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PART 3

European technological productivity and competitiveness

5.1. Introduction

Transforming technological knowledge into economic growth and welfare through its exploitation is a key tool to boost the competitiveness of a country in the modern economy. Being a complex phenomenon, evaluating how countries perform in developing and commercialising technology is not an easy task.

Among the indicators that may help to measure a country's performance in technological output, patents statistics are a widely used measure, as they represent an outcome of technologically oriented inventive activity. Although patents do not cover all kinds of innovation, they do account for a considerable part of it. There are some good reasons that have made patents one of the most widely used sources of data to construct indicators of inventive output such as the availability of detailed information for a relatively long time series or their close link to invention (1).

Nevertheless, using patent indicators does also have several shortcomings, and therefore 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. Among the drawbacks, an important one is that not all inventions are patented and not all patents have the same value. In fact, there is broad recognition that the value distribution of patents is very skewed: a few patents have large value, whereas many have very low value. However, as there are no generally recognised and easy applicable methods for measuring the value of patents, this chapter limits itself to simply counting the number of patents.

This chapter analyses the structure and evolution of patenting in the EU, Iceland, Liechtenstein, Norway, Candidate Countries, Japan and the United States and it is divided into three sections: a first section studies the international performances of EU-15, Japan and the United States, by looking at patent applications to the European Patent Office — EPO, patents granted by the United States Patent and Trademark Office — USPTO — as well as the so-called ***triadic patent families***; a second section focuses on the performance of European countries mainly at the EPO; finally, an insight into the patenting activities of the EEA regions at the EPO is given. The analysis covers the period from 1991 to 2001 for the EPO and USPTO data, whereas triadic patent family data covers the time-series from 1987 to 1998.

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 three main 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. Triadic patent family data originate from the OECD, who constructs such indicators combining data from the EPO, the USPTO and the Japanese Patent Office — JPO.
- In addition, some indicators from the *Third European Report on Science and Technology Indicators* — REIST-3 — prepared by the Directorate-General for Research are also presented in this chapter.

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. 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 United States, up until recently, only information on granted patents was published and therefore data on applications is not yet presented in this chapter. In the USPTO, patents take from two to five years to be granted. With regard to the triadic patent families, they are counted according to the year of priority, i.e. year in which the patent was first applied for at any patent office and refer to applications to the EPO and the JPO and grants by the USPTO.

When interpreting the data at the international level, the reader should bear in mind that due to a 'home' advantage, European countries may be dominant in the European patent system, whereas the United States 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.

Some of these weaknesses are reduced or suppressed in the triadic patent family indicators, as they only take into account patents that have been applied for at the EPO and the JPO and granted by the USPTO. Besides improving international comparability of patent based indicators, triadic patent family data also balances the differences in the value of the patents associated with traditional indicators. This is because patenting in the three offices is very costly due to, not only administrative fees, but also translation costs. In this context, the patentee will only proceed to do such applications if he/she deems it worthwhile, i.e. if the expectation for having the patent granted and the expected return from protection through sales or licenses in the designated countries are high enough.

Due to methodological differences in the manner of processing the data, no cross sectional comparisons are advisable between the EPO, the USPTO and triadic patent family data. For further explanations on the methodology used, please refer to the methodological notes starting on page 150 or to Eurostat's reference database ***NewCronos***.

(1) For further details on the advantages and drawbacks of using patents statistics as an S&T indicator, please refer to the methodological notes in Eurostat's reference database ***NewCronos*** or to ***Statistics on Science and Technology — 1991-2001***, Detailed tables collection, Theme 9 — Science and Technology, Eurostat, 2003.

5.2. International comparison: EU-15, Japan and the United States

The performance of the EU, Japan and the United States in technological output is analysed in this section by looking at their patenting activities at the EPO and the USPTO, as well as their attainment in terms of triadic patent families.

Patent applications to the EPO

Whilst the EU led in absolute terms, Japan retained the highest rate relative to population

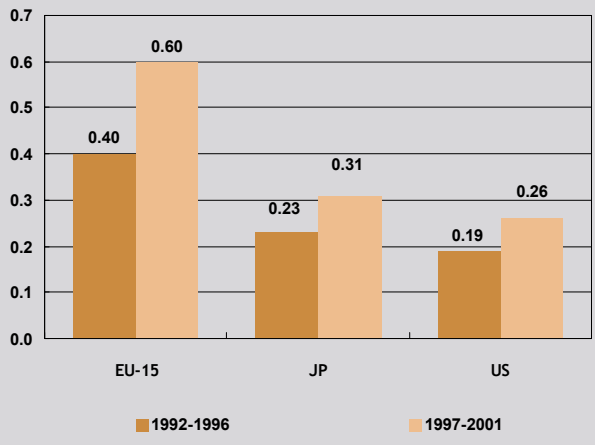
As globalisation shows that protecting inventions is becoming increasingly important, patent applications to the EPO from the EU, Japan and the United States continue on an upward trend — Figure 5.2. Although patent applications to the EPO were already growing steadily during the first part of the nineties, annual average growth rates were especially high from 1996 onwards for all the EU, Japan and the United States. For the 1996-2001 period, it was Japan that recorded the highest annual average growth rate (11.9% per annum), followed by the EU (11.0%) and the United States (10.9%).

In 2001, the EPO received 60 890 patent applications from EU Member States, 168.3% of its value in 1996 and more than double the applications made in 1991. Patent applications to the EPO from Japan and the United States in 2001 amounted to 22 226 and 47 202, respectively. These represented 175.8% and 167.8% of their corresponding values in 1996. Europe still has the highest share of patents at the European Patent Office, but according to the *Third European Report on Science and Technology Indicators* — REIST-3, the United States has increased its presence over the past decade in terms of percentage of patent applications filed at the EPO. The gap between the EU and the United States was 16.6% in 1992, compared with only 9.8% in 2001. In 2001, the EU was responsible for 42.2% of patents applied for at the EPO, the United States for 32.4% and Japan for 14.6%. Over the period 1992 to 2001, the United States managed to increase its share by 4.2%, while the EU's share fell by 2.6% and Japan's by 4.9% — REIST-3, p.329.

Figure 5.3. shows the evolution of patent applications to the EPO as a proportion of population for the 1991-2001 period. When taking population into account, the differences across the three blocks become smaller and the positions invert. In 2001, the highest ratio was registered by Japan — 175 patent applications per million inhabitants, followed by the United States (170) and the EU (161).

When set against its business R&D effort, the EU's performance in patenting has been relatively healthy since the late 1990's. As shown in Figure 5.1., during the 1997-2001 period, the EU recorded a rate of European patents per unit of business R&D expenditure equal to 0.60, followed by Japan with 0.31 and the United States with 0.26 all countries increasing their rates with regard to the 1992-96 period. In spite of a much more modest increase in R&D spending by business compared with its counterparts, Europe has managed to generate a significant growth in patenting at the EPO. This may suggest that the EU patenting activity has been boosted by more than just an expansion of business research spending.

Figure 5.1. **European patents per unit of business R&D expenditure (1) EU-15, Japan and the United States 1992 to 1996 and 1997 to 2001**

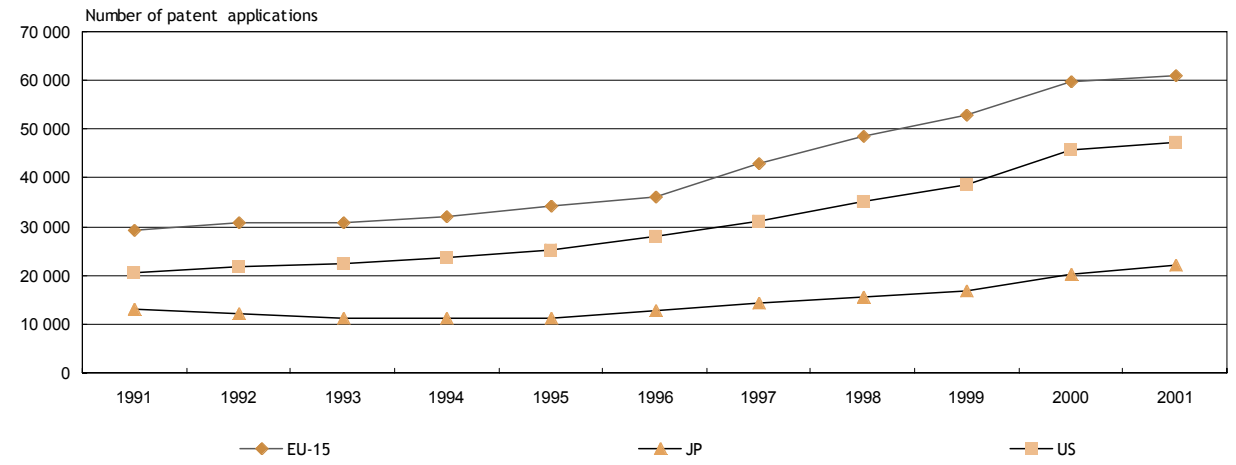


(1) Business R&D — BERD — measured in million purchasing power standards — PPS — at 1995 prices. Calculated using a two-year time lag between year of R&D expenditure and year of patenting.

Source: *Third European Report on Science and Technology Indicators*, Directorate-General for Research, 2003, p. 352.
Data: EPO — data processed by OST; OECD, Eurostat.

Figure 5.2.

**Trends of patent applications to the EPO
EU-15, Japan and the United States
1991 to 2001 (1)**



NB: Reference year corresponds to year of filing.
(1) 2001 provisional data.

Sources: Eurostat, EPO.

Figure 5.3.

**Trends of patent applications to the EPO per million inhabitants
EU-15, Japan and the United States
1991 to 2001 (1)**

NB: Reference year corresponds to year of filing.
(1) 2001 provisional data;
EU-15 — 1999, 2000, 2001 population data: Eurostat estimates;
JP and US — 2001 population data: Eurostat estimates.

Sources: Eurostat, EPO.

Patents are classified according to the International Patent Classification, which is commonly referred to as IPC. 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. The IPC is therefore a combined function-application classification system in which the function takes precedence.

Table 5.1. shows the distribution of patent applications to the EPO from the EU, Japan and the United States by IPC section. EU patent applications to the EPO in 2001 specialised in the 'Performing operations; transporting' section (19.4% of total applications). Whilst Japan specialised in 'Electricity' (26.4%), the United States applied for most patents on the field of 'Physics' (25.5%).

The second largest section in the EU and the United States was 'Electricity', as it accounted for 18.8% and 19.6% of their respective totals. 'Physics' was the second largest section for Japan (24.0%).

An increasing proportion of patent applications to the EPO refers to applications in the high technology fields — see definition of high tech patents in methodological notes starting on page 150. This increasing trend is clear for both the EU and the United States in Figure 5.4., as high tech patent applications to the EPO are plotted as a percentage of total applications. Whilst they represented 9.4% of total applications from the EU in 1991, they amounted to 19.6% in 2001. United States high tech applications increased from 18.5% in 1991 to 33.6% in 2001. The trend for Japan appears fairly stable ranging from 24.5% in 1991 to 25.7% in 2001.

The increasing proportion of high tech patents is explained by the fact that applications in this fields are growing faster than other type of applications. As shown in Table 5.2., whilst patent applications to the EPO from the EU in the 1996-2001 period grew at an annual average growth rate of 11.0%, applications in the high tech fields grew at a rate of 22.3% per annum. The growth rate for high tech applications from the United States (20.4%) also almost doubled that of patents overall (10.9%). Although the difference is not as striking, Japanese high tech patent applications (15.4%) also grew at a rate well above the total (11.9%).

In 2001, high tech patent applications to the EPO from the EU amounted to 11 928. The United States and Japan applied for 15 839 and 5 707 high tech patents, respectively. As a proportion of population, with 57 high tech patent applications per million inhabitants, the United States was ahead, followed by Japan (45) and the EU (32). Although the EU seems to be lagging behind its competitors in the high tech fields, it is also catching up, as shown by the annual average growth rates.

Table 5.3. shows the distribution of high tech patent applications to the EPO by high tech group. High tech patents may be grouped in the following technology groups ([2]):

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

Most high tech patent applications to the EPO from EU-15 (47.1% of total applications) and Japan (38.1%) in 2001 were done in the field of 'Communication Technology', which includes electrical communication systems such as telephones or television. This is also the second largest group for the United States (30.8%). 'Computer and automated business equipment' was the most important high tech group for the United States (41.5%), whereas it was the second one for both the EU (28.5%) and Japan (35.0%).

([2]) See composition of each group in methodological notes starting on page 150.

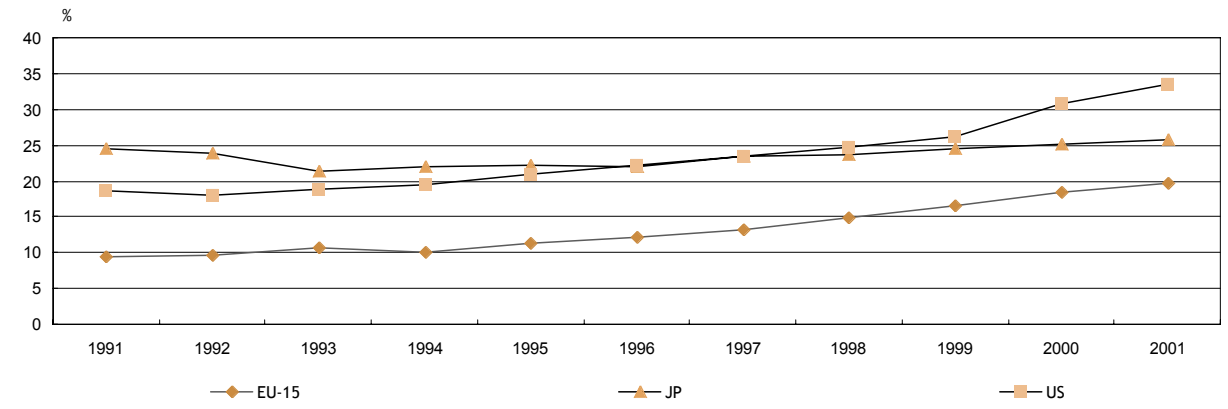
Table 5.1. Distribution of patent applications to the EPO, by IPC section in %
EU-15, Japan and the United States
2001 (1)

IPC section		EU-15	JP	US
A	Human necessities	15.0	9.4	18.1
B	Performing operations; transporting	19.4	14.8	11.3
C	Chemistry; metallurgy	14.3	15.7	18.2
D	Textiles; paper	1.9	1.2	1.0
E	Fixed constructions	4.2	0.7	1.6
F	Mechanical engineering; lighting; heating; weapons; blasting	9.8	7.7	4.6
G	Physics	16.7	24.0	25.5
H	Electricity	18.8	26.4	19.6
Total number		60 890	22 226	47 202

NB: Reference year corresponds to year of filing.
(1) 2001 provisional data.

Sources: Eurostat, EPO.

Figure 5.4. Trends of high tech patent applications to the EPO as a % of total applications
EU-15, Japan and the United States
1991 to 2001 (1)



NB: Reference year corresponds to year of filing.
(1) 2001 provisional data.

Sources: Eurostat, EPO.

Table 5.2. High tech patent applications to the EPO
EU-15, Japan and the United States
1991 to 2001 (1)

	EU-15	JP	US
High tech patent applications in 2001			
Total number	11 928	5 707	15 839
Per million inhabitants	32	45	57
As a % of total	19.6	25.7	33.6
Annual average growth rates in %			
High tech patents 1991-96	9.7	-2.9	10.5
High tech patents 1996-2001	22.3	15.4	20.4
All patents 1991-96	4.4	-0.8	6.6
All patents 1996-2001	11.0	11.9	10.9

NB: Reference year corresponds to year of filing.
(1) 2001 provisional data.
EU-15, JP and US — 2001 population data: Eurostat estimates.

Sources: Eurostat, EPO.

Table 5.3. Distribution of high tech patent applications to the EPO, by high tech group in %
EU-15, Japan and the United States
2001 (1)

High tech group	EU-15	JP	US
Aviation	1.2	0.3	0.8
Computer and automated business equipment	28.5	35.0	41.5
Communication technology	47.1	38.1	30.8
Lasers	1.4	2.3	1.5
Micro-organism and genetic engineering	13.0	8.4	17.0
Semi-conductors	8.9	15.9	8.4
Total number	11 928	5 707	15 839

NB: Reference year corresponds to year of filing.
(1) 2001 provisional data.

Sources: Eurostat, EPO.

Patents granted by the USPTO

Great differences between the number of domestic patents and foreign ones

As regards industrial property protection in the United States, the number of patents granted by the USPTO is also on an upward trend — Figure 5.6. Among the triad, the EU recorded the highest annual average growth rate of patents granted by the USPTO for the 1996-2001 period (10.8%). However, this can just be seen as a certain consolidation, as comparing the share of the EU in the total number of patents granted by the USPTO, no increase can be noticed between 1991 and 2001. During the 1996-2001 period, the number of patents granted to both US and Japan grew at an annual average growth rate of 7.7% per annum. The differences between the number of domestic patents and foreign ones is indeed somewhat striking. Whilst the USPTO granted 89 636 patents to US inventors in 2001, only 30 285 were awarded to inventors from the EU and 33 733 to inventors from Japan.

As shown in Figure 5.7., when taking population into account, differences still remain large at the USPTO. In 2001, the United States retained a ratio of 322 patents granted per million inhabitants. With 265 patents granted per million inhabitants, the gap with Japan when taking population into account reduces. The ratio of patents granted to the EU per million inhabitants in 2001 was 80, one fourth of the United States' rate.

It may be argued whether the position of EU Member States in the United States and Japan is comparable to that of the United States or Japan in the EU. This is directly linked to the complexity of the European patenting scenario, where the European patenting system ([3]) coexists with those of the Member States. This has implications on the cost of patenting in Europe, which has been proved to be three to five times more expensive than in the United States or Japan. 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 ([4]).

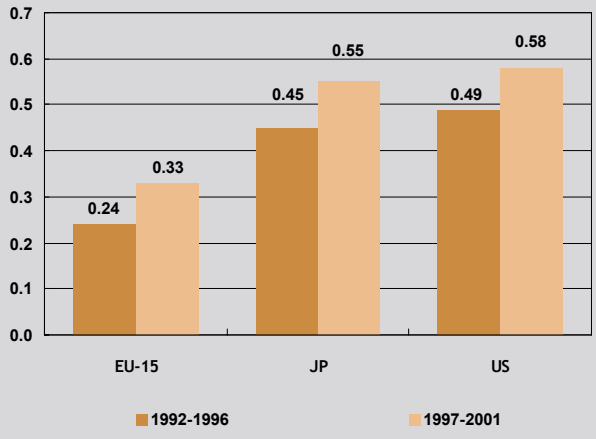
([3]) Please note that an European patent does not necessarily imply protection in the entire EU territory, but only at the designated states. This is not the case for the United States or Japanese patents, where one patent always covers the whole country.

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

Figure 5.1. set European patents against its business R&D effort, showing a relatively healthy performance of the EU since the late 1990's.

Figure 5.5. looks at the corresponding figures for the US patents. During the 1997-2001 period, the United States recorded the highest rate of US patents per unit of business R&D expenditure (0.58), followed by Japan with 0.55 and the EU with 0.33. As for the European patents, all blocks increased their rates with regard to the 1992-96 period.

Figure 5.5. **US patents per unit of business R&D expenditure ([1]) 1992 to 1996 and 1997 to 2001**

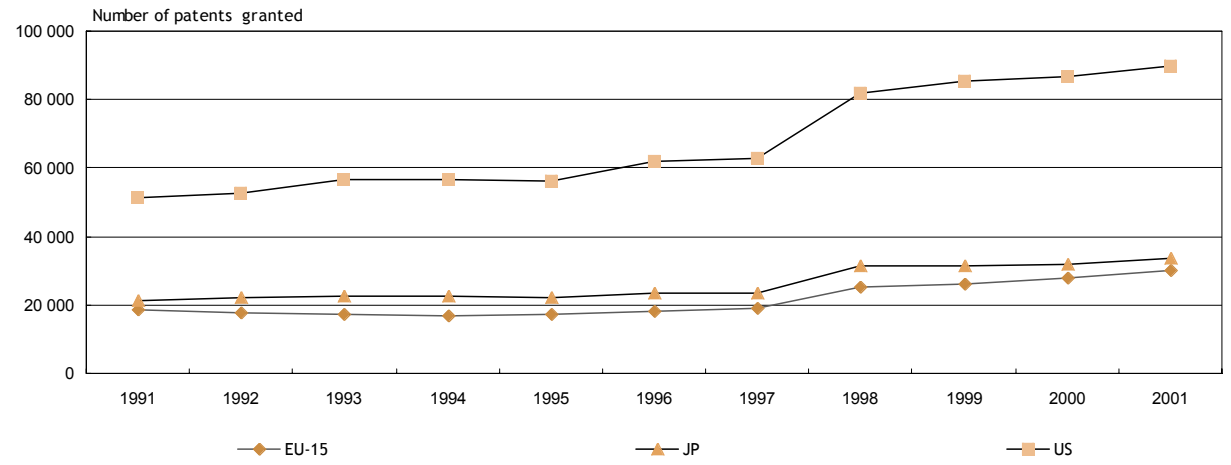


([1]) Business R&D — BERD — measured in million purchasing power standards — PPS — at 1995 prices. Calculated using a two-year time lag between year of R&D expenditure and year of patenting.

Source: *Third European Report on Science and Technology Indicators,* Directorate-General for Research, 2003, p. 353.
Data: EPO — data processed by OST; OECD, Eurostat.

Figure 5.6.

**Trends of patents granted by the USPTO
EU-15, Japan and the United States
1991 to 2001**

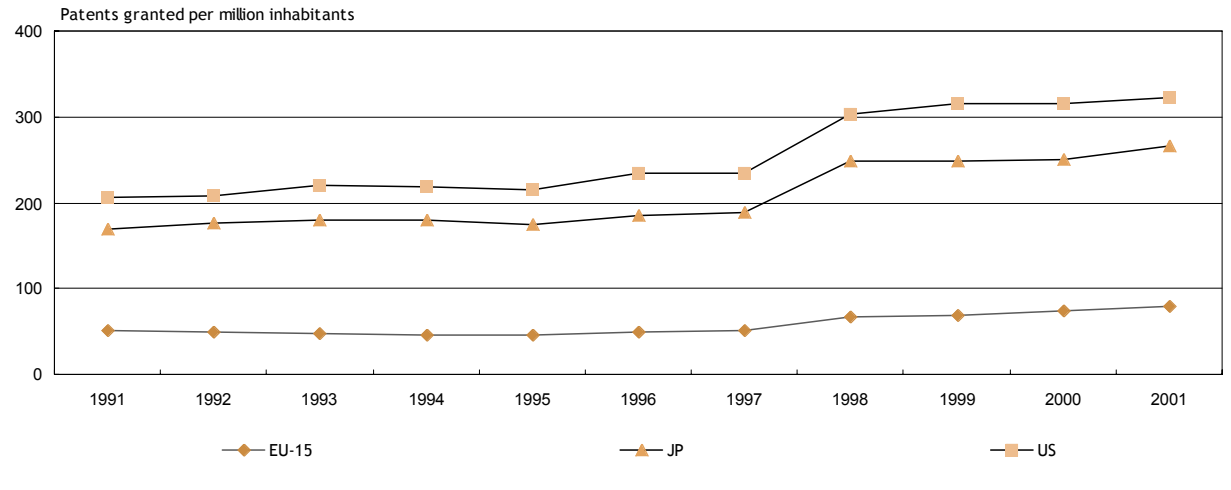


NB: Reference year corresponds to year of publication.

Sources: Eurostat, USPTO.

Figure 5.7.

**Trends of patents granted by the USPTO per million inhabitants
EU-15, Japan and the United States
1991 to 2001 (1)**



NB: Reference year corresponds to year of publication.
(1) EU-15 — 1999, 2000, 2001 population data: Eurostat estimates;
JP and US — 2001 population data: Eurostat estimates.

Sources: Eurostat, USPTO.

Triadic patent families

In absolute terms, the United States leads closely followed by the EU; as a proportion of population Japan is ahead

In order to overcome comparability problems associated to data derived from patents filed at a single patent office, the OECD is using the concept of patent family. A patent family is defined as a set of patents taken in various countries for protecting a single invention. In other words, 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.

As patent families are counted according to the priority year, i.e. year in which the patent was first applied for at any patent office, the latest year for which triadic patent family data are available is 1998. This is because the time lag between the priority date and the availability of information on patent applications to the EPO and JPO could be up to 4 years. As a triadic patent family is only counted after the USPTO has granted it, the duration of this granting procedure and its publication also needs to be taken into account. In total, therefore, information on USPTO grants could be available up to 6 to 10 years after the priority date. Hence, at present the OECD has almost complete patent families data up to 1996 only. In this context, data for 1997 and 1998 are OECD Secretariat estimates based on projections of the number of USPTO patent grants, evaluated using the available data for these years and the time lags between priority and grant over the period 1992-96.

