DG RTD, 2001.