The evolution of the number of triadic patent families in the EU, Japan and the United States is revealed in Figure 5.8. In 1998, the patentees from the United States registered the highest number of triadic patent families (14 255), closely followed by the EU (13 187) and Japan (10 033). It may be seen that compared to the figures for each individual patent office, when only patent families are taken into account, differences across the three blocks are somewhat reduced.

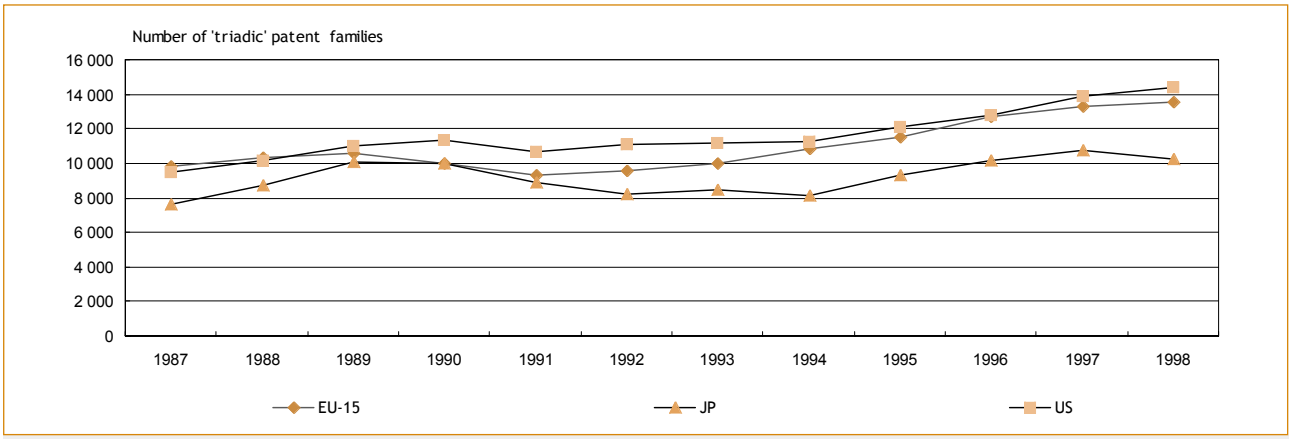
Although the upwards trend in the case of patent families is not as clear and steady as it is for individual patent offices, all the EU, Japan and the United States recorded positive annual average growth rates for the 1987-98 period. A steady upward trend is especially visible from 1993 onwards. For the 1993-98 period, the EU recorded the highest annual average growth rate of triadic patent families (6.2% per annum), followed by the United States (5.2%) and Japan (3.9%).

The distribution of triadic patent families in the OECD's total is shown in Figures 5.9. and 5.10. Although the EU accounted for the largest proportion of triadic patent families in 1987 and 1988, the United States has retained a larger proportion since, with the exception of the year 1996, when both the EU and the United States accounted for 34% of the total. The proportion of patent families by Japanese inventors increased in the late eighties, but is on a downward trend since 1990. In 1998 the United States accounted for the largest percentage of patent families in the OECD (35.7%), followed by the EU (33.5%) and Japan (25.4%).

When taking population into consideration, Japan leads ahead of the United States and the EU. As shown in Figure 5.11., during the 1987-98 period, Japanese triadic patent families per million inhabitants were well above the corresponding ratios retained by the United States and the EU. In 1998, Japan registered 81 patent families per million inhabitants, followed by the United States with 54 and the EU with 36.

Figure 5.8.

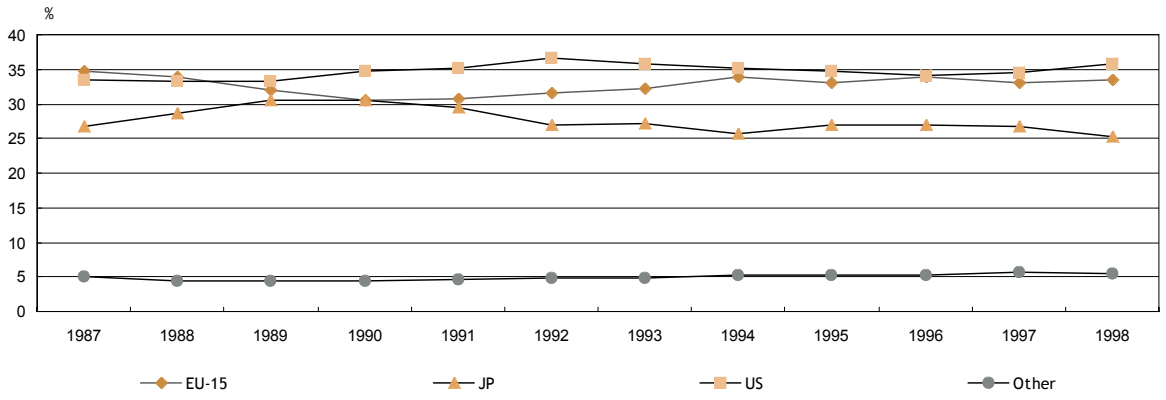
Trends of triadic patent families
EU-15, Japan and the United States
1987 to 1998 (1)



NB: Reference year corresponds to year of priority.
(1) **OECD Secretariat estimates or projections based on national sources**
EU-15, JP and US: 1997 and 1998;
EU-15 and JP: 1996.

Source: OECD MSTI 2003/1.

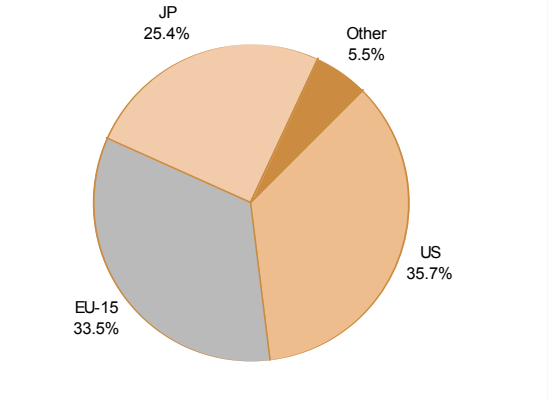
Figure 5.9. Distribution of triadic patent families in OECD total EU-15, Japan and the United States 1987 to 1998 (1)



NB: Reference year corresponds to year of priority.
(1) **OECD Secretariat estimates or projections based on national sources**
EU-15, JP and US: 1997 and 1998;
EU-15 and JP: 1996.

Source: OECD MSTI 2003/1.

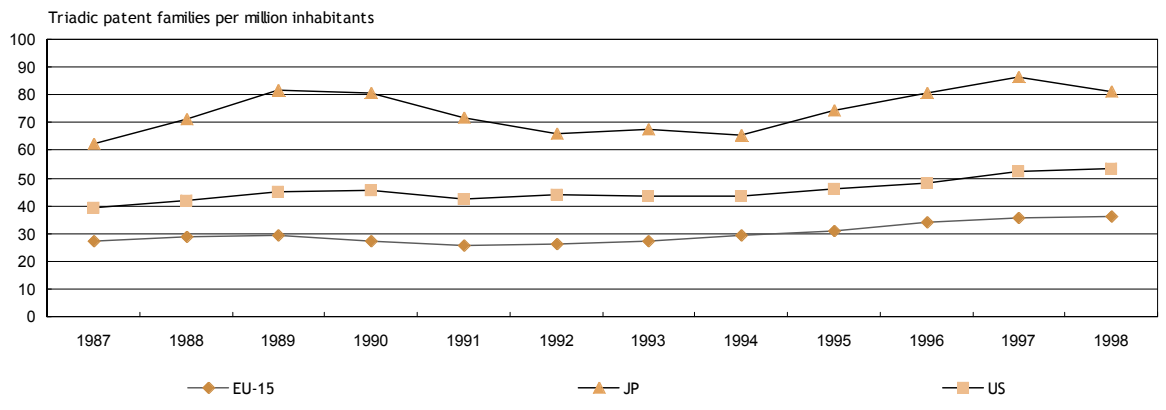
Figure 5.10. Distribution of triadic patent families in OECD total EU-15, Japan and the United States 1998 (1)



NB: Reference year corresponds to year of priority.
(1) **OECD Secretariat estimates or projections based on national sources**

Source: OECD MSTI 2003/1.

Figure 5.11. Trends of triadic patent families per million inhabitants EU-15, Japan and the United States 1987 to 1998 (1)



NB: Reference year corresponds to year of priority.
(1) EU-15 — 1999, 2000, 2001 population data: Eurostat estimates; JP and US — 2001 population data: Eurostat estimates.
OECD Secretariat estimates or projections based on national sources
EU-15, JP and US: 1997 and 1998; EU-15 and JP: 1996.

Sources: Eurostat; OECD MSTI 2003/1.

Table 5.4.

Patent applications to the EPO
EU-15, Candidate Countries, Iceland, Liechtenstein and Norway
2001 (1)

	Total number	Per million inhabitants	Distribution by IPC section in % (6)							
			A	B	C	D	E	F	G	H
EU-15 (2)	**60 890**	**161**	**15.0**	**19.4**	**14.3**	**1.9**	**4.2**	**9.8**	**16.7**	**18.8**
EUR-12 (2)	**48 516**	**160**	**14.2**	**20.8**	**14.4**	**1.9**	**4.2**	**10.4**	**15.5**	**18.5**
BE	1 558	152	14.9	18.5	28.5	3.1	3.8	6.1	13.6	11.4
DK	1 129	211	24.1	13.0	18.4	1.1	4.6	8.7	16.1	14.1
DE	25 489	310	11.7	22.3	14.8	1.7	4.1	12.6	15.4	17.4
EL (2)	82	8	22.8	16.1	11.7	-	4.3	11.0	15.3	18.7
ES	967	24	23.3	22.4	14.7	2.1	5.9	7.9	11.6	12.2
FR	8 580	145	18.3	19.0	13.9	1.1	3.7	8.1	16.9	18.9
IE (4)	327	86	21.5	13.4	8.7	0.2	3.9	3.7	25.9	22.6
IT (3)	4 318	75	21.1	27.1	11.3	3.4	5.5	11.2	9.7	10.8
LU (3)	93	211	2.8	28.4	21.5	-	9.1	21.4	8.7	8.0
NL	3 881	243	13.5	12.3	14.6	0.8	3.1	4.7	22.4	28.8
AT	1 414	174	13.6	22.2	14.6	2.3	9.1	11.4	11.6	15.1
PT (3)	56	5	24.1	20.2	22.6	1.2	8.4	11.9	5.3	6.2
FI	1 750	338	7.8	13.9	6.8	7.6	2.7	5.0	15.5	40.6
SE	3 256	367	15.8	17.6	7.6	2.7	2.9	8.9	17.3	27.3
UK (3)	7 989	133	18.1	12.6	15.7	1.2	4.7	6.3	23.4	18.1
ACC (5)	**568**	**8**	**24.3**	**13.0**	**15.7**	**2.0**	**4.1**	**9.0**	**16.3**	**15.6**
CZ	110	11	17.6	24.3	15.3	8.2	3.6	11.4	12.4	7.2
EE (4)	15	11	23.4	6.6	10.0	-	-	13.3	40.1	6.7
CY	11	14	45.4	9.1	18.2	-	-	-	9.1	18.2
LV	18	8	37.3	9.2	38.1	-	4.2	5.6	5.6	-
LT	9	2	26.7	-	51.1	-	-	-	22.2	-
HU (2)	190	19	24.3	8.3	13.0	-	3.2	4.9	24.2	22.1
MT	4	10	8.3	-	-	-	-	50.1	41.6	-
PL	97	3	23.7	17.0	12.3	1.9	7.2	14.2	12.6	11.1
SI	81	41	29.8	8.1	17.4	0.6	6.8	6.2	8.5	22.6
SK	33	6	23.0	14.6	19.9	-	-	16.7	6.1	19.7
BG	17	2	37.3	17.7	5.8	-	-	17.6	21.6	-
RO	17	1	8.8	23.5	17.7	-	7.4	11.8	1.5	29.4
TR (2)	72	1	30.6	4.2	7.6	10.4	3.5	17.4	11.1	15.3
EEA (2)	**62 259**	**163**	**15.1**	**19.4**	**14.2**	**1.8**	**4.3**	**9.8**	**16.7**	**18.7**
IS	33	117	53.8	4.5	17.7	-	-	-	13.5	10.5
LI (3)	36	1 080	29.4	27.5	14.9	-	7.0	11.2	3.6	6.3
NO	1 300	289	20.8	16.2	11.2	0.4	11.7	10.4	17.8	11.4

NB: Reference year corresponds to year of filing.
(1) 2001 provisional data.
(2) EU-15, EUR-12,EL, HU, TR and EEA — 2001 population data: Eurostat estimates.
(3) IT, LU, PT, UK and LI — 2001 population data: estimated values.
(4) IE and EE — 2001 population data: provisional value.
(5) Acceding Countries — ACC — includes: CZ, EE, CY, LV, LT, HU, MT, PL, SI and SK.
2001 population data: Eurostat estimates.
(6) A Human necessities;
B Performing operations; transporting;
C Chemistry; metallurgy;
D Textiles; paper;
E Fixed constructions;
F Mechanical engineering; lighting; heating; weapons; blasting;
G Physics;
H Electricity.

Sources: Eurostat, EPO.

5.3. Performance at the national level in Europe

Total patent applications to the EPO

Germany leads at the EPO in absolute terms, whereas Sweden and Finland are ahead as a proportion of population

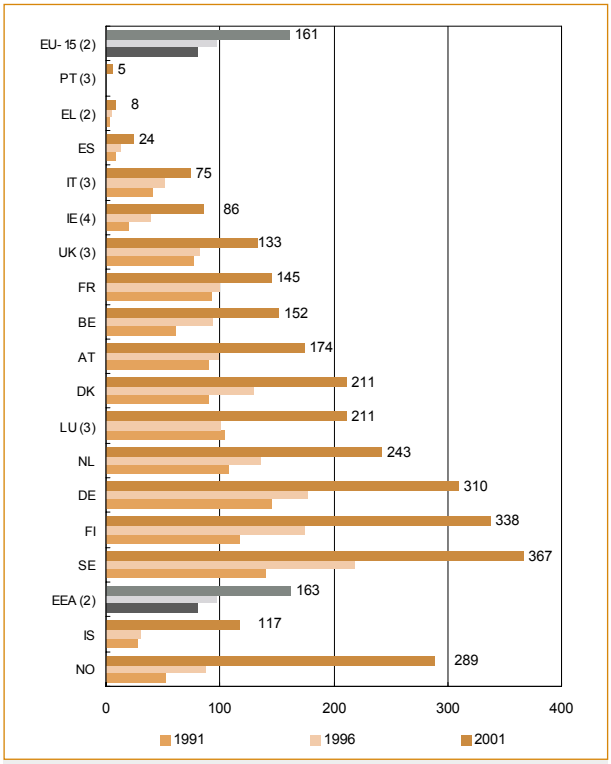
At the EU Member State level, Germany leads in absolute terms, with 25 489 patent applications in 2001 — Table 5.4. Following Germany were France (8 580) and the United Kingdom (7 989). Nevertheless, when taking population into account, with 367 and 338 patent applications per million inhabitants respectively, Sweden and Finland are ahead of Germany which retained a rate of 310 — Figure 5.12.

Although patent applications to the EPO from Acceding and Candidate Countries are still below the European Union average, Hungary (190),the Czech Republic (110 patent applications), Poland (97), Slovenia (81) and Turkey (72) applied for a higher number than the EU Member State that applied for the least amount of patents at the EPO (Portugal, 56). As a proportion of population, Slovenia was the Acceding Country that retained the highest rate (41 patent applications per million inhabitants), Followed by Hungary (19) and Cyprus (14). Eight Acceding Countries registered rates per million inhabitants above that of Portugal and six above that of Greece — Table 5.4.

Although on average the EU patent applications to the EPO in 2001 specialised in 'Performing operations; transporting — Section B' with 19.4% of the total applications, the distribution across IPC sections varies at the Member State level: 4 countries specialised in 'Human necessities — Section A', 5 in 'Performing operations; transporting — Section B', 1 in 'Chemistry; metallurgy — Section C', 2 in 'Physics — Section G' and 3 in 'Electricity — Section H' — Table 5.4.

Although the distribution across IPC sections varied among Acceding Countries, overall, they applied for most patents in the 'Human necessities — Section A' field (24.3% of total applications), which is the 4th largest section in the EU total. 'Performing operations; transporting — Section B', the largest section for the EU, was only the fifth in the Acceding Countries out of a total of 8 sections.

Figure 5.12. Patent applications to the EPO per million inhabitants EU-15, Iceland and Norway 1991, 1996 and 2001 (1)

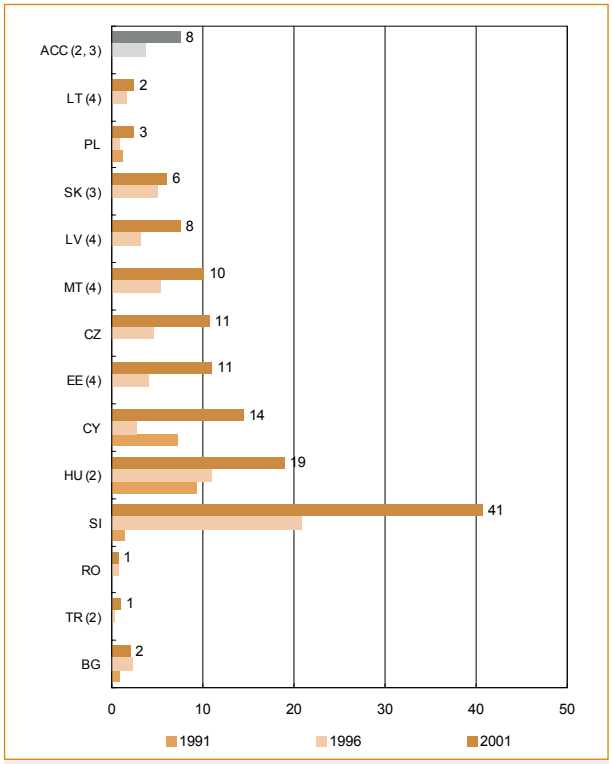


NB: Reference year corresponds to year of filing.

(1) 2001 provisional data.
(2) EU-15, EL and EEA — 2001 population data: Eurostat estimates.
(3) IT, LU, PT and UK — 2001 population data: estimated values.
(4) IE — 2001 population data: provisional value.

Sources: Eurostat, EPO.

Figure 5.13. Patent applications to the EPO per million inhabitants Candidate Countries 1991, 1996 and 2001 (1)



NB: Reference year corresponds to year of filing.

(1) 2001 provisional data.
(2) ACC, HU and TR — 2001 population data: Eurostat estimates.
(3) ACC and SK — 1991: not available.
(4) EE, MT, LV and LT — 1991: value equal to real zero.

Sources: Eurostat, EPO.

As regards the distribution of patents among EU Member States, a strong skewness towards the large European Economies may be observed both in terms of the total number of patent applications to the EPO and grants by the USPTO – Figures 5.14. and 5.15.

At the EPO, Germany accounted for the largest amount of patent applications (41.9%), followed by France (14.1%) and the United Kingdom (13.1%). Together they represented over two thirds of the EU total.

The distribution of patents granted by the USPTO is similar: Germany leads with 40.0% of the patents granted, but the United Kingdom (15.3%) is ahead of France (14.9%). Germany, the United Kingdom and France together they also represent over two thirds of the total number of patents granted by the USPTO to EU inventors.

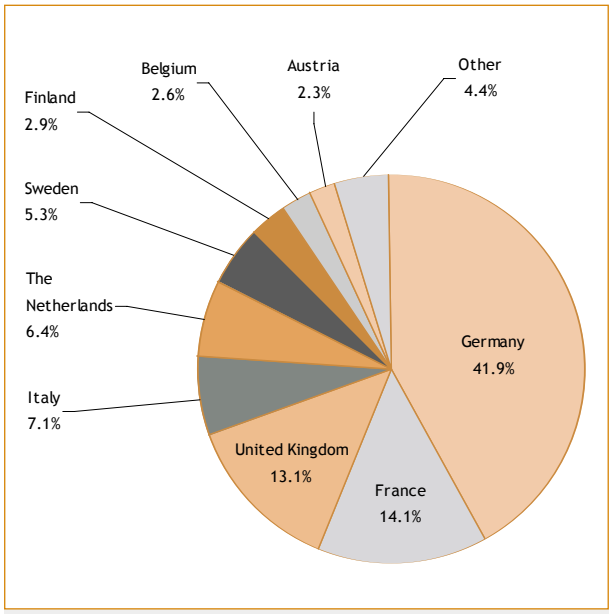
High tech patent applications to the EPO

High tech patents account for an increasing proportion of applications

Although patent applications to the EPO are overall growing for all the Member States of the EU, this is especially true for patents in the high technology fields. As shown in Table 5.5., patent applications to the EPO in the high technology fields during the 1996-2001 period grew at an annual average growth rate that doubled that of patents overall: whilst all patents grew at 11.0% per annum, high tech patents grew at 22.3%. At the Member State level, from 1996 to 2001, high tech patent applications grew faster than patents overall for all countries except Italy.

On average, in 2001 high tech patents accounted for 19.6% of the total number of applications from EU inventors. The EU Member State for which high tech patents accounted for the highest proportion of the total was Finland (40.3%), followed by Ireland (35.9%) and the Netherlands (28.3%).

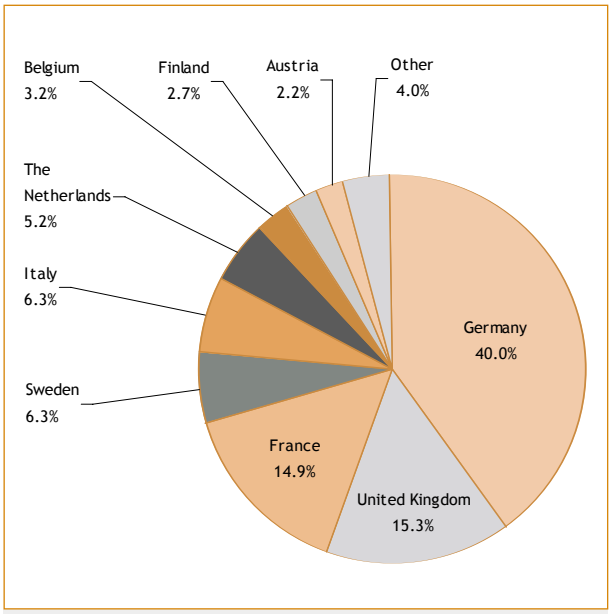
Figure 5.14. **Distribution of patent applications to the EPO EU-15 by Member State 2001**



NB: Reference year corresponds to year of filing.
(1) 2001 provisional data.

Sources: Eurostat, EPO.

Figure 5.15. **Distribution of patents granted by the USPTO EU-15 by Member State 2001**



NB: Reference year corresponds to year of publication.

Sources: Eurostat, USPTO.

Table 5.5.

High tech patent applications to the EPO
EU-15, Candidate Countries, Iceland, Liechtenstein and Norway
1991 to 2001 (1)

	High tech patent applications in 2001			Annual average growth rates in %			
				High tech patents		All patents	
	Total number	Per million inhabitants	As a % of total	1991-96	1996-2001	1991-96	1996-2001
EU-15 (2)	**11 928**	**32**	**19.6**	**9.7**	**22.3**	**4.4**	**11.0**
EUR-12 (2)	**8 673**	**29**	**17.9**	**9.1**	**22.2**	**4.5**	**11.0**
BE	240	23	15.4	12.9	14.0	9.3	10.3
DK	225	42	19.9	9.5	27.1	8.1	10.6
DE	4 017	49	15.8	8.8	24.6	4.7	11.9
EL (2)	22	2	27.0	3.1	50.4	7.2	11.4
ES	143	4	14.8	10.3	31.5	9.0	13.6
FR	1 791	30	20.9	3.0	20.1	1.9	8.2
IE (4)	117	31	35.9	20.5	36.0	15.7	18.1
IT (3)	374	6	8.7	12.6	6.8	5.0	8.3
LU (3)	5	11	5.1	-	48.6	0.7	17.5
NL	1 100	69	28.3	11.4	25.2	5.4	13.0
AT	152	19	10.8	7.5	20.1	2.3	12.3
PT (3)	7	1	12.3	2.2	64.8	11.7	30.0
FI	705	136	40.3	31.3	23.1	8.8	14.5
SE	896	101	27.5	29.5	23.0	9.8	11.1
UK (3)	2 134	36	26.7	7.6	21.7	2.0	10.6
ACC (2)	**89**	**1**	**15.6**	**:**	**37.0**	**:**	**14.8**
CZ	7	1	6.2	-	9.4	116.9	18.0
EE (4)	2	1	13.4	-	31.4	-	20.0
CY	2	3	18.2	-	-	-16.7	40.6
LV	1	0	5.6	-	-	-	17.5
LT	3	1	28.8	-	-	-	8.4
HU (2)	43	4	22.9	7.3	40.1	3.1	11.2
MT	-	-	-	-	-	-	14.8
PL	8	0	7.8	-11.5	72.5	-6.2	25.0
SI	17	9	21.4	-	63.3	69.1	14.3
SK	6	1	17.9	:	18.9	:	4.1
BG	3	0	17.6	-3.0	14.8	22.1	-2.2
RO	3	0	17.7	0.0	24.6	41.4	0.0
TR (2)	12	0	16.7	-	59.3	20.9	31.9
EEA (2)	**12 160**	**32**	**19.5**	**9.8**	**22.6**	**4.5**	**11.2**
IS	9	31	26.5	-17.9	77.4	2.8	32.7
LI (3)	-	-	-	-	-	-2.4	3.4
NO	223	50	17.2	23.2	58.5	11.6	27.9

NB: Reference year corresponds to year of filing.

(1) 2001 provisional data.
(2) EU-15, EUR-12, EL, ACC, HU, TR and EEA — 2001 population data: Eurostat estimates.
(3) IT, LU, PT, UK and LI — 2001 population data: estimated values.
(4) IE and EE — 2001 population data: provisional value.

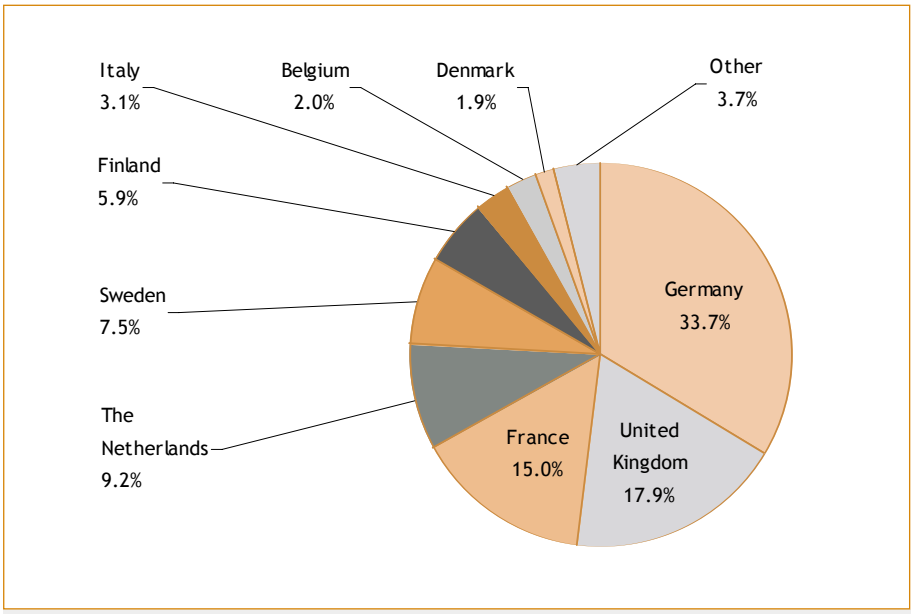
Sources: Eurostat, EPO.

In 2001, high tech patent applications to the EPO from the EU amounted to 11 928. Of these, 33.7% were applied for by German inventors, 17.9% by inventors from the UK and 15.0% by French inventors — Figure 5.16. Compared to the distribution of total patents, it may be seen that in high tech patents, the share accounted for by Germany reduces by 8.2%, whereas that of the United Kingdom and France increases by 4.8% and 0.9%, respectively.

As a proportion of population, the EU recorded an average of 32 high tech patent applications per million inhabitants. At the national level, the highest ratio was retained by Finland with 136 high tech patents per million inhabitants, followed by Sweden with 101 patent applications per million inhabitants — Figure 5.17. The Netherlands (69), Germany (49), Denmark (42) and the United Kingdom (36) also registered rates above the EU average.

As shown in Table 5.5., the number of high tech patent applications to the EPO from Acceding Countries is still relatively low. In 2001, Hungary was the Acceding Country with most patent applications in the high tech field (43). However, with 9 high tech patent applications per million inhabitants in 2001, Slovenia leads in relative terms with a rate in relation to population above those of Greece, Spain, Italy and Portugal.

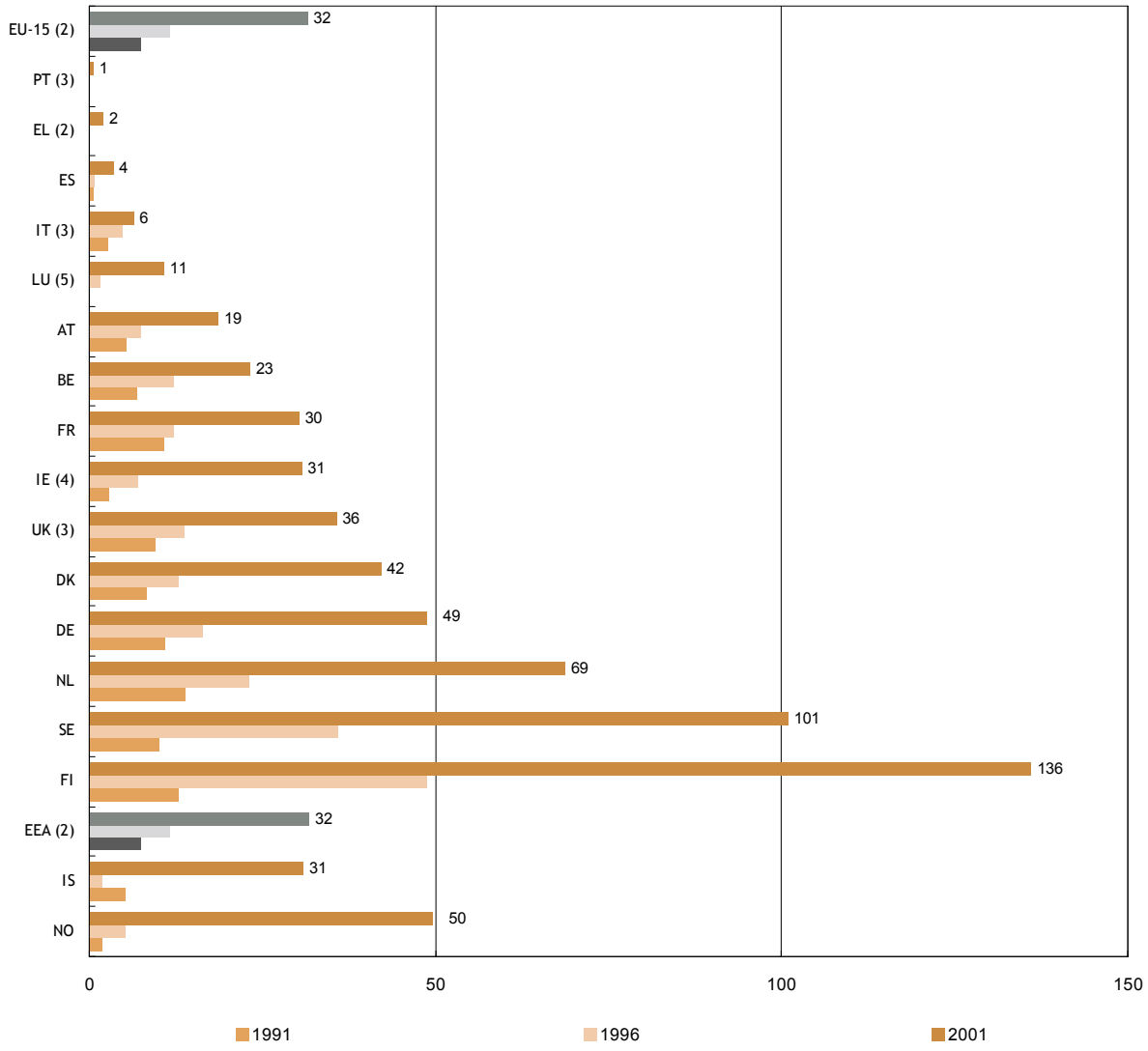
Figure 5.16. **Distribution of high tech patent applications to the EPO EU-15 by Member State 2001**



NB: Reference year corresponds to year of filing.
(1) 2001 provisional data.

Sources: Eurostat, EPO.

Figure 5.17. **Evolution of high tech patent applications to the EPO per million inhabitants EU-15, Iceland and Norway 1991, 1996 and 2001 (1)**



NB: Reference year corresponds to year of filing.

(1) 2001 provisional data.
(2) EU-15, EL and EEA — 2001 population data: Eurostat estimates.
(3) IT, PT and UK — 2001 population data: estimated values.
(4) IE — 2001 population data: provisional value.
(5) LU 1991: value equal to real zero.

Sources: Eurostat, EPO.

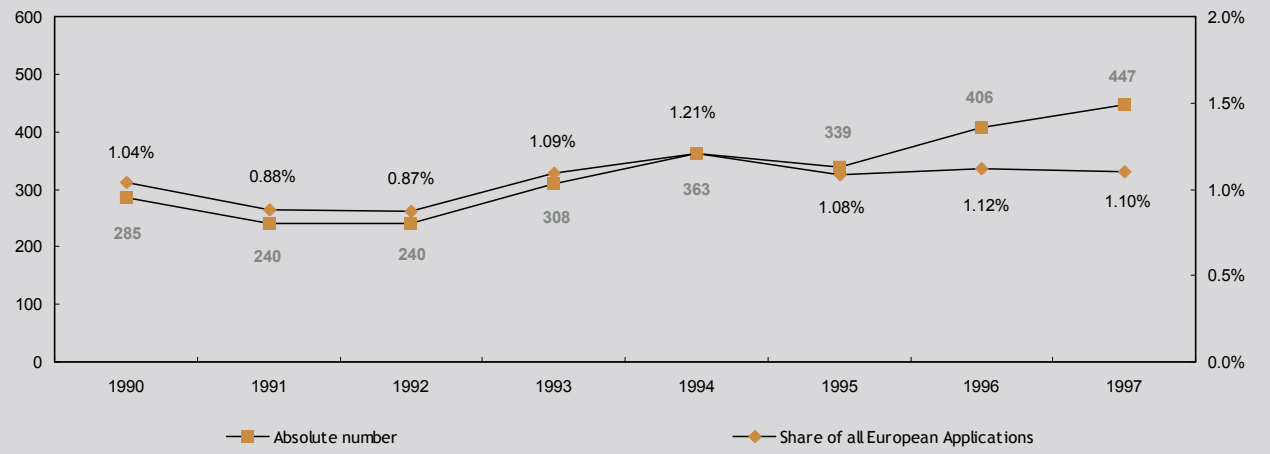
'Communication technology' accounts for almost half of all high tech patent applications from EU-15

Table 5.6. shows the distribution of high tech patent applications to the EPO by high tech group. As said earlier, high tech patents may be grouped in the following technology groups:

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

Most high tech patent applications to the EPO from EU-15 in 2001 were done in the field of 'Communication technology' (47.1% of high tech applications), which includes electrical communication systems such as telephones or television. Together with CAB, they account for 75.6% of total applications. Among Member States, Finland appears highly specialised in this field, as 80.5% of the high tech applications from Finnish inventors were done in 'Communication technology'. To a lesser extent, also Sweden (60.5%) and Netherlands (52.8%) are specialised in 'Communication technology'. 'Computer and automated business equipment' was the most important high tech group for Greece (45.4%), whereas 'Micro-organism and genetic engineering' was the largest for Denmark (36.5%). Similar exceptions to the general pattern can be noticed for Luxembourg (52.2% in CAB) and Portugal (44.9% in MGE), but due to the low absolute figures they are less striking.

Figure 5.18. **Patent applications of 50 selected companies 1990 to 1997**



Source: *Third European Report on Science and Technology Indicators*, Directorate-General for Research, 2003, p. 409.
Data: EPO — data processed by Fraunhofer-ISI.

Patenting activities and innovation in the services sectors

Services encompass a broad spectrum of activities, ranging from retailing, architectural, software consulting, engineering and to public services such as the mail system and public transportation. There is no doubt about the fact that innovation exists in these sectors. Characteristics of service innovation still allow the use of the traditional taxonomy into product (service), process, organisational and market innovations. However, traditionally, a significant part of innovation patterns in services has been 'soft' or non technological. Innovation in services is especially present in knowledge-intensive services — KIS. However, innovation in services is still relatively under explored, although with the proliferating use of Information Technology in the delivery, use and composition of services, understanding how intellectual property rights are protected in the services sectors is becoming increasingly important.

In this context, a study which intends to find empirical evidence about patenting activities of services companies has been carried out by DG Research. The study selected 50 companies and then identified all the patent applications they made to the EPO between 1990 and 1997. Figure 5.18. shows the evolution of patent applications of 50 selected services companies. Going from 285 patent applications to 447, the number of patent applications to the EPO by this group of services firms almost doubled during the 1990-97 period. However, when compared to the total of patent applications, the percentage share of the sample group is just over 1%.

For further details on Patenting activities in the services sectors please refer to:
Third European Report on Science and Technology Indicators, Dossier V p. 407 ff, http://www.cordis.lu/indicators.

Overall, the 'Communication technology' field together with 'Computer and automated business equipment' account for most high tech patent applications from the Acceding Countries — 77.9% of total applications.

Table 5.6. **Distribution of high tech patent applications to the EPO, by high tech group EU-15, Candidates Countries, Iceland, Liechtenstein and Norway 2001 (1)**

	Total number	Distribution by high tech group in % (2)					
		AVI	CAB	CTE	LSR	MGE	SMC
EU-15	11 928	1.2	28.5	47.1	1.4	13.0	8.9
EUR-12	8 673	1.4	26.2	47.4	1.3	12.9	10.9
BE	240	0.6	26.6	34.5	1.3	21.0	16.1
DK	225	0.2	26.8	33.6	0.9	36.5	2.0
DE	4 017	1.7	24.6	42.6	1.7	15.1	14.3
EL	22	2.3	45.4	29.0	-	9.8	13.6
ES	143	2.1	30.2	38.6	-	25.0	4.1
FR	1 791	2.3	31.4	46.0	1.4	11.8	7.1
IE	117	0.9	41.9	44.7	1.5	8.4	2.7
IT	374	0.5	30.0	43.4	2.5	13.1	10.6
LU	5	2.7	52.2	38.2	-	6.9	-
NL	1 100	0.2	26.7	52.8	0.1	9.3	10.8
AT	152	1.3	25.5	39.4	2.0	16.9	14.9
PT	7	-	21.7	19.1	-	44.9	14.3
FI	705	-	15.3	80.5	0.1	3.4	0.8
SE	896	0.9	26.9	60.5	1.2	6.9	3.5
UK	2 134	0.9	38.6	41.7	1.9	13.1	3.9
ACC	89	3.4	31.2	46.7	-	17.0	1.7
CZ	7	14.8	44.3	14.8	-	26.1	-
EE	2	-	50.0	-	-	50.0	-
CY	2	-	50.0	50.0	-	-	-
LV	1	100.0	-	-	-	-	-
LT	3	-	-	-	-	100.0	-
HU	43	-	35.3	55.2	-	7.3	2.3
MT	-	-	-	-	-	-	-
PL	8	13.1	30.5	32.8	-	23.6	-
SI	17	-	23.1	57.7	-	19.2	-
SK	6	-	16.9	50.6	-	24.0	8.5
BG	3	-	66.9	-	-	33.1	-
RO	3	66.7	-	-	-	-	33.3
TR	12	-	41.7	50.0	-	8.3	-
EEA	12 160	1.2	28.7	47.0	1.4	13.0	8.7
IS	9	-	22.6	28.4	-	37.5	11.4
LI	-	-	-	-	-	-	-
NO	223	1.1	38.8	43.0	1.8	14.3	0.9

NB: Reference year corresponds to year of filing.

(1) 2001 provisional data.
(2) See abbreviations on page 168.

Sources: Eurostat, EPO.

5.4. Performance at the regional level in the EEA

This section provides an insight into the regional patenting activities. The analysis covers the EEA regions with special focus on EU-15. Regions are considered at the NUTS 2 level. For Denmark and Luxembourg, the entire national territory is classified as a NUTS 2 region, which explains their potential appearance in the regional rankings.

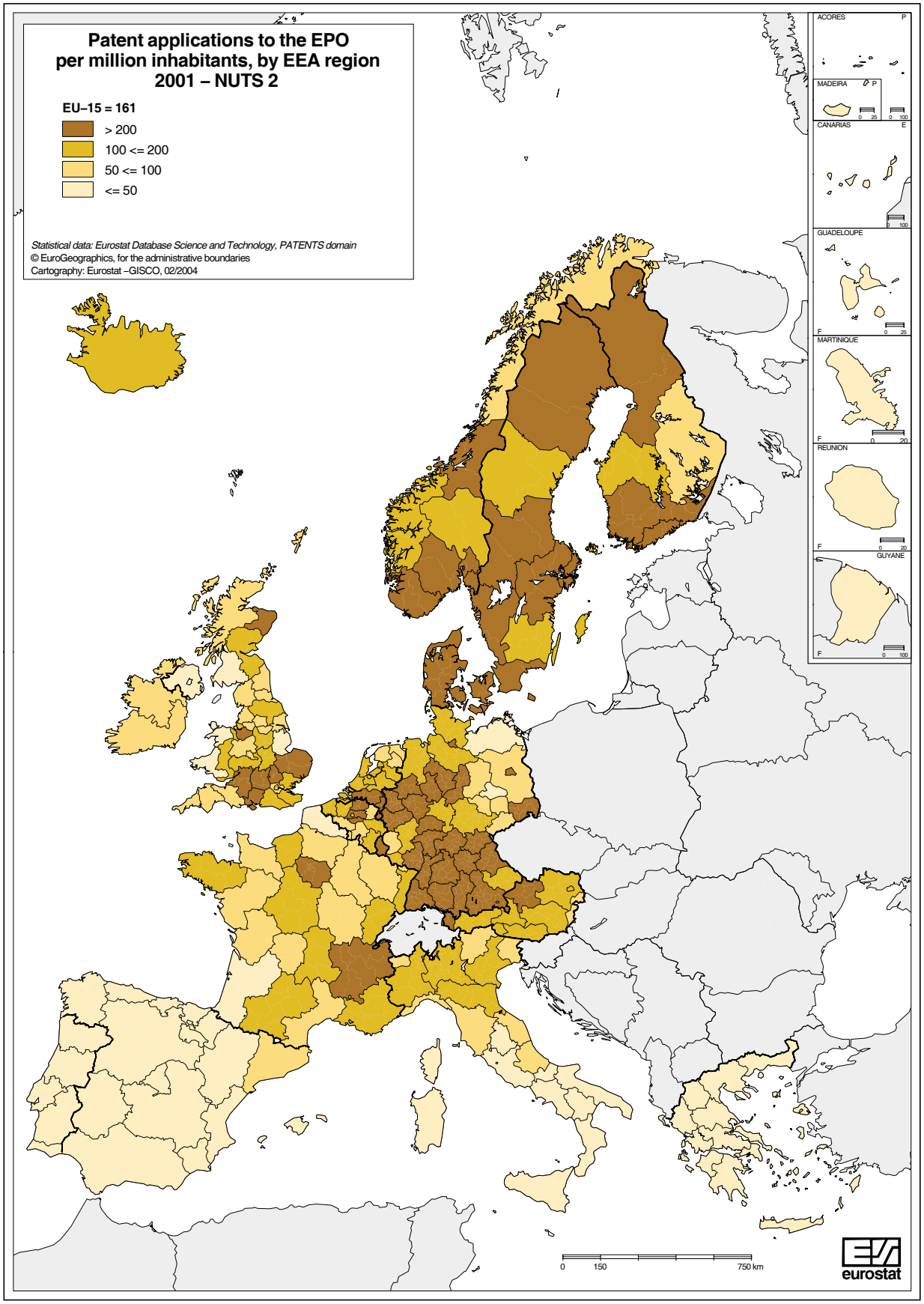
Total patent applications to the EPO

Île de France (FR) leads in absolute terms and Oberbayern (DE) as a proportion of population

Map 5.1. gives an overview of the inventive performance of the EEA regions, as it depicts the ratios of patent applications to the EPO per million inhabitants.

Patent applications to the EPO per million inhabitants in the EEA ranged from 824 in Oberbayern (DE) to zero applications in various regions of Greece (Dytiki Makedonia, Ipeiros, Anatoliki Makedonia-Thraki, Thessalia, Ionia Nisia, Voreio Aigaio), Spain (Ceuta y Melilla), France (Martinique, French Guiana) and Portugal (Acores, Madeira). Three main areas where regions with high levels of patent applications per million inhabitants are concentrated: regions in Northern Europe, in central Europe — particularly the regions surrounding Bayern and Baden-Württemberg (DE) — and the South of the United Kingdom. In addition, Île de France and Rhône-Alpes in France also feature among the leading EU regions.

Map 5.1.



NB: Reference year corresponds to year of filing.

EU-15 = 161 refers to the EU-15 average, i.e. in 2001 inventors from the EU applied at the EPO for 161 patents per million inhabitants.
2001 provisional data;
All regions of EU-15 except for those in ES, LU and DK — 2001 population data: Eurostat estimates;
LU and LI — 2001 population data: estimated values;
EU-15 — 2001 population data: Eurostat estimates.

As shown in Table 5.7., the EU region that recorded the highest ratio of patent applications to the EPO per million inhabitants in 2001 was Oberbayern (824, DE), followed by the Dutch region of Noord-Brabant (822) and Stuttgart in Germany (719).

In absolute terms, Table 5.8. illustrates that Île de France was leading, with 3 423 patent applications, ahead of Oberbayern (3 325) and Stuttgart (2 817). Out of the 211 EU regions at the NUTS 2 level, the top 15 regions ranked in Table 5.8. account for 42.9% of the total number of patent applications from the EU, showing thus a very high concentration of patenting activities.

The dominance of German regions among the leaders in patenting may be observed as 9 of the 15 leading regions both in absolute and relative terms belonged to this country. Two regions from Sweden and one region from the Netherlands, Finland, Austria and Belgium were also present in the top 15 as a proportion of population. In absolute terms, besides the 9 German regions, there were 2 regions from France and one from the Netherlands, Italy, Denmark and Sweden.

Table 5.9. shows the top three patenting regions of each Member State in absolute terms in 2001. It provides details on the total number of applications to the EPO, their ratio per million inhabitants and their corresponding distribution by IPC section.

The leading regions in absolute terms for each Member State were: Antwerp in Belgium, Oberbayern in Germany, Attiki in Greece, Cataluña in Spain, Île de France in France, Southern and Eastern in Ireland, Lombardia in Italy, Noord-Brabant in the Netherlands, Oberösterreich in Austria, Lisboa e Vale do Tejo in Portugal, Uusimaa (Suuralue) in Finland, Stockholm in Sweden and East Anglia in the United Kingdom.

Concerning the distribution by IPC section, the percentage of patent applications accounted for by each IPC section varies across countries and regions. However, leading regions are often specialised in 'Electricity — Section H' and in 'Performing operations; transporting — Section B', being therefore in line with the distribution for the EU average. The specialisation in 'Electricity — Section H' is most evident for the leading regions of Finland, Sweden and the United Kingdom.

The lead of German regions in absolute terms is also evident as regards to Table 5.9., as even the third region in this country is above the top regions of the rest of the Member States — with the exception of the French capital region of Île de France and the Dutch region of Noord-Brabant.

Table 5.7. Top fifteen patenting regions in terms of applications per million inhabitants EU-15 2001 (1)

Ranking	Country	NUTS 2 region	Patent applications: Per million inhabitants	Patent applications: Total number
1	DE	Oberbayern	824	3 325
2	NL	Noord-Brabant	822	1 937
3	DE	Stuttgart	719	2 817
4	SE	Stockholm	610	1 101
5	FI	Uusimaa (Suuralue)	582	803
6	DE	Mittelfranken	518	872
7	DE	Rheinhessen-Pfalz	494	990
8	DE	Karlsruhe	493	1 319
9	DE	Darmstadt	491	1 825
10	DE	Tübingen	481	845
11	DE	Freiburg	474	1 008
12	AT	Vorarlberg	453	158
13	BE	Brabant Wallon	448	157
14	SE	Sydsverige	435	555
15	DE	Köln	395	1 684
		EU-15	161	60 890

NB: Reference year corresponds to year of filing.

(1) 2001 provisional data.
All regions of EU-15 **except for those in DK, ES and LU** —
2001 population data: Eurostat estimates;
LU — 2001 population data: estimated values;
EU-15 — 2001 population data: Eurostat estimates.

Sources: Eurostat, EPO.

Table 5.8. Top fifteen patenting regions in terms of total number of applications EU-15 2001 (1)

Ranking	Country	NUTS 2 region	Patent applications: Total number	Patent applications: Per million inhabitants
1	FR	Île de France	3 423	312
2	DE	Oberbayern	3 325	824
3	DE	Stuttgart	2 817	719
4	NL	Noord-Brabant	1 937	822
5	DE	Darmstadt	1 825	491
6	DE	Düsseldorf	1 788	340
7	DE	Köln	1 684	395
8	IT	Lombardia	1 528	169
9	FR	Rhône-Alpes	1 383	244
10	DE	Karlsruhe	1 319	493
11	DK	Denmark	1 129	211
12	SE	Stockholm	1 101	610
13	DE	Freiburg	1 008	474
14	DE	Rheinhessen-Pfalz	990	494
15	DE	Mittelfranken	872	518
		EU-15	60 890	161

NB: Reference year corresponds to year of filing.

(1) 2001 provisional data.
All regions of EU-15 **except for those in DK, ES and LU** —
2001 population data: Eurostat estimates;
LU — 2001 population data: estimated values;
EU-15 — 2001 population data: Eurostat estimates.

Sources: Eurostat, EPO.

Table 5.9. **Top three patenting regions in terms of total number of applications EU-15 by Member State 2001 (1, 2)**

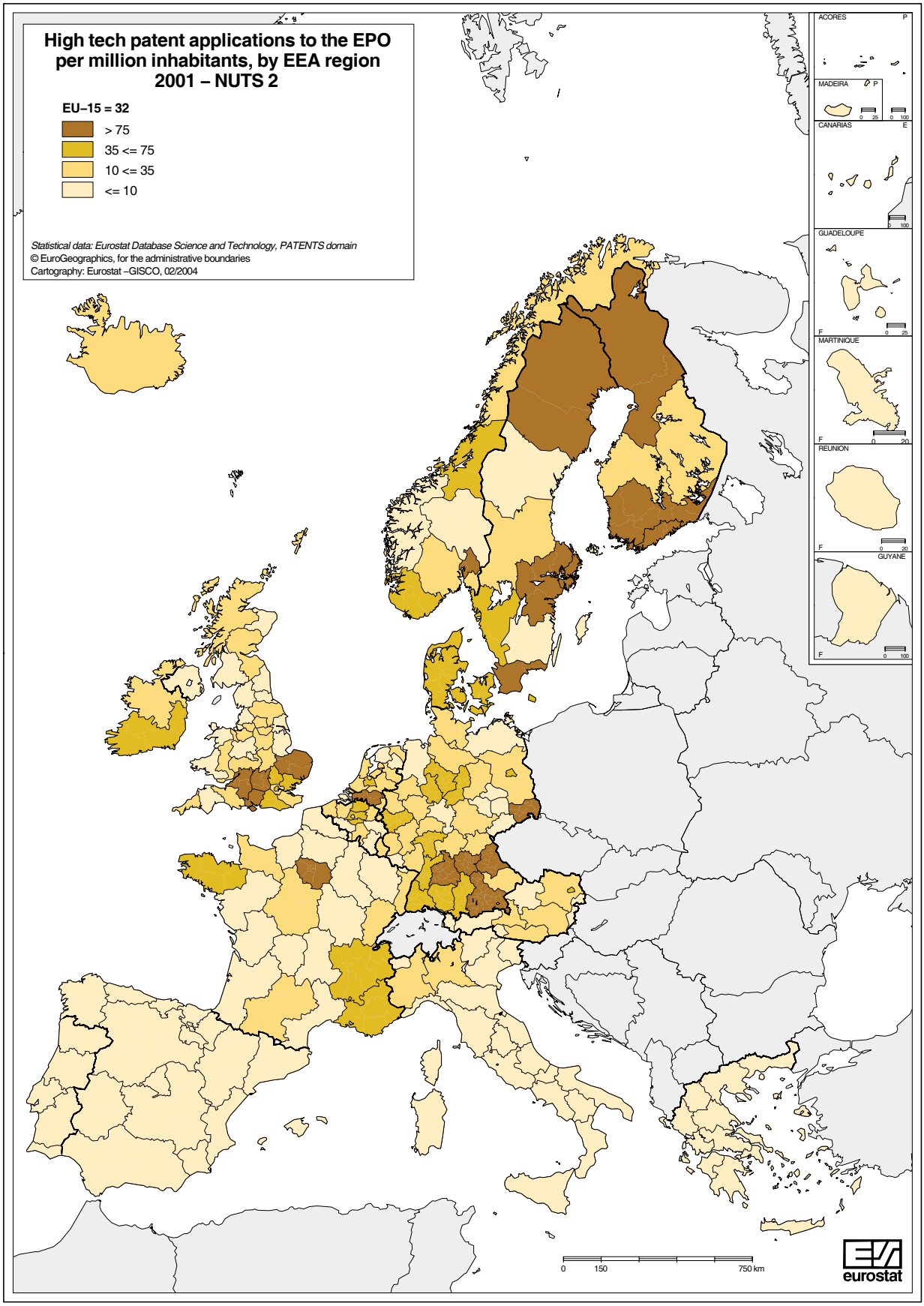
EU-15 Ranking in relative terms	Country	NUTS 2 region	Total number	Per million inhabitants	Distribution by IPC section in % (3)							
					A	B	C	D	E	F	G	H
		EU-15	60 890	161	15.0	19.4	14.3	1.9	4.2	9.8	16.7	18.8
50		Antwerpen	334	203	11.8	22.6	21.0	1.1	2.5	6.2	20.7	14.1
35	BE	Vlaams Brabant	242	238	13.7	12.7	37.4	1.8	2.5	1.8	13.5	16.6
83		Oost-Vlaanderen	174	127	20.9	13.2	22.3	2.3	3.1	3.8	16.8	17.7
46	DK	Denmark	1 129	212	24.1	13.0	18.4	1.1	4.6	8.7	16.1	14.1
1		Oberbayern	3 325	824	8.6	15.8	7.6	0.5	2.0	9.2	23.8	32.3
3	DE	Stuttgart	2 817	719	4.0	25.7	3.5	1.8	3.4	27.3	16.3	18.1
9		Darmstadt	1 825	491	16.8	21.3	29.3	1.8	2.5	7.8	9.9	10.6
172		Attiki	44	13	18.9	24.0	15.6	-	8.0	3.4	8.5	21.5
178	EL	Kentriki Makedonia	18	10	22.5	-	0.7	-	-	22.5	34.5	19.9
174		Kriti	7	12	53.8	15.1	11.1	-	-	-	-	20.0
142		Cataluna	382	62	23.9	26.2	13.2	4.0	4.7	5.5	10.9	11.6
162	ES	Comunidad de Madrid	187	36	19.0	16.3	19.0	-	3.5	4.5	16.7	20.9
167		Comunidad Valenciana	104	26	23.6	15.4	24.3	2.4	10.1	5.2	11.9	7.1
26		Île de France	3 423	312	18.8	15.7	12.1	0.3	2.9	9.7	19.3	21.3
31	FR	Rhône-Alpes	1 383	244	18.9	16.5	18.6	2.4	3.0	6.6	15.9	18.2
92		Provence-Alpes-Côte d'Azur	516	114	15.8	11.0	12.4	0.1	2.5	3.3	35.2	19.7
107	IE	Southern and Eastern	262	94	17.7	12.1	10.7	0.1	4.5	4.1	29.9	20.8
135		Border, Midlands and Western	65	66	36.9	18.7	0.8	0.5	1.5	1.9	9.8	29.9
59		Lombardia	1 528	169	20.1	22.4	14.3	4.8	4.8	9.6	10.1	13.9
56	IT	Emilia-Romagna	703	177	19.1	45.0	7.5	1.1	5.9	11.3	6.0	4.1
95		Veneto	496	110	29.3	22.7	7.6	3.1	7.3	12.0	8.8	9.1
44	LU	Luxembourg	93	211	2.8	28.4	21.5	-	9.1	21.4	8.7	8.0
2		Noord-Brabant	1 937	822	6.0	6.0	4.3	0.4	0.6	2.6	32.4	47.7
69	NL	Zuid-Holland	509	150	26.6	14.0	22.3	1.1	9.3	4.6	14.4	7.7
74		Noord-Holland	354	140	16.3	22.7	27.9	0.7	5.3	4.9	14.3	7.8
49		Oberösterreich	283	205	7.8	32.7	17.9	3.7	9.2	17.4	6.3	5.1
67	AT	Wien	251	156	19.7	15.2	14.9	0.7	4.9	2.1	21.2	21.1
53		Steiermark	221	184	7.5	26.3	19.2	3.6	8.0	9.0	10.2	16.2
186		Lisboa e Vale do Tejo	23	7	41.2	7.4	25.3	-	3.3	10.3	2.2	10.2
188	PT	Norte	21	6	19.4	34.8	26.7	3.1	-	5.1	5.3	5.7
187		Centro (PT)	11	6	1.5	11.8	11.9	-	35.8	29.9	9.0	-
5		Uusimaa (Suuralue)	803	582	8.7	10.7	8.7	7.7	1.6	2.8	15.1	44.7
23	FI	Etelä-Suomi	597	328	6.7	18.6	6.1	6.8	3.2	5.4	17.4	35.8
25		Pohjois-Suomi	180	323	8.4	10.2	2.7	1.7	1.3	3.6	12.9	59.2
4		Stockholm	1 101	610	14.3	9.8	7.2	1.1	1.9	5.6	18.9	41.1
21	SE	Västsverige	605	343	22.6	23.3	6.9	4.7	3.2	13.0	12.4	13.9
14		Sydsverige	555	435	15.4	18.4	8.0	1.4	3.2	7.4	22.1	24.1
20		East Anglia	784	356	11.7	9.0	14.1	0.4	2.9	3.4	26.2	32.3
18	UK	Berks., Bucks and Oxfords.	764	360	17.6	10.6	19.4	0.6	1.6	4.4	28.7	17.2
34		Gloucesters., Wilts. & North Somerset	522	239	12.9	12.6	5.7	2.3	3.5	4.5	28.0	30.5

NB: Reference year corresponds to year of filing.

(1) 2001 provisional data.
(2) All regions of EU-15 **except for those in DK, ES and LU —** 2001 population data: Eurostat estimates;
LU — 2001 population data: estimated values;
EU-15 — 2001 population data: Eurostat estimates.
(3) A Human necessities;
B Performing operations; transporting;
C Chemistry; metallurgy;
D Textiles; paper;
E Fixed constructions;
F Mechanical engineering; lighting; heating; weapons; blasting;
G Physics;
H Electricity.

Sources: Eurostat, EPO.

Map 5.2.



NB: Reference year corresponds to year of filing.

EU-15 = 32 refers to the EU-15 average, i.e. in 2001 inventors from the EU applied at the EPO for 32 high tech patents per million inhabitants.
2001 provisional data;
All regions of EU-15 **except for those in DK, ES and LU —** 2001 population data: Eurostat estimates.
LU and LI — 2001 population data: estimated values.
EU-15 — 2001 population data: Eurostat estimates.

High tech patent applications to the EPO

Oberbayern (DE) leads in absolute terms, as does Noord-Brabant (NL) relative to population

Map 5.2. shows the regional distribution of high tech patenting in the EU at the NUTS 2 level. In 2001, high tech patent applications per million inhabitants in the EEA regions ranged between 342 in Noord-Brabant (NL) to zero applications in various regions of Greece (Dytiki Makedonia, Ipeiros, Anatoliki Makedonia-Thraki, Thessalia, Ionia Nisia, Sterea Ellada, Voreio Aigaio), Spain (Cantabria, La Rioja, Castilla-la Mancha, Extremadura, Ceuta y Melilla), France (Corse, Martinique, Guadeloupe, French Guiana, Reunion) and Portugal (Alentejo, Algarve, Acores, Madeira).

Relative to the population, the EU region that registered the highest rate in 2001 was Noord-Brabant in the Netherlands, as it recorded a rate of 342 high tech patent applications per million inhabitants — Table 5.10. Following Noord-Brabant were the Finish region of Uusimaa (286) and Oberbayern (282) in Germany.

The top fifteen regions in terms of the total number of patent applications to the EPO in 2001 are listed in Table 5.11. The EU region that applied for most high tech patents at the EPO was Oberbayern in Germany — 1 138 high tech patent applications, followed by Île de France (886), the Dutch region of Noord-Brabant (805), Stockholm in Sweden (444) and Uusimaa in Finland (395).

It may be observed that the inventive activity in the high tech fields is more spread across the Member States of the EU and is less concentrated in German regions as it is the case for total patenting. The United Kingdom retained the largest number of regions in the top 15: 4 regions in the ranking as a proportion of population and 5 in the ranking in absolute terms.

Table 5.10. Top fifteen high tech patenting regions in terms of applications per million inhabitants EU-15 2001 (1)

Ranking	Country	NUTS 2 region	High tech patent applications: Per million inhabitants	High tech patent applications: Total number
1	NL	Noord-Brabant	342	805
2	FI	Uusimaa (Suuralue)	286	395
3	DE	Oberbayern	282	1 138
4	SE	Stockholm	246	444
5	UK	East Anglia	168	369
6	FI	Pohjois-Suomi	151	84
7	UK	Hamps. & Isle of Wight	145	258
8	SE	Sydsverige	142	181
9	FI	Etelä-Suomi	112	204
10	DE	Mittelfranken	104	175
11	UK	Berks., Bucks & Oxfords.	101	214
12	DE	Stuttgart	95	371
13	UK	Gloucesters., Wilts. & North Somerset	94	206
14	FR	Île de France	81	886
15	SE	Östra Mellansverige	80	119
		EU-15	32	11 928

NB: Reference year corresponds to year of filing.

(1) 2001 provisional data.
All regions of EU-15 **except for those in DK, ES and LU —**
2001 population data: Eurostat estimates;
LU — 2001 population data: estimated values;
EU-15 — 2001 population data: Eurostat estimates.

Sources: Eurostat, EPO.

Table 5.11. Top fifteen high tech patenting regions in terms of total number of applications EU-15 2001 (1)

Ranking	Country	NUTS 2 region	High tech patent applications: Total number	High tech patent applications: Per million inhabitants
1	DE	Oberbayern	1 138	282
2	FR	Ile de France	886	81
3	NL	Noord-Brabant	805	342
4	SE	Stockholm	444	246
5	FI	Uusimaa (Suuralue)	395	286
6	DE	Stuttgart	371	95
7	UK	East Anglia	369	168
8	UK	Hamps. & Isle of Wight	258	145
9	FR	Rhône-Alpes	240	42
10	DE	Köln	233	55
11	DK	Denmark	225	42
12	UK	Berks., Bucks & Oxfords.	214	101
13	UK	Gloucesters., Wilts. & North Somerset	206	94
14	FI	Etelä-Suomi	204	112
15	UK	Inner London	202	71
		EU-15	11 928	32

NB: Reference year corresponds to year of filing.

(1) 2001 provisional data.
All regions of EU-15 **except for those in DK, ES and LU —**
2001 population data: Eurostat estimates;
LU — 2001 population data: estimated values;
EU-15 — 2001 population data: Eurostat estimates.

Sources: Eurostat, EPO.

Table 5.12. **Top three high tech patenting regions in terms of total number of applications EU-15 by Member State 2001 (1, 2)**

EU-15 ranking in relative terms	Country	NUTS 2 region	Total number	Per million inhabitants	Distribution by high tech group in % (2)					
					AVI	CAB	CTE	LSR	MGE	SMC
		EU-15	11 928	32	1.2	28.5	47.1	1.4	13.0	8.9
40	BE	Antwerpen	62	38	1.6	37.2	45.4	0.4	7.1	8.2
26		Vlaams Brabant	51	50	-	17.6	27.7	-	23.1	31.6
50		Oost-Vlaanderen	41	30	-	14.2	38.7	6.1	25.1	15.9
35	DK	Denmark	225	42	0.2	26.8	33.6	0.9	36.5	2.0
3	DE	Oberbayern	1 138	282	1.3	26.5	47.8	1.6	6.2	16.5
12		Stuttgart	371	95	1.1	28.4	52.2	3.7	5.5	9.2
22		Köln	233	55	0.5	23.8	44.3	-	23.3	8.2
157	EL	Attiki	11	3	4.6	21.5	40.3	-	9.0	24.5
155		Kentriki Makedonia	6	3	-	83.3	16.7	-	-	-
153		Dytiki Ellada	3	4	-	100.0	-	-	-	-
116	ES	Cataluna	51	8	1.0	57.0	21.1	-	13.6	7.2
108		Comunidad de Madrid	47	9	5.3	9.2	59.7	-	21.1	4.7
148		Comunidad Valenciana	18	4	-	22.7	31.4	-	45.9	-
14	FR	Île de France	886	81	1.6	27.8	53.4	2.2	10.9	4.2
34		Rhône-Alpes	240	42	-	35.6	29.0	0.6	14.4	20.3
32		Provence-Alpes-Côte d'Azur	199	44	2.2	59.0	28.5	0.2	5.1	5.0
41	IE	Southern and Eastern	101	36	1.0	48.5	35.9	1.7	9.7	3.1
82		Border, Midlands and Western	16	16	-	-	100.0	-	-	-
75	IT	Lombardia	174	19	1.1	27.7	47.8	1.3	11.9	10.1
103		Piemonte	43	10	-	38.5	42.9	6.1	1.2	11.3
130		Lazio	31	6	-	16.2	38.0	-	34.6	11.2
98	LU	Luxembourg	5	11	2.7	52.2	38.2	-	6.9	-
1	NL	Noord-Brabant	805	342	-	27.6	57.7	0.1	1.0	13.5
65		Zuid-Holland	76	22	2.2	25.1	30.3	-	38.4	4.1
62		Noord-Holland	60	24	-	33.1	31.2	-	35.7	-
38	AT	Wien	66	41	-	22.7	55.5	1.5	19.6	0.7
71		Niederösterreich	31	20	-	25.2	50.1	1.6	20.2	2.9
95		Steiermark	14	12	-	32.5	8.8	-	29.3	29.3
171	PT	Lisboa e Vale do Tejo	5	1	-	10.6	28.1	-	40.2	21.1
182		Norte	2	1	-	48.8	-	-	51.2	-
188		Centro (PT)	0	0	-	-	-	-	100.0	-
2	FI	Uusimaa (Suuralue)	395	286	-	15.4	80.0	-	3.5	1.1
9		Etelä-Suomi	204	112	-	16.2	80.0	0.3	3.1	0.5
6		Pohjois-Suomi	84	151	-	11.2	86.2	-	2.5	-
4	SE	Stockholm	444	246	0.3	21.6	68.1	1.6	5.1	3.3
8		Sydsverige	181	142	0.6	41.1	50.9	0.2	7.0	0.3
15		Östra Mellansverige	119	80	3.4	29.7	44.1	-	16.3	6.5
5	UK	East Anglia	369	168	0.1	31.0	45.6	3.8	13.2	6.3
7		Hamps. & Isle of Wight	258	145	-	43.1	48.4	2.6	1.2	4.7
11		Berks., Bucks & Oxfords.	214	101	1.5	47.2	36.1	0.6	12.6	2.0

NB: Reference year corresponds to year of filing.
Total figures are rounded, while percentages are calculated on precise total figures as resulting from fractional counting. For example, the real values for Centro (PT) are 0.17 high tech patent applications in 2001, corresponding to a ratio of 0.096 per million inhabitants.

(1) 2001 provisional data.
All regions of EU-15 **except for those in DK, ES and LU —** 2001 population data: Eurostat estimates;
LU 2001 population data: estimated values;
EU-15 2001 population data: Eurostat estimates.

(2) See abbreviations on page 168.

Sources: Eurostat, EPO.

Details for the top three regions of each Member State in terms of the total number of high tech patent applications to the EPO are provided in Table 5.12. Information is given on the total number of high tech patent applications to the EPO, their ratio per million inhabitants and their corresponding distribution by high tech group.

The leading regions in high tech patents in absolute terms for each Member State were: Antwerp in Belgium, Oberbayern in Germany, Attiki in Greece, Cataluña in Spain, Île de France in France, Southern and Eastern in Ireland, Lombardia in Italy, Noord-Brabant in the Netherlands, Wien in Austria, Lisboa e Vale do Tejo in Portugal, Uusimaa (Suuralue) in Finland, Stockholm in Sweden and East Anglia in the United Kingdom. With the exception of Austria, the leading region by Member State in high tech patenting coincides with those of patenting overall shown in Table 5.9.

The dominance of German regions is less striking in the high tech fields. As shown in Table 5.12., the leading region of France, (Île de France), the Netherlands (Noord-Brabant), Finland (Uusimaa) and Sweden (Stockholm) applied for more patents than the second German region.

Many of the leading regions by Member State are also specialised, as the EU average is, in 'Communication technology — CTE'. A very high proportion of patent applications in the 'Communication technology' field is retained by the top three leading regions of Finland: 80.0% in Uusimaa (Suuralue) and Etelä-Suomi and 86.2% in Pohjois-Suomi. The 'Computer and automated business equipment — CAB' and the 'Micro-organism and genetic engineering — MGE' fields were also the largest for several of the leading regions. All leading Portuguese regions were specialised in the field of the 'Micro-organism and genetic engineering'. Concerning the dynamics of high tech patent applications to the EPO at the regional level, an overall upward trend may be observed.

Table 5.13. shows the ten regions with the highest growth and those with the lowest growth when taking into consideration only regions that in 2001 registered a rate per million inhabitants above the EU average.

Among these regions, the region that recorded the highest annual average growth rate of high tech patent applications during the 1996-2001 period was Västsverige in Sweden (50.4% per annum), whereas the region of the Belgian capital city of Brussels (Région Bruxelles-capitale) grew at the slowest rate (5.5% per annum).

Table 5.13. **Regions with highest and lowest growth (1) in high tech patenting EU-15 1996 to 2001 (2)**

Regions with highest growth				Regions with lowest growth			
Country	NUTS 2 region	Total number 2001	AAGR (3) 1996-2001 in %	Country	NUTS 2 region	Total number 2001	AAGR (3) 1996-2001 in %
SE	Västsverige	85	50.4	BE	Région Bruxelles-capitale	30	5.5
DE	Detmold	106	49.5	BE	Antwerpen	62	5.8
DE	Braunschweig	70	40.0	UK	Surrey, East and West Sussex	103	8.6
FR	Bretagne	158	36.6	DE	Freiburg	98	9.6
NL	Noord-Brabant	805	33.7	FI	Pohjois-Suomi	84	11.3
IE	Southern and Eastern	101	33.6	UK	Bedfordshire, Hertfordshire	74	13.0
UK	Hampshire and Isle of Wight	258	33.4	NL	Utrecht	39	13.7
SE	Övre Norrland	40	31.3	AT	Wien	66	14.1
FR	Provence-Alpes-Côte d'Azur	199	31.2	BE	Vlaams Brabant	51	14.5
UK	Inner London	202	30.0	DE	Hannover	105	16.2

NB: Reference year corresponds to year of filing.
High tech patent applications in the EU grew during the 1996-2001 period at an annual average growth rate of 22.3%.

(1) With a ratio of high tech patent applications per million inhabitants at least equal to the EU average (32).
(2) 2001 provisional data.
(3) AAGR: Annual average growth rate.

Sources: Eurostat, EPO.

6.1. Introduction

Creating, exploiting and commercialising new technologies is vital for the competitiveness of a country in the modern economy. This is because high technology sectors are key drivers for economic growth, productivity and welfare, and are generally a source of high value added and well-paid employment.

The firms which are technology-intensive are known as high technology — or high tech — firms. These firms are vital to the competitiveness position of nations because:

- they are associated with innovation and hence tend to gain a larger market share, create new product markets, and use resources more productively
- they are linked to high value-added production and success in foreign markets, which sometimes helps to support higher returns to the workers they employ
- the industrial R&D they perform has spillover effects which benefit other commercial sectors by generating new products and processes, often leading to productivity gains, business expansions, and the creation of high wage jobs.

In this context, this chapter analyses Europe's performance in high technology sectors by looking at statistics on employment, value added and labour productivity in high tech and knowledge-intensive industries as well as international trade of high technology products. In order to perceive how European countries perform in comparison to their main competitors, other leading economies are also considered whenever possible.

- Firstly, in Section 6.2. the chapter looks at the evolution and distribution of employment in high tech and knowledge-intensive sectors both at the national and regional levels. Covering the period 1997-2002, national data are given for the 15 Member States of the EU and the Candidate Countries. Regional data are analysed at the NUTS 2 level covering EU-15, Iceland and Norway. Employment in high tech and knowledge-intensive services are extracted and built up using data from the *EU Labour Force Survey* — EU LFS.

- Secondly, in Section 6.3. an overview is provided on statistics on value added and labour productivity by looking at the performance on selected sectors in 2000:
  - high tech manufacturing,
  - medium-high tech manufacturing,
  - knowledge-intensive market services and
  - high tech services.

  Here, EU and Candidate Countries are considered at the national level. These data have been obtained from *Structural Business Statistics* — SBS — database.

- Finally, in Section 6.4. the analysis describes the evolution of international high tech trade which makes up a considerable proportion of total trade in many advanced economies. The data generally cover the reference period 1996-2001 and international comparison is made between the EU, Japan and the United States. Where the relevant data are available, the Acceding Countries aggregate — ACC — is also considered. EU-15 aggregate data refer to extra EU trade, i.e. they exclude trade within the countries of the European Union. Data for individual Member States include both intra and extra EU trade, unless otherwise stated.

  All high tech trade data relating to the EU countries are based on data extracted from the *COMEXT* database — Eurostat's database of official statistics on EU's external trade and trade between EU Member States. This database includes imports and exports data flows with Member States and third countries as reported by the EU countries only. Trade data reported by third countries — including the Acceding Countries were therefore extracted from the UN statistical office's *Comtrade* database.

  For a detailed definition of high tech products and sectors please refer to the methodological notes starting on page 150.

6.2. Employment in high tech and knowledge-intensive sectors in the EU and Candidate Countries

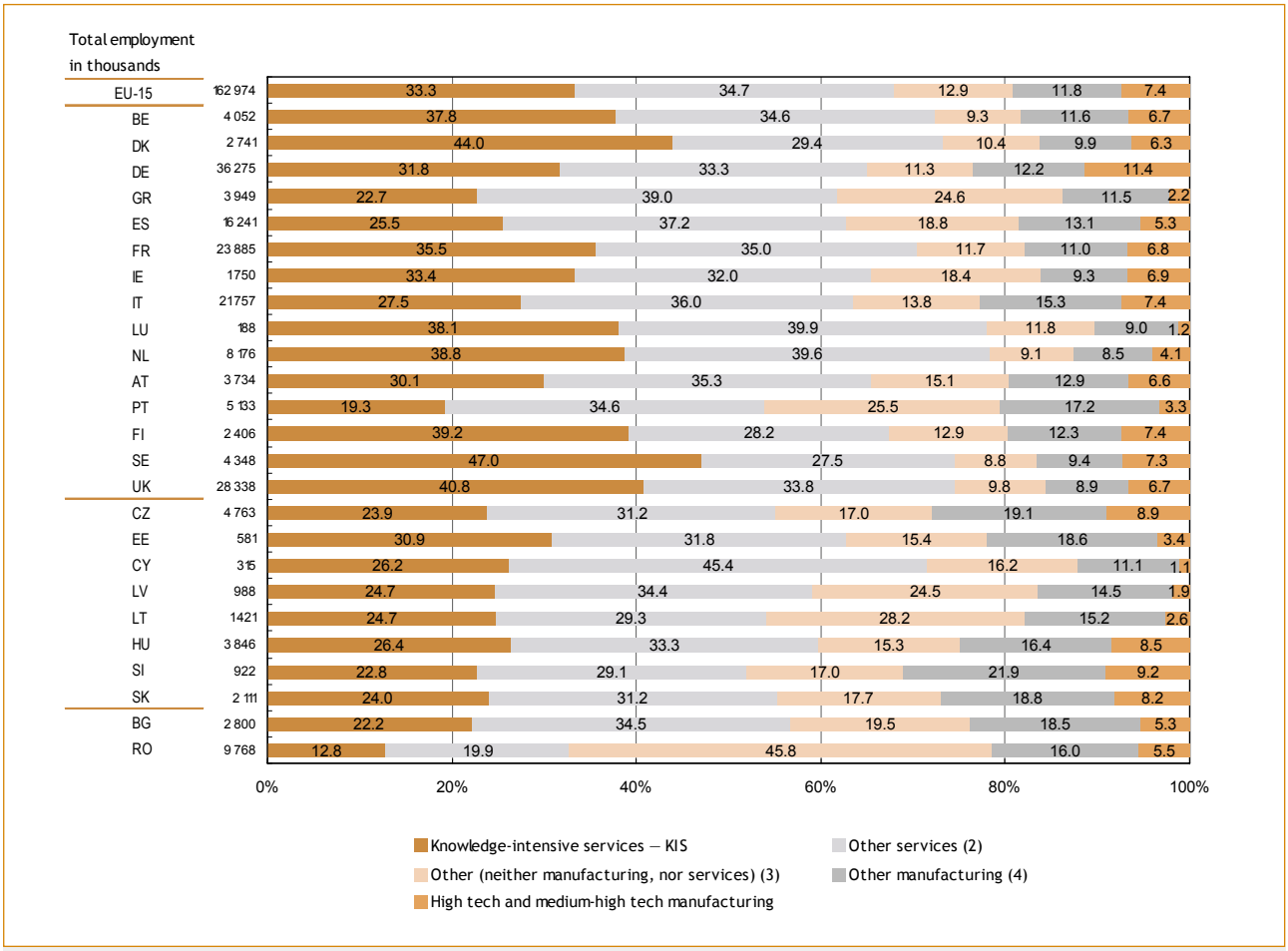
At the national level

In the EU, 33.3% of workers are employed in KIS and 7.4% in high tech and medium-high tech manufacturing

Figure 6.1. shows the distribution of employment in the EU and Candidate Countries by selected sectors in 2002. With almost 163 million people employed in the EU, services sectors accounted for 68% of total employment in 2002, among which knowledge-intensive services — KIS — are becoming increasingly important: 33.3% of total employment. Whilst high tech and medium-high tech manufacturing sectors account for 7.4% of employment, other manufacturing sectors employ 11.8% of the EU's workforce and other non manufacturing and non services sectors — i.e. agriculture, fishing, mining, construction, etc. — 12.9%.

At the Member State level, Germany was the country where high tech and medium-high tech manufacturing sectors accounted for the largest proportion, 11.4% of total employment, in 2002. Following Germany were Italy and Finland, both 7.4%. The rest of the EU Member States recorded rates that were below the EU average.

Figure 6.1. **Distribution of employment by selected sector EU-15 and Candidate Countries (1) 2002**



(1) Data for MT, PL and TR are not available, as there are not EU LFS data with the necessary breakdowns to construct high tech and knowledge-intensive employment indicators.
(2) 'Other services' refers to total services excluding knowledge-intensive services — KIS.
(3) 'Other (neither manufacturing, nor services)' refers to total economy excluding manufacturing and services sectors.
(4) 'Other manufacturing' refers to total manufacturing excluding high tech and medium-high tech manufacturing sectors.

Source: Eurostat, EU LFS — spring data.

Concerning the proportion of employment accounted for by knowledge-intensive services , in 2002, Sweden was the EU Member State most specialised in these sectors: 47.0% of total employment. With the exception of Germany, Greece, Spain, Italy, Austria and Portugal, employment in KIS accounted for a proportion above the EU average in all other Member States of the Union.

As for the Acceding Countries, Slovenia recorded the highest percentage of people employed in high tech and medium-high tech manufacturing sectors (9.2%). The Czech Republic (8.9%), Hungary (8.5%) and Slovak Republic (8.2%) also recorded rates above the EU average. As regards knowledge-intensive services, Estonia had the highest percentage of people employed in KIS (30.9%), it remains however below the EU mean.

Looking at the distribution of employment by gender, female employment appears even more skewed towards knowledge-intensive services, as 45.2% of the EU's female employment was in these sectors — Table 6.1. On the contrary, employment in knowledge-intensive services only accounted for 24.3% of male employment in the EU. Male employment seems to be more specialised in high tech and medium-high tech manufacturing sectors. These sectors accounted for 9.8% of total male employment, whereas they only represented 4.1% of the EU's female employment.

Table 6.1. **Distribution of employment by selected sector and gender**
EU-15 and Candidate Countries
2002

	Women					Men				
	KIS	Other services (1)	Other (neither manufacturing nor services) (2)	Other manufacturing (3)	High tech and medium-high tech manufacturing	KIS	Other services (1)	Other (neither manufacturing nor services) (2)	Other manufacturing (3)	High tech and medium-high tech manufacturing
EU-15	45.2	37.1	5.1	8.5	4.1	24.3	32.8	18.8	14.3	9.8
BE	50.8	35.6	2.5	7.2	3.9	28.2	33.9	14.3	14.9	8.8
DK	58.8	27.3	3.0	6.7	4.3	31.0	31.2	17.0	12.7	8.1
DE	42.8	37.6	4.7	8.9	6.0	22.9	29.9	16.6	14.8	15.6
EL	30.8	40.2	18.6	9.3	1.2	17.7	38.3	28.3	12.9	2.8
ES	37.4	43.9	6.1	9.5	3.2	18.4	33.2	26.4	15.3	6.7
FR	46.6	37.2	4.6	7.4	4.2	26.3	33.1	17.6	14.0	9.0
IE	47.9	36.9	3.2	5.8	6.2	22.9	28.5	29.3	11.9	7.4
IT	39.1	36.9	5.7	13.9	4.4	20.4	35.5	18.8	16.2	9.1
LU	51.7	40.7	2.8	3.8	1.1 u	28.9	39.4	17.8	12.5	1.3
NL	50.9	39.2	3.2	5.0	1.6	29.4	39.8	13.6	11.3	6.0
AT	40.6	40.4	8.1	7.6	3.4	21.5	31.3	20.8	17.3	9.2
PT	27.7	37.1	15.3	17.2	2.8	12.4	32.5	34.1	17.3	3.8
FI	53.4	29.2	5.3	8.3	3.8	26.0	27.2	20.0	16.1	10.7
SE	62.6	25.9	2.5	5.2	3.9	32.8	29.0	14.6	13.3	10.4
UK	52.7	35.8	2.7	5.4	3.4	31.0	32.1	15.7	11.8	9.5
CZ	35.6	33.2	6.7	17.3	7.3	14.8	29.6	24.9	20.4	10.2
EE	40.9	31.8	6.0	17.3	4.1	21.1	31.7	24.5	19.9	2.7
CY	34.1	49.5	6.1	9.1	1.2	19.9	42.2	24.2	12.7	1.0
LV	35.2	37.5	14.0	12.4	1.0	14.5	31.5	34.6	16.6	2.8
LT	36.4	29.1	16.8	16.0	1.8	13.5	29.4	39.2	14.4	3.5
HU	38.1	33.9	5.8	15.5	6.8	16.9	32.9	23.2	17.1	9.9
SI	31.1	30.8	11.2	19.1	7.7	15.8	27.6	21.9	24.2	10.5
SK	35.6	33.9	6.5	17.4	6.6	14.3	29.0	27.2	20.0	9.5
BG	30.9	32.2	11.4	21.6	3.9	14.3	36.6	26.8	15.7	6.6
RO	17.7	17.8	42.4	18.2	3.9	8.6	21.7	48.7	14.2	6.9

(1) 'Other services' refers to total services excluding knowledge-intensive services — KIS.
(2) 'Other (neither manufacturing, nor services)' refers to total economy excluding manufacturing and services sectors.
(3) 'Other manufacturing' refers to total manufacturing excluding high tech and medium-high tech manufacturing sectors.

Source: Eurostat, EU LFS — spring data.

Whilst Ireland is most specialised in employment in high tech manufacturing (3.2% of employment), Germany is in employment in medium-high tech (9.4%)

Looking at high tech and medium-high tech manufacturing sectors alone, in 2002 there were 12 million people employed in these sectors in the EU, of which over 2 million were working in high tech manufacturing sectors — Table 6.2. The EU Member State with most people employed in high tech and medium-high tech manufacturing in 2002 was Germany (4 122 thousand), followed by the United Kingdom (1 901 thousand), France (1 628 thousand) and Italy (1 603 thousand). Among the Acceding Countries, the Czech Republic registered the largest number of people employed in these sectors (425 thousand). The percentage of women in manufacturing sectors remains yet relatively low in the EU — 28.3% of people employed in total manufacturing, although this proportion is slightly higher for high tech manufacturing sectors (31.8%).

Figure 6.2. provides the breakdown of the percentage of employment accounted for by medium-high tech manufacturing sectors on the one side, and high tech manufacturing sectors on the other. Of the 7.4% of employment in high tech and medium-high tech manufacturing sectors in the EU, 6.1% corresponded to medium-high tech, whereas 1.3% to high technology. Although Germany remains as the EU Member State most specialised in medium-high tech manufacturing sectors, when looking exclusively at high tech manufacturing sectors, Ireland is ahead, as in 2002 3.2% of its labour force was employed in these sectors. This rate was almost 2.5 times larger than the EU average. The percentage of employment in high tech manufacturing sectors in Germany, France, Austria, Finland, Sweden and the United Kingdom were also equal or above the EU mean.

Among Acceding Countries, the percentage of employment accounted for by high tech manufacturing sectors in Hungary is remarkable: with a rate of 2.6% it outperformed all the EU Member States except for Ireland. The Czech Republic (1.4%) and the Slovak Republic (1.5%) also retained rates above the EU average of 1.3%.

Table 6.2.

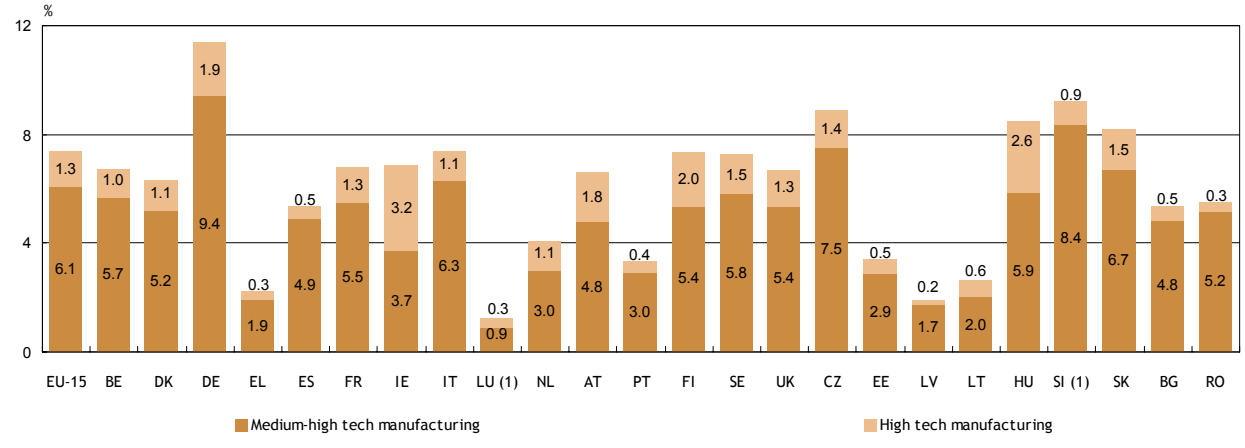
Employment in high tech and medium-high tech manufacturing in thousands and percentage of women EU-15 and Candidate Countries 2002 (1)

	Manufacturing		High tech and medium-high tech manufacturing		High tech manufacturing	
	Number of persons employed in thousands	Of which women in %	Number of persons employed in thousands	Of which women in %	Number of persons employed in thousands	Of which women in %
EU-15	31 201	28.3	12 018	24.2	2 126	31.8
BE	742	25.7	271	24.5	40	29.8
DK	444	31.6	173	31.6	30	38.1
DE	8 541	28.2	4 122	23.7	704	32.3
EL	541	29.1	87	20.1	11	: u
ES	3 000	25.7	869	22.3	77	27.2
FR	4 256	29.3	1 628	27.7	314	34.8
IE	283	30.8	120	37.6	55	42.5
IT	4 934	30.4	1 603	22.7	231	32.2
LU	19	18.9	2	34.4 u	1 u	80.2 u
NL	1 031	22.9	332	17.3	89	24.6
AT	729	25.4	246	23.3	67	28.3
PT	1 056	43.9	171	37.6	19	55.9 u
FI	474	29.7	177	25.0	48	35.5
SE	724	26.1	316	25.8	64	36.7
UK	4 428	25.2	1 901	22.5	376	27.4
CZ	1 333	38.3	425	35.5	67	48.9
EE	128	47.9	20	59.2	3	90.7
CY	39	37.1	4	48.4	: u	: u
LV	162	39.9	19	26.0	2	31.2
LT	253	48.9	38	32.5	9	: u
HU	958	40.3	327	35.8	100	49.5
SI	287	39.6	85	38.4	8 u	41.6 u
SK	570	40.8	173	37.0	32	61.1
BG	667	50.9	149	35.1	14	41.0 u
RO	2 101	47.5	537	32.8	34	37.2

Source: Eurostat, EU LFS — spring data.

Figure 6.2.

Percentage of employment in high tech and medium-high tech manufacturing sectors EU-15 and Candidate Countries 2002



(1) LU and SI — high tech manufacturing: unreliable data.

Source: Eurostat, EU LFS — spring data.

The evolution of employment in high tech and medium-high tech manufacturing sectors is considered in Table 6.3. Employment in high tech and medium-high tech in the EU grew at an annual average growth rate of 0.9% during the 1997-2002 period, compared to 0.4% of overall manufacturing. High tech manufacturing sectors instead grew at an annual average growth rate of 0.3%. Among Member States, Spain (3.9%) shows the highest annual average growth rate for the period 1997-2002, followed by Finland (3.8%); Luxembourg instead showed an average decline of 7.0%.

Hungary, the Acceding Country with the largest high tech manufacturing sector (100 thousand, see Table 6.2.), retained an annual average growth rate of 12.2% in these sectors during the 1997-2002 period. The Czech Republic, with 67 thousand people employed in high tech manufacturing sectors, according to Table 6.2., grew at 4.3% per annum — Table 6.3.

Table 6.3. **Evolution of employment in high tech and medium-high tech manufacturing EU-15 and Candidate Countries 1997 to 2002 (1)**

	Number of persons employed in thousands						Annual average growth rates in %		
	High tech and medium-high tech manufacturing						Manufacturing	High tech and medium-high tech manufacturing	High tech manufacturing
	1997	1998	1999	2000	2001	2002	1997-2002	1997-2002	1997-2002
EU-15	11 492	11 819	11 938	12 140	12 211	12 018	0.4	0.9	0.3
BE	288	279	287	284	265	271	-0.4	-1.2	-2.5
DK	169	183	173	175	190	173	-2.4	0.5	6.6
DE	3 824	3 922	3 924	4 063	4 093	4 122	0.3	1.5	2.3
EL	85	95	87	87	87	87	-0.6	0.5	10.0
ES	717	760	792	825	874	869	3.8	3.9	-0.2 u
FR	1 558	1 551	1 628	1 672	1 695	1 628	0.7	0.9	-0.7
IE	102	112	116	116	125	120	1.6	3.3	6.0
IT	1 449	1 552	1 570	1 596	1 586	1 603	1.9	2.0	1.4
LU	3	3	3	4	2	2	-2.5	-7.0	2.9 u
NL	367	359	355	350	346	332	-0.8	-2.0	0.0
AT	233	235	243	249	240	246	-0.4	1.1	0.5
PT	:	170	173	179	178	171	-2.0	0.2	-0.9
FI	147	157	169	171	179	177	2.3	3.8	4.4
SE	338	340	335	326	335	316	-0.8	-1.3	-3.3
UK	2 052	2 100	2 083	2 043	2 017	1 901	-2.4	-1.5	-3.6
CZ	426	419	415	419	430	425	-0.7	0.0	4.3
EE	28	22	23	24	28	20	-2.7	-6.5	-7.3
CY	:	:	3	3	3	4	1.7	6.4	: u
LV	:	8	9	6	17	19	-4.1	25.4	9.9
LT	:	59	61	48	47	38	-3.4	-10.7	-1.3
HU	282	310	318	307	337	327	2.3	3.0	12.2
SI	79	78	74	78	80	85	0.0	1.4	-3.2 u
SK	:	:	141	143	143	173	1.4	7.2	17.2
BG	:	:	:	161	151	149	-0.4	-3.7	-9.3
RO	751	689	642	543	531	537	-3.0	-6.5	-2.9

(1) **Exceptions to the reference year 1997**
PT, LV and LT: 1998;
CY and SK: 1999;
BG: 2000.

Source: Eurostat, EU LFS — spring data.

Sweden is the Member State most specialised in high tech services — 5.2% of employment — and also in other knowledge-intensive services (41.8%)

In 2002 there were almost 111 million people employed in services in the EU, of which more than 54 million were engaged in knowledge-intensive services — KIS. Among these, almost 6 million people worked in high tech services — Table 6.4.

At the Member State level, the largest number of people employed in knowledge-intensive services in 2002 was retained by the United Kingdom (11 552 thousand), followed by Germany (11 536 thousand), and France (8 485 thousand). Table 6.4. denotes a stronger presence of females in services sectors than in manufacturing — see Table 6.2., especially in knowledge-intensive sectors, where female employment accounts for at least 51.7% of employment not only in the EU Member States but also in each individual Candidate Country. On average, 58.5% of the people employed in KIS in the EU are females. All Candidate Countries except for Cyprus retained rates that were at least 4 percentage points above the EU average.

Table 6.4.

Employment in knowledge-intensive services in thousands and percentage of women EU-15 and Candidate Countries 2002 (1)

	Services		Knowledge-intensive services		High tech services	
	Number of persons employed in thousands	Of which women in %	Number of persons employed in thousands	Of which women in %	Number of persons employed in thousands	Of which women in %
EU-15	110 737	52.2	54 257	58.5	5 803	32.5
BE	2 935	50.7	1 531	57.1	169	25.7
DK	2 011	54.9	1 205	62.5	130	35.2
DE	23 632	55.0	11 536	60.0	1 209	34.0
EL	2 438	43.9	898	51.7	69	27.1
ES	10 189	48.6	4 148	54.9	406	35.0
FR	16 833	53.9	8 485	59.5	971	38.7
IE	1 145	54.3	584	60.1	75	32.4
IT	13 811	45.1	5 973	53.6	657	32.7
LU	147	47.5	72	54.4	4	31.2
NL	6 404	50.1	3 168	57.1	304	25.2
AT	2 444	55.6	1 124	60.6	129	30.9
PT	2 766	54.4	991	65.0	74	37.9
FI	1 622	59.2	944	65.7	114	37.2
SE	3 241	56.8	2 045	63.7	227	34.8
UK	21 120	53.5	11 552	58.3	1 265	27.1
CZ	2 622	54.5	1 138	65.0	147	50.2
EE	364	57.2	179	65.2	17	70.2
CY	226	51.3	83	57.3	6	27.8
LV	584	60.3	244	70.0	21	47.5
LT	767	59.5	351	72.2	24	45.5
HU	2 298	54.2	1 016	64.9	118	44.3
SI	479	54.7	211	62.5	22	33.0
SK	1 167	57.5	507	67.8	60	48.7
BG	1 587	52.9	621	66.2	74	53.3
RO	3 195	50.3	1 254	64.0	153	47.6

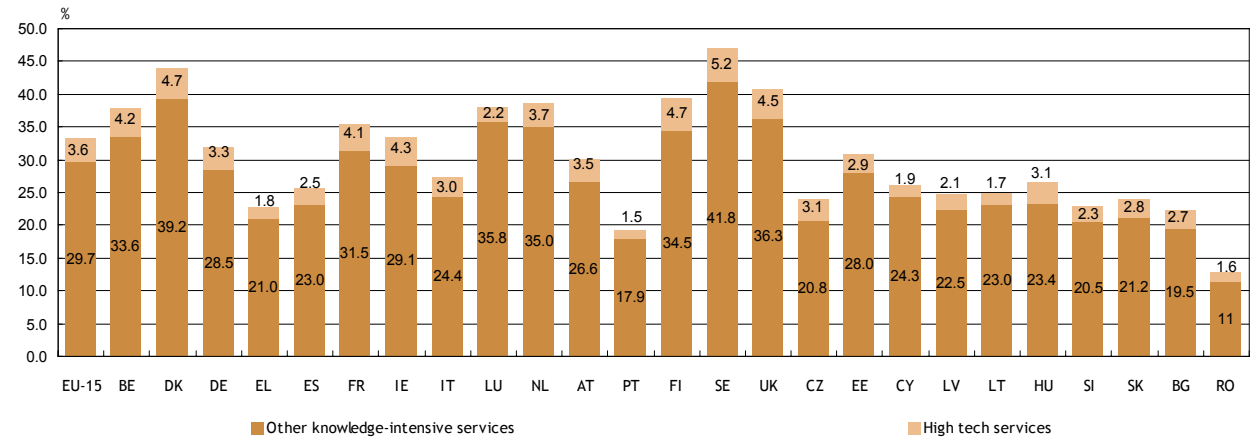
Source: Eurostat, EU LFS — spring data.

Figure 6.3. provides the breakdown of the percentage of employment accounted for by high tech services on the one hand, and other knowledge-intensive services on the other. Of the 33.3% KIS employment in the EU, 3.6% corresponded to high tech services and 29.7% to other knowledge-intensive services. The country most specialised in these sectors in 2002 was Sweden, where high tech services accounted for 5.2% of employment and other knowledge-intensive services for 41.8%. Among Acceding Countries, KIS in 2002 still retained ratios of employment below the EU average. Being the Acceding Country with most people employed in KIS — 1 138 thousand, the Czech Republic employed 3.1% and 20.8% of its workforce in high tech services and in other knowledge-intensive services, respectively. However, Estonia was the Acceding Country most specialised in KIS, as these sectors accounted for over 30% of the country's total employment.

Table 6.5. reveals that KIS are the most dynamic sectors in the EU, especially high tech services: for the 1997-2002 period, the EU recorded an annual average growth rate of 3.1% for KIS and 5.6% for high tech services, compared to 2.3% in total services and 0.4% in manufacturing — see Table 6.3. In this period, annual average growth rates for KIS were above their respective growth rates for services for all the Member States. Among Acceding Countries the situation varies: whilst KIS grew faster than services overall in Cyprus, Estonia, Hungary and Slovenia, the Czech Republic and Latvia retained equal rates. On the contrary, employment in KIS in Lithuania and Slovak Republic decreased during the 1997-2002 period.

Figure 6.3.

**Percentage of employment in knowledge-intensive services
EU-15 and Candidate Countries
2002**



Source: Eurostat, EU LFS — spring data.

Table 6.5.

**Evolution of employment in knowledge-intensive services
EU-15 and Candidate Countries
1997 to 2002 (1)**

	Number of persons employed in thousands						Annual average growth rates in %		
	Knowledge-intensive services						Services	Knowledge-intensive services	High tech services
	1997	1998	1999	2000	2001	2002	1997-2002	1997-2002	1997-2002
EU-15	**46 670**	**48 010**	**49 938**	**51 397**	**53 104**	**54 257**	**2.3**	**3.1**	**5.6**
BE	1 340	1 384	1 464	1 516	1 538	1 531	1.8	2.7	5.7
DK	1 093	1 088	1 125	1 144	1 161	1 205	1.4	2.0	4.4
DE	10 078	10 386	10 797	11 031	11 330	11 536	1.4	2.7	3.9
EL	801	863	872	875	892	898	1.9	2.3	4.7
ES	3 150	3 274	3 483	3 756	3 952	4 148	4.5	5.7	12.3
FR	7 447	7 628	7 814	8 019	8 295	8 485	2.2	2.6	4.4
IE	402	454	497	529	548	584	6.6	7.8	18.2
IT	5 031	5 236	5 404	5 581	5 756	5 973	2.2	3.5	4.6
LU	58	60	67	64	66	72	3.1	4.3	1.4
NL	2 653	2 812	2 970	3 083	3 222	3 168	3.5	3.6	6.8
AT	994	1 016	1 028	1 036	1 082	1 124	1.3	2.5	8.9
PT	:	847	910	925	954	991	3.5	4.0	3.2
FI	792	834	873	898	940	944	3.3	3.6	9.2
SE	1 728	1 732	1 840	1 886	2 002	2 045	3.0	3.4	7.5
UK	10 120	10 395	10 793	11 054	11 365	11 552	2.0	2.7	5.8
CZ	1 121	1 091	1 076	1 124	1 135	1 138	0.3	0.3	-2.4
EE	166	171	166	153	161	179	1.2	1.5	-0.1
CY	:	:	66	70	77	83	5.7	8.0	14.6
LV	:	227	241	240	238	244	1.8	1.8	3.5
LT	:	366	390	400	397	351	-0.9	-1.0	-11.2
HU	908	941	965	1 009	1 006	1 016	1.7	2.3	3.1
SI	180	193	205	203	210	211	2.4	3.2	3.6
SK	:	:	515	510	536	507	0.3	-0.5	0.7
BG	:	:	:	608	637	621	1.0	1.1	1.6
RO	1 313	1 271	1 231	1 181	1 188	1 254	-0.2	-0.9	-3.2

(1) **Exceptions to the reference year 1997**
PT, LV and LT: 1998;
CY and SK: 1999;
BG: 2000.

Source: Eurostat, EU LFS — spring data.

At the regional level

Stuttgart (DE) is the region most specialised in high tech and medium-high tech manufacturing sectors — 21.2% of employment

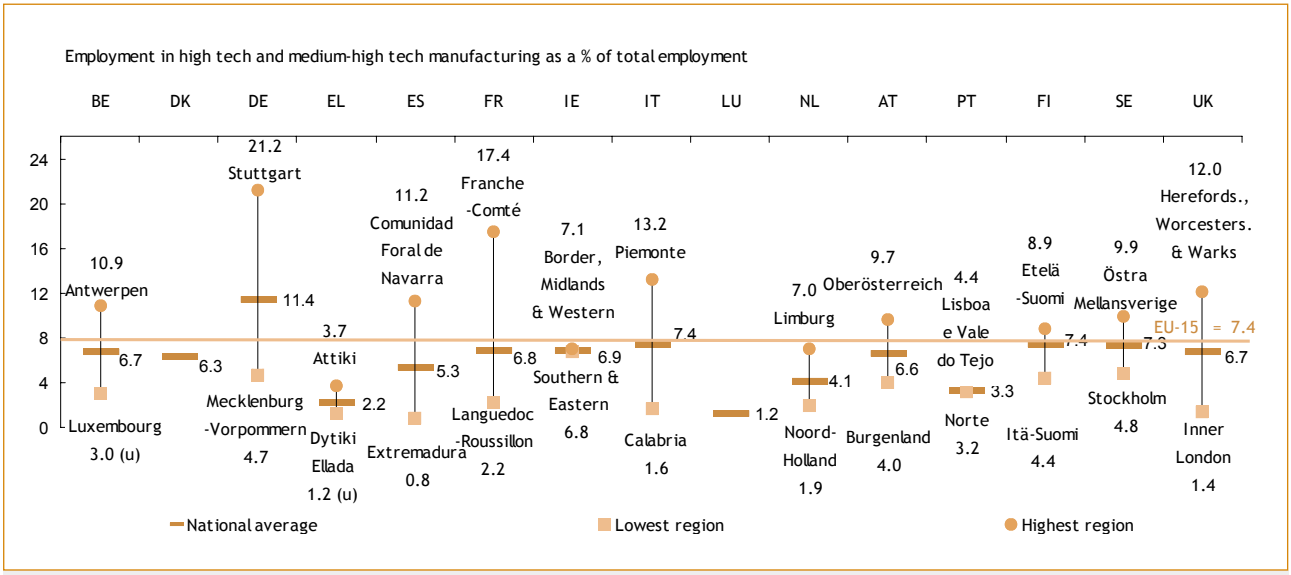
This section analyses the evolution and composition of employment in high tech and knowledge-intensive sectors in the EU, Iceland and Norway at the regional level. Readers should notice that according to the NUTS classification, for Denmark and Luxembourg the entire national territory is considered as a NUTS 0, 1 and 2 region, which explains their potential appearance in the regional ranking.

Map 6.1. provides an overview of the percentage of employment accounted for by high tech and medium-high tech manufacturing sectors in 2002 across the regions of the EU, Iceland and Norway at the NUTS 2 level. Regions specialised in high tech and medium-high tech manufacturing sectors are highly concentrated in the southern regions of Germany: Baden-Württemberg, Bayern, Rheinhessen-Pfalz and Darmstadt. Braunschweig (DE), Franche-Comté (FR), Alsace (FR) and Piemonte (IT) are also among the leading EU regions in terms of the percentage of employment in high tech and medium-high tech manufacturing sectors.

Figure 6.4. shows the regional disparities in the percentage for employment accounted for by high tech and medium-high tech manufacturing sectors across the European Union. For each Member State, this figure maps the national average, the region with the lowest percentage and the region with the highest percentage.

In 2002 the percentage of employment accounted for by high tech and medium-high tech manufacturing sectors in the EU ranged from 0.8% in Extremadura (ES) to 21.2% in Stuttgart (DE). Belgium, Germany, Spain, France, Italy, Austria, Finland, Sweden and the United Kingdom had at least one region with the percentage of employment accounted for by high tech and medium-high tech manufacturing sectors above the EU average (7.4%). Regional disparities are largest for Germany, France and Italy, with Stuttgart (21.2%), Franche-Comté (17.4%) and Piemonte (13.2%) recording the highest percentage of employment, respectively.

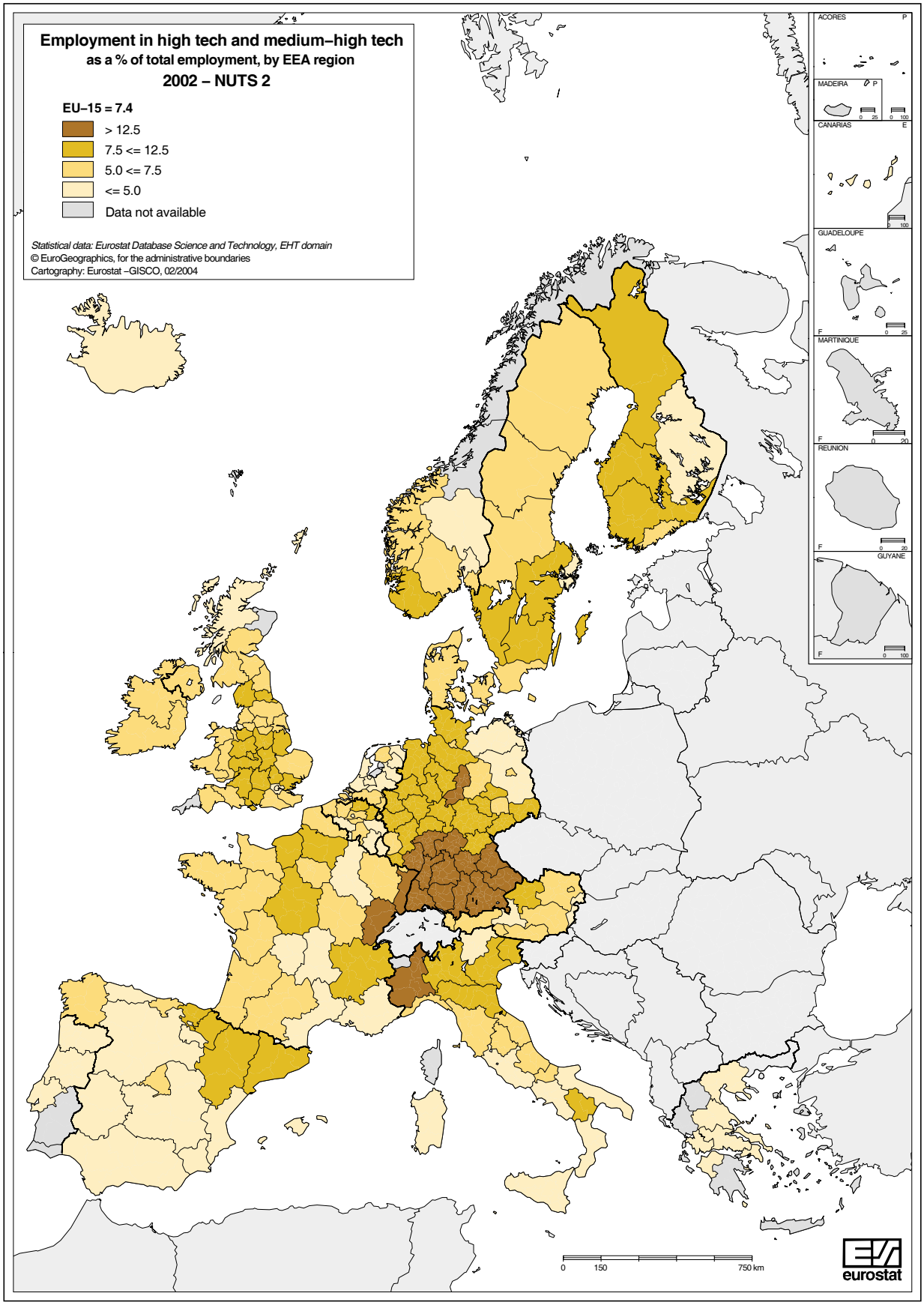
Figure 6.4. **Regional range of percentage of employment accounted for by high tech and medium-high tech manufacturing EU-15 by Member State 2002 (1)**



(1) Rankings exclude regions for which reliability levels do not permit publication according to the EU LFS.

Source: Eurostat, EU LFS — spring data.

Map 6.1.



EU-15 = 7.4 refers to the EU-15 average,
i.e. in 2002 7.4% of the EU's workforce was employed in high tech and medium-high tech manufacturing sectors.

Exception to the reference year 2002
IS: 2001.

Luxembourg (BE), Dytiki Ellada (EL), Thessalia (EL), Baleares (ES), Extremadura (ES), La Rioja (ES) and Molise (IT): unreliable data.

Table 6.6. shows the 15 leading NUTS 2 regions in the EU as regards employment in high tech and medium-high tech manufacturing in absolute terms. For these regions, details are provided on employment in total, in manufacturing and in high tech and medium-high tech sectors.

The leading EU region in absolute terms in 2002 was Lombardia (IT), as it employed 431 thousand people in high tech and medium-high tech sectors. These represented 10.7% of employment. During the 1997-2002 period, employment in high tech and medium-high tech manufacturing sectors in Lombardia grew above the EU average (0.9%) at 1.2% per annum. Following Lombardia in the ranking were Stuttgart (DE), the leading EU region in relative terms, with 401 thousand people employed and Cataluña (ES) with 287 thousand. The top 15 regions represented 31% of the EU's total employment in high tech and medium-high tech manufacturing sectors, but only 2% of the total employment in the Union.

Table 6.7. shows the 15 leading NUTS 2 regions in the EU in terms of employment in high tech and medium-high tech manufacturing in relative terms — as a percentage of total employment. As in Table 6.6., details are provided on employment in total, in manufacturing and in high tech and medium-high tech sectors.

The EU region most specialised in high tech and medium-high tech manufacturing sectors in 2002 was Stuttgart (DE), with 21.2% of employment in these sectors. During the 1997-2002 period, employment in high tech and medium-high tech manufacturing sectors in Stuttgart grew at an annual average growth rate of 1.5% above the EU average (0.9%) but below other leading regions such as Tübingen (5.1%). Employment in high tech and in medium-high tech manufacturing sectors in Tübingen accounted for 18.7% of the total employment in the region. The dominance of German regions in high tech and medium-high tech manufacturing as a percentage of total employment is noticeable, as 12 out of the 15 leading regions are situated in this country.

Table 6.6. **Leading EU regions in employment in high tech and medium-high tech manufacturing in absolute terms 2002**

	Country	NUTS 2 region	Total	Manufacturing	High tech and medium-high tech manufacturing			High tech manufacturing		
			In thousands	In thousands	In thousands	% of total employment	AAGR (1) in % 1997-2002 (2)	In thousands	% of total employment	AAGR (1) in % 1997-2002 (2)
		EU-15	162 974	31 201	12 018	7.4	0.9	2 126	1.3	0.3
1	IT	Lombardia	4 011	1 284	431	10.7	1.2	67	1.7	4.2
2	DE	Stuttgart	1 889	658	401	21.2	1.5	63	3.3	-0.8
3	ES	Cataluna	2 769	773	287	10.4	5.2	25	0.9	-1.3
4	FR	Île de France	5 029	564	286	5.7	-2.4	**75**	1.5	-3.6
5	DE	Oberbayern	2 055	486	285	13.9	2.4	54	2.6	5.5
6	DE	Darmstadt	1 753	390	237	13.5	1.5	40	2.3	4.3
7	IT	Piemonte	1 785	533	235	13.2	-0.4	23	1.3	-7.9
8	DE	Düsseldorf	2 200	505	209	9.5	-1.5	34	1.6	0.0
9	FR	Rhône-Alpes	2 376	511	205	8.6	1.5	48	2.0	1.0
10	DE	Karlsruhe	1 245	359	204	16.4	-0.1	36	2.9	-1.6
11	IT	Veneto	1 972	631	197	10.0	2.8	33	1.7	8.8
12	DE	Köln	1 832	400	197	10.7	0.6	32	1.7	-0.5
13	IT	Emilia-Romagna	1 804	499	188	10.4	2.6	20	1.1	0.7
14	DK	Denmark	2 741	444	173	6.3	0.5	30	1.1	6.6
15	DE	Arnsberg	1 559	432	163	10.4	1.9	27	1.7	7.8

(1) AAGR — Annual average growth rate.
(2) **Exceptions to the reference period 1997-2002**
Chemnitz, Dresden and Leipzig (all in DE): 2000-2002;
PT regions: 1998-2002.

Source: Eurostat, EU LFS — spring data.

Table 6.7. **Leading EU regions in employment in high tech and medium-high tech manufacturing as a percentage of total employment (1) 2002**

	Country	NUTS 2 region	Total	Manufacturing	High tech and medium-high tech manufacturing			High tech manufacturing		
			In thousands	In thousands	In thousands	% of total employment	AAGR (2) in % 1997-2002 (3)	In thousands	% of total employment	AAGR (2) in % 1997-2002 (3)
		EU-15	162 974	31 201	12 018	7.4	0.9	2 126	1.3	0.3
1	DE	Stuttgart	1 889	658	401	21.2	1.5	63	3.3	-0.8
2	DE	Tübingen	845	287	158	18.7	5.1	36	4.3	11.6
3	DE	Braunschweig	687	198	121	17.5	3.2	12	1.8	10.4
4	FR	Franche-Comté	503	161	88	17.4	2.9	19	3.8	2.1
5	DE	Karlsruhe	1 245	359	204	16.4	-0.1	36	2.9	-1.6
6	DE	Niederbayern	574	172	90	15.6	3.8	10	1.7	-1.9
7	DE	Unterfranken	619	191	96	15.6	1.9	14	2.3	4.4
8	DE	Rheinhessen-Pfalz	897	230	138	15.4	-0.6	12	1.4	1.1
9	DE	Freiburg	1 010	323	151	14.9	4.7	49	4.9	6.2
10	DE	Schwaben	845	248	122	14.5	3.3	18	2.1	8.2
11	DE	Mittelfranken	786	214	111	14.1	-0.7	20	2.5	-3.4
12	DE	Oberbayern	2 055	486	285	13.9	2.4	54	2.6	5.5
13	DE	Darmstadt	1 753	390	237	13.5	1.5	40	2.3	4.3
14	IT	Piemonte	1 785	533	235	13.2	-0.4	23	1.3	-7.9
15	FR	Alsace	767	205	100	13.0	2.7	11	1.5	0.0

(1) NUTS 2 regions are only taken into account if there are at least 80 thousand people working in high tech and medium-high tech manufacturing sectors.
(2) AAGR — Annual average growth rate.
(3) **Exceptions to the reference period 1997-2002**
Chemnitz, Dresden and Leipzig (all in DE): 2000-2002;
PT regions: 1998-2002.

Source: Eurostat, EU LFS — spring data.

During the 1997-2002 period, employment in high tech and medium-high tech manufacturing in the EU grew at an annual average growth rate of 0.9%. Table 6.8. shows the regions with the highest growth and the regions with the lowest growth in these sectors. The reader should note that, in order to avoid biases in the data presented, only regions with at least 80 thousand people working in high tech industries are taken into account for the ranking. According to Table 6.8., the most dynamic EU region during the 1997-2002 period was Southern and Eastern (IE), as it grew at an annual average growth rate of 17.0%. Following Southern and Eastern were Thüringen (DE) with a rate of 6.2% and Cataluña (ES) growing at 5.2%.

The regions where employment in high tech and medium-high tech manufacturing decreased the most during the 1997-2002 period were Gloucestershire, Wiltshire and North Sommerset in the United Kingdom (-3.6%) and Schleswig-Holstein in Germany (-3.4%).

Figures 6.5. and 6.6. show the leading regions in high technology manufacturing sectors alone.

In absolute terms, Île de France (FR) was the region that employed most people, 75 thousand, followed by Lombardia (IT) with 67 thousand and Stuttgart (DE) with 63 thousand — Figure 6.5. The leading ten regions in employment in high tech manufacturing sectors accounted for 24% of the EU's total employment in these sectors, but it barely represented a 0.4% of EU-15's total employment.

As a percentage of total employment, Freiburg (DE) was leading, as 4.9% of the people employed in this region were working in high tech manufacturing sectors compared to 1.3% in the EU overall. Following Freiburg were Tübingen (DE) and Franche-Comté (FR), with 4.3% and 3.8% of employment accounted for by high tech sectors, respectively — Figure 6.6.

Table 6.8. **EU regions with highest and lowest growth (1) in employment in high tech and medium-high tech manufacturing 1997 to 2002**

Regions with highest growth					Regions with lowest growth				
Country	NUTS 2 region	In thousands 2002	% of total employment 2002	AAGR (2) in % 1997-2002 (3)	Country	NUTS 2 region	In thousands 2002	% of total employment 2002	AAGR (2) in % 1997-2002 (3)
IE	Southern and Eastern	89	6.8	17.0	UK	Gloucesters., Wilts. & North Somerset	86	7.6	-3.6
DE	Thüringen	94	8.9	6.2	DE	Schleswig-Holstein	93	7.6	-3.4
ES	Cataluna	287	10.4	5.2	DE	Hannover	87	9.5	-3.0
DE	Tübingen	158	18.7	5.1	UK	West Midlands	120	10.6	-2.7
DE	Weser-Ems	96	9.2	4.8	FR	Île de France	286	5.7	-2.4
DE	Freiburg	151	14.9	4.7	DE	Berlin	85	5.9	-2.4
DE	Münster	106	9.9	4.0	UK	Greater Manchester	86	7.2	-1.9
DE	Niederbayern	90	15.6	3.8	NL	Noord-Brabant	84	6.8	-1.8
FR	Bretagne	80	6.4	3.8	SE	Västsverige	81	9.3	-1.7
DE	Schwaben	122	14.5	3.3	DE	Düsseldorf	209	9.5	-1.5

NB: Employment in high tech and medium-high tech manufacturing in the EU grew during the 1997-2002 period at an annual average growth rate of 0.9%.

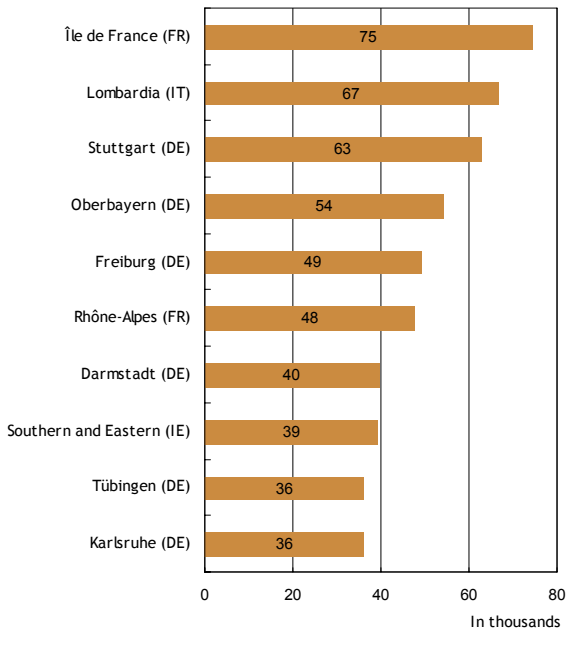
(1) NUTS 2 regions are only taken into account if there are at least 80 thousand people working in high tech and medium-high tech manufacturing sectors.

(2) AAGR — Annual average growth rate.

(3) **Exceptions to the reference period 1997-2002**
Chemnitz, Dresden and Leipzig (all in DE): 2000-2002;
PT regions: 1998-2002.

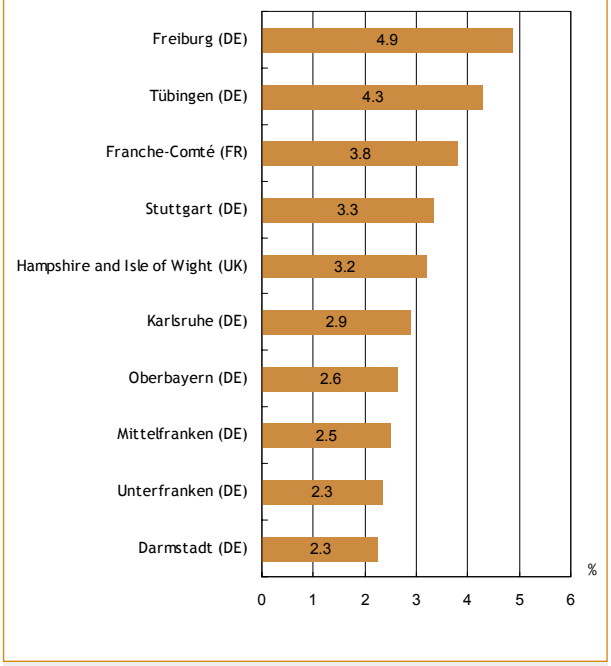
Source: Eurostat, EU LFS — spring data.

Figure 6.5. **Leading EU regions in employment in high tech manufacturing in absolute terms 2002**



Source: Eurostat, EU LFS — spring data.

Figure 6.6. **Leading EU regions in employment in high tech manufacturing as a percentage of total employment (1) 2002**



(1) NUTS 2 regions are only taken into account if there are at least 80 thousand people working in high tech and medium-high tech manufacturing sectors.

Source: Eurostat, EU LFS — spring data.

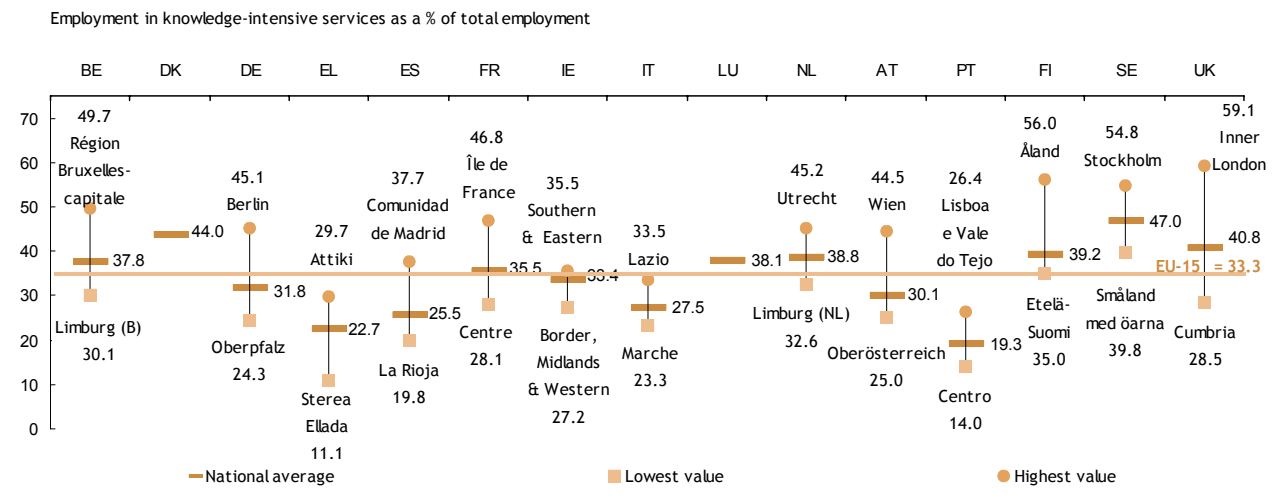
Inner London (UK) is the EU region most specialised in employment in knowledge-intensive services — 59.1% of employment

Map 6.2. shows employment in knowledge-intensive services — KIS — as a percentage of total employment for the regions of the EU, Iceland and Norway at the NUTS 2 level. It can be seen that regions where employment is most specialised in KIS are more evenly distributed across Europe than the leading regions in employment in high tech and medium-high tech showed in Map 6.1. However, it may also be observed that most specialised regions tend to be concentrated around the main European cities such as London, Paris, Brussels, Amsterdam, Copenhagen, Berlin, Hamburg and Wien. In the case of Norway and Sweden, it is not only the region of the capital city where KIS account for a large proportion of employment, but almost the entire country is highly specialised in these sectors. This may be due to the role of the public services sector, which tends to be very high in these countries, especially in social and health services sectors.

Figure 6.7. shows the regional disparities in the percentage for employment accounted for by knowledge-intensive services across the EU. For each Member State, this figure maps the national average, the region with the lowest percentage and the region with the highest percentage.

The proportion of employment accounted for by KIS sectors in the EU ranged from 11.1% in Sterea Ellada (EL) to 59.1% in Inner London (UK). With the exception of Greece and Portugal, all countries had at least one region with the percentage of employment accounted for by knowledge-intensive services above the EU average (33.3%).

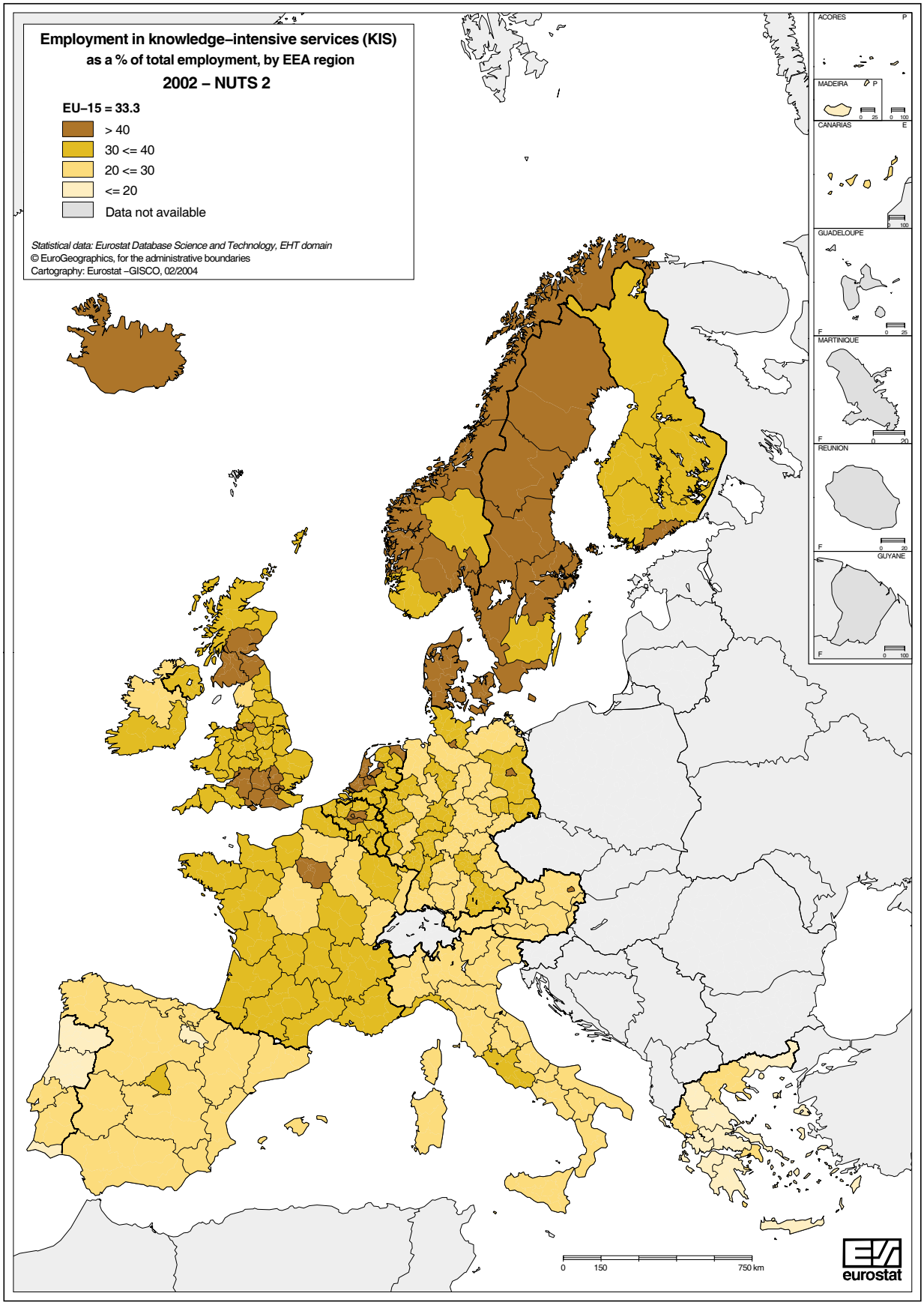
Figure 6.7. **Regional range of percentage of employment accounted for by knowledge-intensive services — KIS EU-15 by Member State 2002 (1)**



(1) Rankings exclude regions for which reliability levels do not permit publication according to the EU LFS.

Source: Eurostat, EU LFS — spring data.

Map 6.2.



EU-15 = 33.3 refers to the EU-15 average,
i.e. in 2002 33.3% of the EU's workforce was employed in knowledge-intensive services.

Exception to the reference year 2002
IS: 2001.

Table 6.9. shows the 15 leading NUTS 2 regions in the EU as regards employment in knowledge-intensive services in absolute terms. For these regions, details are provided on employment in total, in services, in knowledge-intensive services and in high tech services.

The leading EU region in absolute terms in 2002 was Île de France (FR), as it employed 2 353 thousand people in knowledge-intensive services. These represented 46.8% of the region's employment. During the 1997-2002 period, employment in knowledge-intensive services in Île de France grew above the EU average (3.1%) at 3.4% per annum. Following Île de France in the ranking were Denmark (DK) with 1 205 thousand people employed and Lombardia (IT) with 1 119 thousand. The top 15 regions amounted to 25% of the EU's total employment in knowledge-intensive services, which represented 8% of the Union's total workforce.

Table 6.10. shows the 15 leading NUTS 2 regions in the EU in terms of employment in knowledge-intensive services as a percentage of total employment. As in Table 6.9., details are provided on employment in total, in services, in knowledge-intensive services and in high tech services.

The EU region most specialised in knowledge-intensive services in 2002 was Inner London (UK), with 59.1% of employment in these sectors. During the 1997-2002 period, employment in knowledge-intensive services in Inner London grew above the EU average (3.1%) at an annual average growth rate of 4.3%. Following Inner London in this ranking were Stockholm (54.8% of employment) and Outer London (50.3%).

Table 6.9. **Leading EU regions in employment in knowledge-intensive services — KIS in absolute terms 2002**

	Country	NUTS 2 region	Total	Services	Knowledge-intensive services			High tech services		
			In thousands	In thousands	In thousands	% of total employment	AAGR (1) in % 1997-2002 (2)	In thousands	% of total employment	AAGR (1) in % 1997-2002 (2)
	EU-15		162 974	110 737	54 257	33.3	3.1	4 418	3.6	5.6
1	FR	Île de France	5 029	4 144	2 353	46.8	3.4	393	7.8	8.0
2	DK	Denmark	2 741	2 011	1 205	44.0	2.0	130	4.7	4.4
3	IT	Lombardia	4 011	2 304	1 119	27.9	3.4	144	3.6	4.5
4	UK	Outer London	2 221	1 876	1 118	50.3	2.3	153	6.9	6.8
5	ES	Comunidad de Madrid	2 318	1 728	874	37.7	8.4	153	6.6	19.1
6	FR	Rhône-Alpes	2 376	1 600	827	34.8	1.2	93	3.9	1.7
7	UK	Inner London	1 332	1 187	788	59.1	4.3	68	5.1	5.5
8	DE	Oberbayern	2 055	1 363	736	35.8	2.6	109	5.3	5.8
9	ES	Cataluna	2 769	1 629	716	25.8	4.6	77	2.8	10.8
10	NL	Zuid-Holland	1 725	1 416	700	40.6	3.3	80	4.6	6.7
11	DE	Düsseldorf	2 200	1 479	691	31.4	2.7	81	3.7	2.8
12	IT	Lazio	2 039	1 585	684	33.5	3.5	116	5.7	5.5
13	DE	Darmstadt	1 753	1 223	673	38.4	3.5	90	5.1	5.4
14	DE	Berlin	1 448	1 159	652	45.1	1.8	75	5.2	5.4
15	DE	Köln	1 832	1 279	640	34.9	2.7	73	4.0	2.8

(1) AAGR — Annual average growth rate.
(2) **Exceptions to the reference period 1997-2002**
Chemnitz, Dresden and Leipzig (all in DE): 2000-2002;
PT regions: 1998-2002.

Source: Eurostat, EU LFS — spring data.

Table 6.10. **Leading EU regions in employment in knowledge-intensive services — KIS as a percentage of total employment (1) 2002**

	Country	NUTS 2 region	Total	Services	Knowledge-intensive services			High tech services		
			In thousands	In thousands	In thousands	% of total employment	AAGR (2) in % 1997-2002 (3)	In thousands	% of total employment	AAGR (2) in % 1997-2002 (3)
	EU-15		162 974	110 737	54 257	33.3	3.1	4 418	3.6	5.6
1	UK	Inner London	1 332	1 187	788	59.1	4.3	68	5.1	5.5
2	SE	Stockholm	969	831	532	54.8	4.1	85	8.8	8.6
3	UK	Outer London	2 221	1 876	1 118	50.3	2.3	153	6.9	6.8
4	FR	Île de France	5 029	4 144	2 353	46.8	3.4	393	7.8	8.0
5	FI	Uusimaa (Suuralue)	749	592	349	46.5	4.6	59	7.9	13.0
6	UK	Surrey, East & West Sussex	1 308	1 037	602	46.0	1.6	77	5.9	3.6
7	SE	Västsverige	870	632	395	45.5	6.1	40	4.6	8.5
8	DE	Berlin	1 448	1 159	652	45.1	1.8	75	5.2	5.4
9	SE	Östra Mellansverige	716	509	318	44.5	2.9	36	5.0	4.6
10	AT	Wien	746	595	332	44.5	3.1	52	7.0	15.2
11	NL	Noord-Holland	1 345	1 132	593	44.1	3.7	52	3.9	6.3
12	DK	Denmark	2 741	2 011	1 205	44.0	2.0	130	4.7	4.4
13	UK	Berks., Bucks & Oxfords.	1 165	884	510	43.8	2.5	99	8.5	6.1
14	DE	Hamburg	792	622	344	43.4	2.6	34	4.3	7.0
15	UK	Eastern Scotland	914	689	388	42.5	3.6	28	3.1	-1.8

(1) NUTS 2 regions are only taken into account if there are at least 300 thousand people working in KIS.
(2) AAGR — Annual average growth rate.
(3) **Exceptions to the reference period 1997-2002**
Chemnitz, Dresden and Leipzig (all in DE): 2000-2002;
PT regions: 1998-2002.

Source: Eurostat, EU LFS — spring data.

During the 1997-2002 period, employment in knowledge-intensive services in the EU grew at an annual average growth rate of 3.1%. Table 6.11. shows the regions with the highest growth and the regions with the lowest growth in these sectors. The reader should note that, in order to avoid biases in the data presented, only regions with at least 300 thousand people working in knowledge-intensive services are taken into account for the ranking. According to Table 6.11., the most dynamic EU region during the 1997-2002 period was Southern and Eastern (IE), as it grew at an annual average growth rate of 31.5%. Following Southern and Eastern were Comunidad de Madrid (ES) with a rate of 8.4% and Lorraine (FR) growing at 6.4%.

The regions where employment in knowledge-intensive services grew the least during the 1997-2002 period were Kent (UK), Rhônes-Alpes (FR) and Bedfordshire, Hertfordshire (UK), which even if below the EU average, still showed a positive trend (0.9% and above).

Table 6.11. **EU regions with highest and lowest growth (1) in employment in knowledge-intensive services — KIS 1997 to 2002**

Regions with highest growth					Regions with lowest growth				
Country	NUTS 2 region	In thousands 2002	% of total employment 2002	AAGR (2) in % 1997-2002 (3)	Country	NUTS 2 region	In thousands 2002	% of total employment 2002	AAGR (2) in % 1997-2002 (3)
IE	Southern and Eastern	465	35.5	31.5	UK	Kent	304	39.8	0.9
ES	Comunidad de Madrid	874	37.7	8.4	FR	Rhône-Alpes	827	34.8	1.2
FR	Lorraine	347	33.7	6.4	UK	Bedfordshire, Hertfordshire	346	41.4	1.3
SE	Västsverige	395	45.5	6.1	UK	West Yorkshire	396	40.0	1.4
ES	Comunidad Valenciana	395	22.7	6.0	UK	South Western Scotland	390	40.5	1.5
ES	Andalucia	593	23.5	5.6	UK	Surrey, East and West Sussex	602	46.0	1.6
DE	Brandenburg	340	30.5	5.1	DE	Hannover	307	33.6	1.6
UK	Hamps. & Isle of Wight	381	41.3	4.8	UK	Essex	324	39.9	1.7
IT	Emilia-Romagna	478	26.5	4.7	FR	Provence-Alpes-Côte d'Azur	571	35.9	1.7
ES	Cataluna	716	25.8	4.6	DE	Berlin	652	45.1	1.8

NB: Employment in knowledge-intensive services in the EU grew during the 1997-2002 period at an annual average growth rate of 3.1%.

(1) NUTS 2 regions are only taken into account if there are at least 300 thousand people working in KIS.

(2) AAGR — Annual average growth rate.

(3) **Exceptions to the reference period 1997-2002**
Chemnitz, Dresden and Leipzig (all in DE): 2000-2002;
PT regions: 1998-2002.

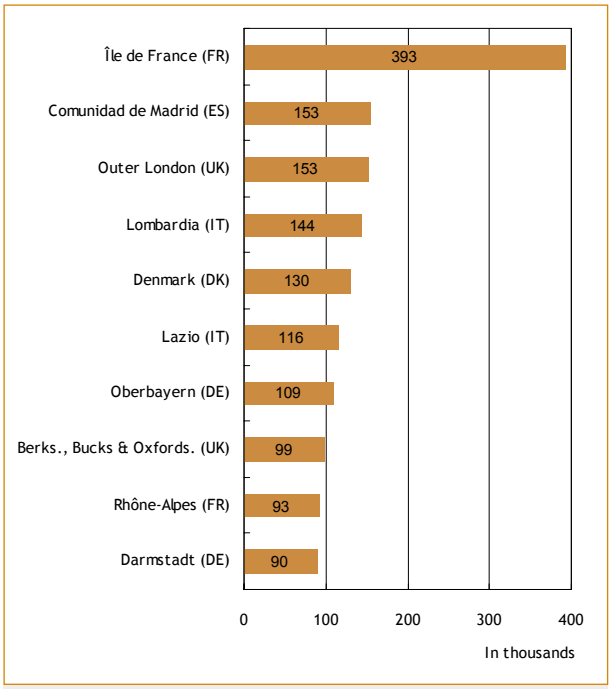
Source: Eurostat, EU LFS — spring data.

Figures 6.8. and 6.9. show the leading regions when high technology services are only taken into account.

In absolute terms, Île de France (FR) was the region that employed most people, 393 thousand, followed by Comunidad de Madrid (ES) and Outer London (UK) both with 153 thousand — Figure 6.8. The leading ten regions in employment in high tech services sectors accounted for 33% of the EU's total.

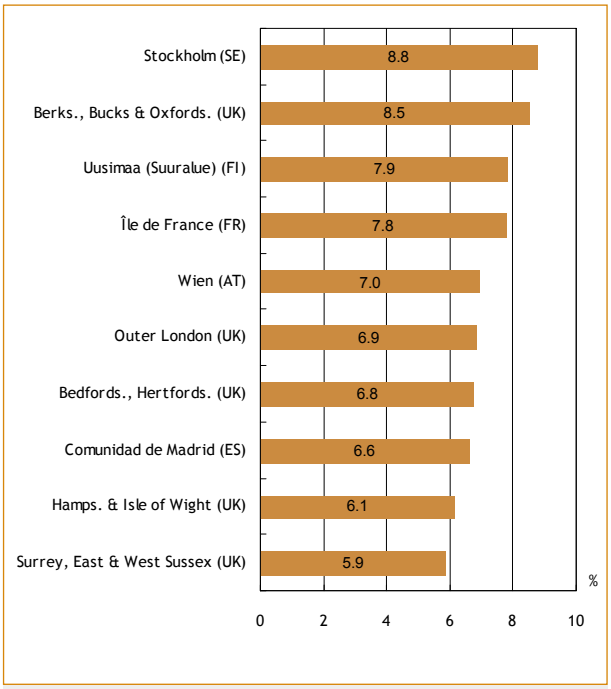
As a percentage of total employment, Stockholm (SE) was leading, as 8.8% of the people employed in this region were working in high tech services sectors compared to the EU average of 3.6%. Following Stockholm were Berkshire, Bucks and Oxfordshire (UK) and Uusimaa (Suuralue) in Finland, with 8.5% and 7.9% of employment in high tech services, respectively — Figure 6.9.

Figure 6.8. Leading EU regions in employment in high tech services in absolute terms 2002



Source: Eurostat, EU LFS — spring data.

Figure 6.9. Leading EU regions in employment in high tech services as a percentage of total employment (1) 2002



(1) NUTS 2 regions are only taken into account if there are at least 300 thousand people working in KIS.

Source: Eurostat, EU LFS — spring data.

6.3. Value added and labour productivity of high tech sectors

Table 6.12. shows the value added generated and the corresponding labour productivity in selected sectors in the EU and Candidate Countries. In 2000, manufacturing sectors recorded a value added of almost EUR 1 500 thousand million, of which EUR 453 thousand million corresponded to medium-high tech manufacturing sectors and EUR 201 thousand million to high tech manufacturing sectors. Whilst value added in knowledge-intensive market services amounted to EUR 848 thousand million, that of high tech services reached almost EUR 331 thousand million.

Whilst the labour productivity rate for overall manufacturing in the EU was EUR 52 thousand per person employed, high tech manufacturing sectors registered a rate of EUR 73 thousand per person employed. High tech services had a labour productivity of EUR 68 thousand per person employed and medium-high tech manufacturing sectors EUR 58 thousand. Knowledge-intensive market services, in turn, retained a labour productivity rate of EUR 53 thousand per person employed.

At the Member State level, Ireland recorded the highest labour productivity in manufacturing — EUR 132 thousand per person employed, high tech manufacturing — EUR 154 thousand per person employed — and medium-high tech manufacturing — EUR 244 thousand per person employed. Germany, Luxembourg and Denmark led in knowledge-intensive market services: EUR 100, EUR 60 and EUR 59 thousand per person employed, respectively. Luxembourg, instead, was the most productive Member State in high tech services — EUR 124 thousand per person employed.

Regarding Candidate Countries, productivity levels are still below the EU average, with the exception of Malta which registered relatively high rates for high tech manufacturing — EUR 73 thousand per person employed, knowledge-intensive market services — EUR 76 thousand per person employed — and high tech services — EUR 50 thousand per person employed. Malta was also the Acceding Country with the highest labour productivity in medium-high tech manufacturing sectors — EUR 33 thousand per person employed.

Table 6.12.

Value added and labour productivity in selected sector EU-15 and Candidate Countries 2000

	Manufacturing		Medium-high tech manufacturing		High tech manufacturing		Knowledge-intensive market services		High tech services	
	Value added at factor cost	Labour productivity	Value added at factor cost	Labour productivity	Value added at factor cost	Labour productivity	Value added at factor cost	Labour productivity	Value added at factor cost	Labour productivity
	Mio EUR	Thousand EUR per person employed	Mio EUR	Thousand EUR per person employed	Mio EUR	Thousand EUR per person employed	Mio EUR	Thousand EUR per person employed	Mio EUR	Thousand EUR per person employed
EU-15 (1)	1 468 402	52	453 370	58	201 121	73	848 176 u	53 u	330 534 u	68 u
BE	44 482	66	13 884	78	5 534	103	17 081	41	8 938	68
DK	24 599	50	5 903	51	3 511	79	15 745	59	5 995	56
DE	405 409	54	172 378	60	46 320	65	283 147 u	100 u	88 356 u	107 u
EL (2)	8 901	40	1 280	40	552	44	:	:	:	:
ES	100 442	39	26 230	47	6 666	57	51 091	30	17 275	50
FR	210 339	52	57 891	59	37 521	72	113 613	47	45 988	57
IE	33 812	132	11 659	244	10 201	154	5 617	48	5 600	120
IT	204 184	42	55 417	48	19 988	58	59 139	34	34 683	57
LU	2 339	68	344	69	72	44	1 698	60 u	1 264	124
NL	56 861	62	14 961	72	6 762	69	44 872	38	16 174	52
AT	35 558	57	9 750	63	4 018	71	12 508	51	5 401	53
PT	18 127	19	3 378	26	1 134	35	6 594	24	3 516	65
FI	30 748	71	5 745	59	7 301	126	7 757	46	4 135	51
SE	48 951	62	16 171	65	7 816	76	23 421 u	51 u	11 352 u	55 u
UK	243 650	59	58 379	60	43 725	82	205 893	56	81 857	69
CZ	13 391	11	4 360	12	877	12	2 580	11	2 206	21
EE	854	7	106	9	64	7	347	9	241	20
CY	975	29	76	26	35	42	:	:	:	:
LV	1 068	7	90	6	36	8	501	11	382	18
LT	:	:	:	:	:	:	338	7	326	15
HU (2)	9 342	12	3 146	16	1 333	17	1 183	10	1 957	23
MT (3)	930	32	76	33	353	73	327	76	175	50
PL	33 107	14	6 926	14	1 882	17	9 993	23	6 149	23
SI (4)	3 532	15	881	16	475	23	640	16	233	22
SK	3 059	7	856	7	173	7	574	9	595	12
BG	1 819	3	384	3	121	5	225	3	528	10
RO	6 433	4	1 421	4	319	7	656	5	1 408	10

NB: Cells flagged as 'u' refer to values partly estimated, and hence, their quality might be inferior.

(1) Knowledge-intensive market services and high tech services: EU-15 excludes EL.

(2) Exceptions to the minimum enterprise size — number of persons employed
EL: 10; HU: 5.

(3) MT: high technology services excludes K73, as no data are available for these sectors.

(4) SI: high technology services excludes K72 and K73, as no data are available for these sectors.

Source: Eurostat, SBS.

6.4. International trade of high technology products

Global high tech trends

In 2001, high tech exports accounted for 29%, 25% and 20% of total exports in the United States, Japan and the EU, respectively. High tech imports accounted for 19% of total imports for the United States and Japan and 21% for the EU

The evolution of the proportion of trade represented by high tech products between 1996 and 2001 in the EU, Acceding Countries, Japan and the United States is shown in Figures 6.10. (exports) and 6.11. (imports). During this period, high tech exports for the United States accounted for 26-30% of their total exports. This proportion was between 25-27% for Japan, but lower for EU-15 — between 16-20% — and even less for the Acceding Countries — between 5-11%.

The proportion of high tech exports accounted for by high tech products during the 1996-2001 period increased for the EU, Acceding Countries and the United States. However, a slight decrease was registered by Japan.

Looking at imports in Figure 6.11., less than 21% of the total imports for the United States and Japan were accounted for by high tech products during the 1996-2001 period. For the EU, this was also the case up to 1997 after which the high tech proportion of total imports rose up to nearly 23% in 2000 and declined in 2001 to 21%. High tech imports for the Acceding Countries accounted between 10% and 14% of total imports.

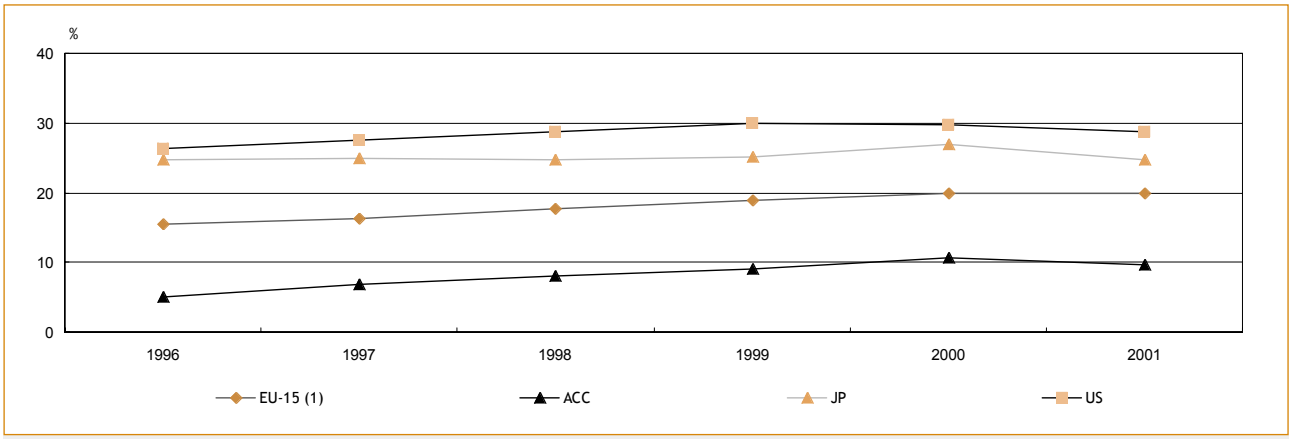
Figure 6.12. shows the high tech exports and imports for the EU and Acceding Countries aggregates as well as the world leading countries in 2001. The United States appears as the leading country in the world both as an exporter and as an importer of high tech products closely followed by the EU. However, amounting to EUR 23 thousand million, the EU had the largest high tech trade deficit.

Japan is the third leading high tech exporter, but it has the highest high tech trade balance surplus of EUR 39 thousand million. Among the EU countries, Germany, France, United Kingdom and the Netherlands feature in the top exporters and importers of high tech products, all with a positive high tech trade balance.

In the United States and Japan, high tech imports as a percentage of total imports are for every year below the corresponding percentage of high tech exports — see Figures 6.10. and 6.11., resulting thus in a positive trade balance for Japan and a minor negative balance for the United States. However, the reverse is true for the EU Member States and the Acceding Countries, where the high tech imports percentage is always slightly higher than the corresponding exports percentage, leading thus to negative high tech trade balances as shown in Figure 6.12.

Figure 6.10.

**High tech exports as a percentage of total exports
EU-15, Acceding Countries, Japan and the United States
1996 to 2001**

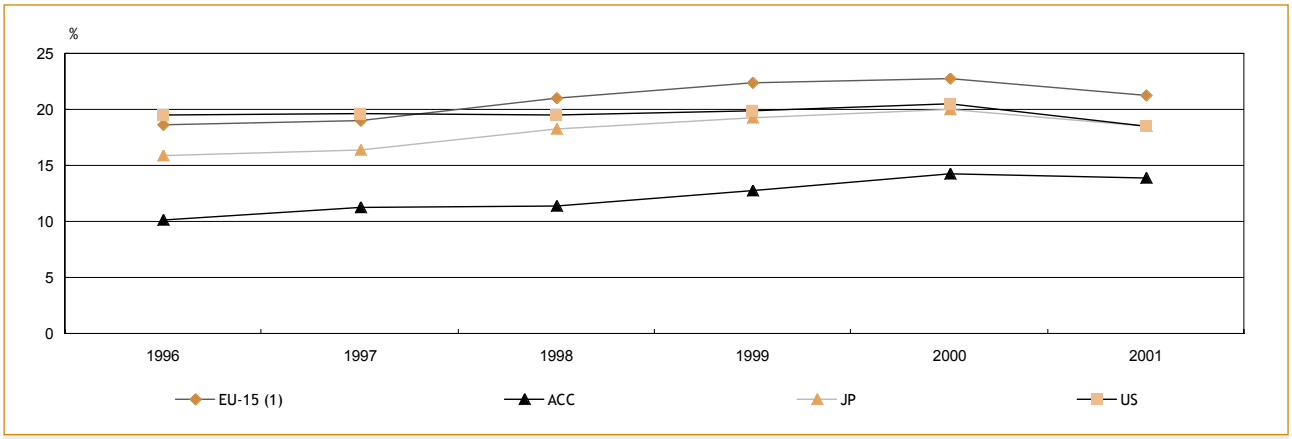


(1) EU-15 includes extra-EU trade only.

Sources: Eurostat, Comext; UN, Comtrade.

Figure 6.11.

**High tech imports as a percentage of total imports
EU-15, Acceding Countries, Japan and the United States
1996 to 2001**

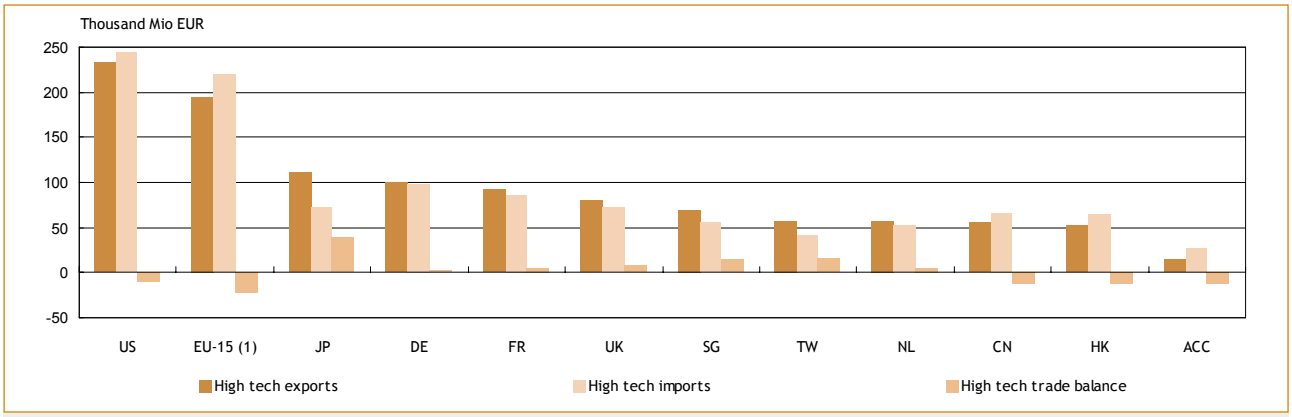


(1) EU-15 includes extra-EU trade only.

Sources: Eurostat, Comext; UN, Comtrade.

Figure 6.12.

**World leading countries
in high tech exports and imports
2001**



(1) EU-15 includes extra-EU trade only.

Sources: Eurostat, Comext; UN, Comtrade.

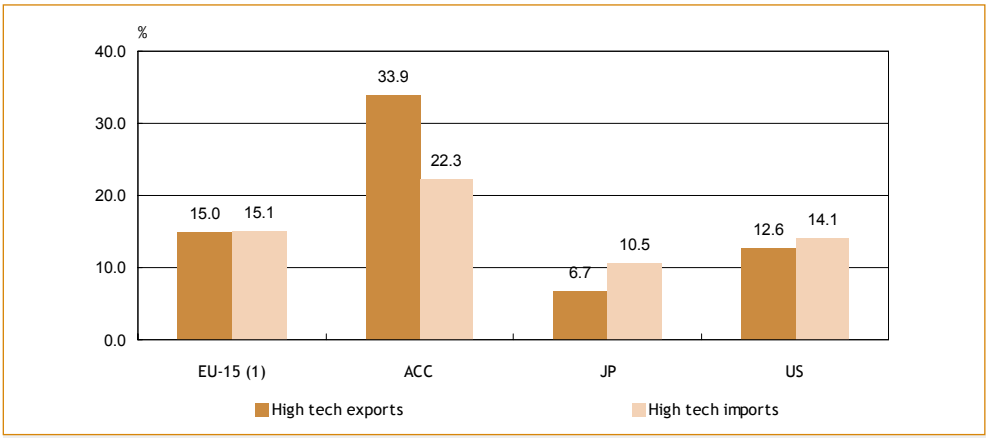
Figure 6.13. examines the annual average growth rates — AAGR — of high tech exports and imports during the 1996-2001 period. The EU experienced almost the same growth for both exports — 15.0% per annum — and imports — 15.1% per annum. This rate was above those retained by Japan and the United States during the same period, where imports grew faster than exports. Whilst the annual average growth rate recorded by Japan for high tech imports was equal to 10.5%, exports grew at 6.7% per annum. United States high tech imports and exports grew at 14.1% and 12.6%, respectively. The Acceding Countries recorded a high annual average growth rate of 33.9% in the export of high tech products, whereas their imports grew by 22.3% during the 1996-2001 period.

Figure 6.14. shows that during 1996-2001, the United States remains the leading exporter of high tech products, followed by the EU and Japan. However, Japan is the only one which showed a positive trade balance throughout the entire period. The high tech exports from Acceding Countries remain far below those of the United States, Japan or the EU. From 1996 to 2000, the global high tech export trends for the EU, Japan, the United States and Acceding Countries followed the same pattern as they all gradually increased. However, between 2000 and 2001 only EU-15 recorded an increase (4.3%) in high tech exports while Japan and the United States decreased by 7.3% and 20.5%, respectively.

The negative EU-15 high tech trade balance continued to increase from EUR 10.9 thousand million in 1996 to EUR 47.3 thousand million in 2000; then it decreased to only EUR 23.1 thousand million in 2001.

In 2001, the United States accounted for the largest share of world high tech exports (18.0%). High tech exports from the EU (excluding intra-EU trade) represented 15.0% of the world's high tech total exports. Following were Japan, Germany, France and the United Kingdom. The leading six countries together represented 57.4% of the world's high tech exports market share in 2001. During the 1996-2001 period, whilst the market share of high tech exports in the EU grew slowly (0.3% per annum), that of the United States and Japan fell on average each year by 1.8% and 6.9%, respectively. The rapid emergence of China as a high tech exporter is illustrated with it having the highest annual average growth rate of 17.5% between 1996 and 2001. Smaller economies like Mexico, Ireland, Hong Kong and the Netherlands experienced positive annual average growth rates — AAGR — at the expense of much larger economies — Figure 6.15.

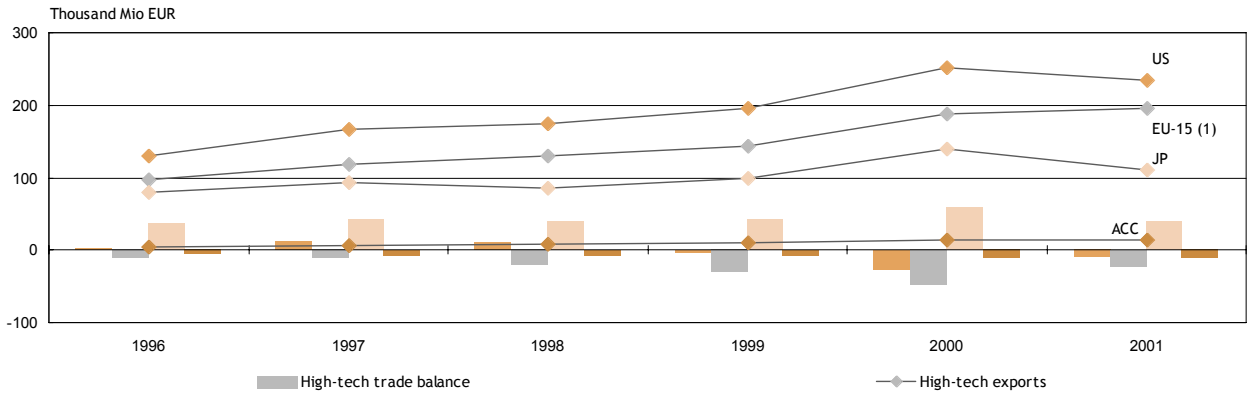
Figure 6.13. Annual average growth rates of high tech exports and imports in %
EU-15, Acceding Countries, Japan and the United States
1996 to 2001



(1) EU-15 includes extra-EU trade only.

Sources: Eurostat, Comext; UN, Comtrade.

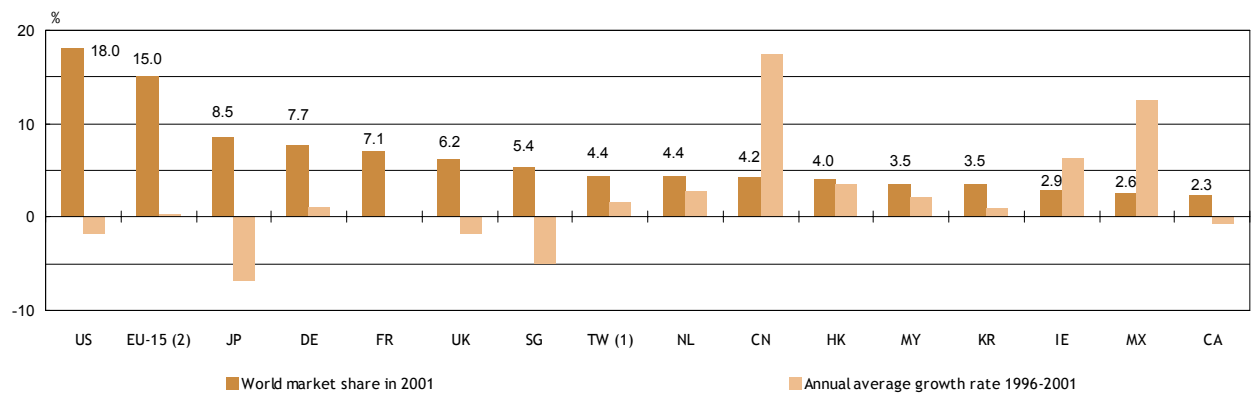
Figure 6.14. Exports and trade balance for high tech products
EU-15, Acceding Countries, Japan and the United States
1996 to 2001



(1) EU-15 includes extra-EU trade only.

Sources: Eurostat, Comext; UN, Comtrade.

Figure 6.15. High tech export world market shares in 2001 and their annual average growth rates in %
in the world leading countries
1996 to 2001 (1)



NB: The world total is estimated as the sum of 87 countries — see list in ***Methodological notes*** starting on page 150.

(1) The world total used to calculate market shares includes intra-EU trade.

(2) EU-15 includes extra-EU trade only, whereas individual Member States include both intra and extra-EU trade.

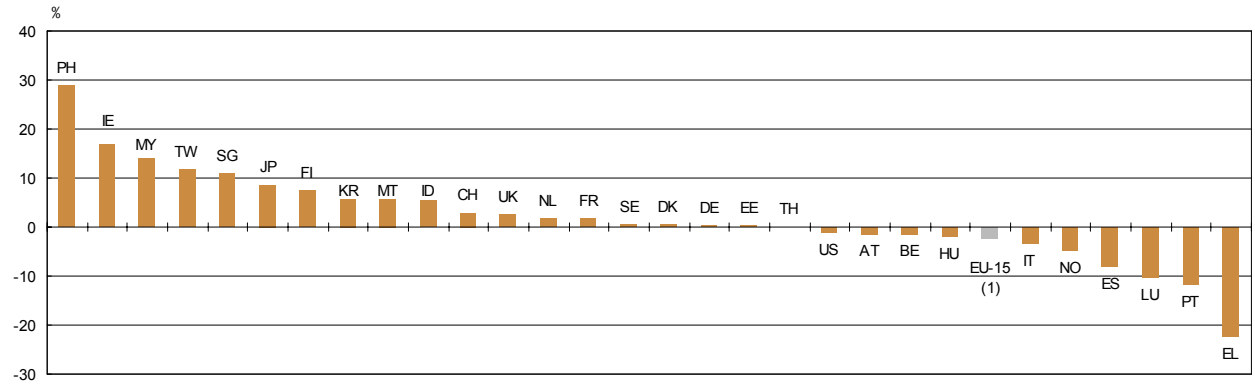
Sources: Eurostat, Comext; UN, Comtrade.

In terms of high tech trade performance, the strong position of the Philippines, Ireland, Malaysia and Singapore as net high tech exporters in 2001 is clearly shown in Figure 6.16., which ranks countries in terms of high tech trade balance as percentage of total exports. The EU's high tech trade balance has a percentage of total exports when only extra-EU trade is taken into account reveals a negative rate of -2.3%. Among the EU Member States, other countries with a significant trade surplus are Ireland, Finland, the United Kingdom, the Netherlands and France.

The extent to which a country's exports are specialised in the high tech sector relative to an average — in this case, the world's total exports — is shown by the relative specialisation index — RSI.

The relative specialisation index of a given country is defined as the proportion of high tech exports in the world's high tech exports, divided by the proportion of total exports in the world's total exports. Both the United States and Japan are specialised in high tech products, but their position has been surpassed by several countries in 2001. Philippines, Malta, Singapore and Malaysia are among the countries to have strengthened their position with an RSI value of 0.4 and above. Apart from Ireland, the United Kingdom, France, the Netherlands and Finland are the only other EU countries to be specialised in the exportation of high technology products — Figure 6.17.

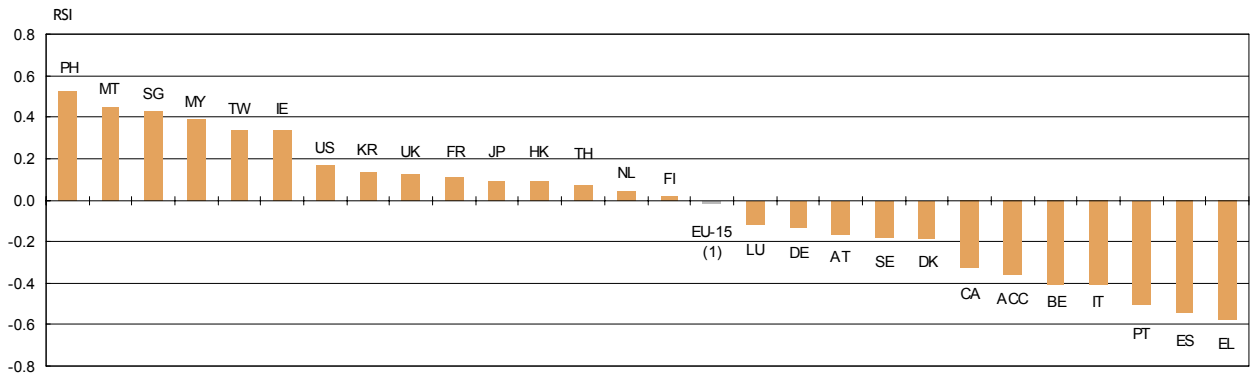
Figure 6.16. **High tech trade balance as a percentage of total exports in the world leading countries 2001**



(1) EU-15 includes extra-EU trade only.

Sources: Eurostat, Comext; UN, Comtrade.

Figure 6.17. **Relative specialisation index of high tech exports in the world leading countries 2001**



(1) EU-15 includes extra-EU trade only.

Sources: Eurostat, Comext; UN, Comtrade.

High tech trade in the EU

Whilst Germany leads in absolute terms, Ireland is the Member State most specialised in high tech trade

As shown in Table 6.13., high tech trade in Europe in 2001 accounted for about a fifth of its total trade. Note that this refers to EU high tech trade with the world but it excludes intra-EU trade. In value terms, high tech exports amounted to EUR 195.5 thousand million and the high tech imports reached EUR 218.6 thousand million, representing a negative balance of EUR 23.1 thousand million.

Considering the high tech trade of the individual EU countries, this time including trading with their EU partners, Germany, France and UK are the leading high tech traders in absolute terms. Ireland stood out given that around 40% of its trade is in high tech, compared to at most 28% for the remaining countries.

In terms of high tech exports in 2001, Germany led with EUR 100.7 thousand million representing 15.8% of its total trade. Next were France and the United Kingdom who exported EUR 92.4 and EUR 80.4 thousand million, respectively accounting for 25.6% and 26.4% of their total exports. Ireland exported only EUR 37.7 thousand million but that represented a high of 40.8% of its total exports.

With respect to high tech imports, Germany again leads in 2001 with EUR 98.8 thousand million, followed by France (EUR 86.6 thousand million) and the United Kingdom (EUR 72.5 thousand million). The lowest high tech trade values were reported for Greece and Luxembourg, although for the latter this represented over a quarter of its total trade.

Ireland had the highest high tech trade surplus of EUR 15.5 thousand million in 2001, followed by the United Kingdom (EUR 7.9 thousand million) and France (EUR 5.8 thousand million). Spain and Italy had the highest high tech trade deficit of over EUR 9 thousand million.

Table 6.13. **High tech exports, imports and trade balance**
EU-15 (1)
2001

	High tech exports		High tech imports		High tech trade balance
	Thousand Mio EUR	As a % of total exports	Thousand Mio EUR	As a % of total imports	Thousand Mio EUR
EU-15 (2)	195.5	19.8	218.6	21.3	-23.1
BE	19.1	9.0	21.6	10.8	-2.5
DK	8.1	14.0	7.8	15.4	0.3
DE	100.7	15.8	98.8	18.2	1.9
EL	0.6	5.5	3.2	10.1	-2.5
ES	7.9	6.1	18.2	10.6	-10.3
FR	92.4	25.6	86.6	23.6	5.8
IE	37.7	40.8	22.2	39.3	15.5
IT	23.2	8.6	32.2	12.4	-9.0
LU	3.0	27.9	3.6	25.8	-0.5
NL	57.4	22.3	52.8	22.7	4.7
AT	11.6	14.6	12.6	15.1	-1.0
PT	1.9	6.8	5.0	11.4	-3.2
FI	10.2	21.1	6.6	18.2	3.6
SE	12.0	14.2	11.5	16.3	0.5
UK	80.4	26.4	72.5	19.5	7.9

(1) All figures for individual countries include both intra and extra EU trade.
(2) EU-15 includes extra-EU trade only.

Source: Eurostat, Comext.

Extra-EU trade of high tech products

41.9% of the EU's total high tech exports in 2001 went to non EU countries

Table 6.14. shows the distribution of EU high tech trade flows by main partners for the 1999-2001 period. It can be seen that intra-EU high tech exports accounted for 59.3% of total EU high tech exports. Excluding intra-EU flows, a total of EUR 195.5 thousand million of high tech products were exported from the EU in 2001. 28.8% of these products were exported to the United States and 4.2% to Japan. With regard to imports, just over half of the total EU high tech imports originate from other Member States. Extra-EU high tech imports alone accounted for EUR 218.6 thousand million in 2001, of which 35.3% were imported from the United States, and 10.5% from Japan.

As shown in Figure 6.18., the EU high tech trade balance was in deficit between 1999 and 2001, and fluctuated from EUR 31 thousand million in 1999 up to EUR 47 thousand million in 2000 and down by half to EUR 23 thousand million in 2001.

Among the EU Member States, the countries with the highest extra-EU high tech trade deficits (excluding intra-EU trade) are the Netherlands, the United Kingdom and Germany with EUR 25 thousand million, EUR 9 thousand million and EUR 4 thousand million each in 2001, respectively. France has the highest high tech trade surplus (EUR 10 thousand million in 2001) followed by Sweden (EUR 4 thousand million) and Finland (EUR 3 thousand million).

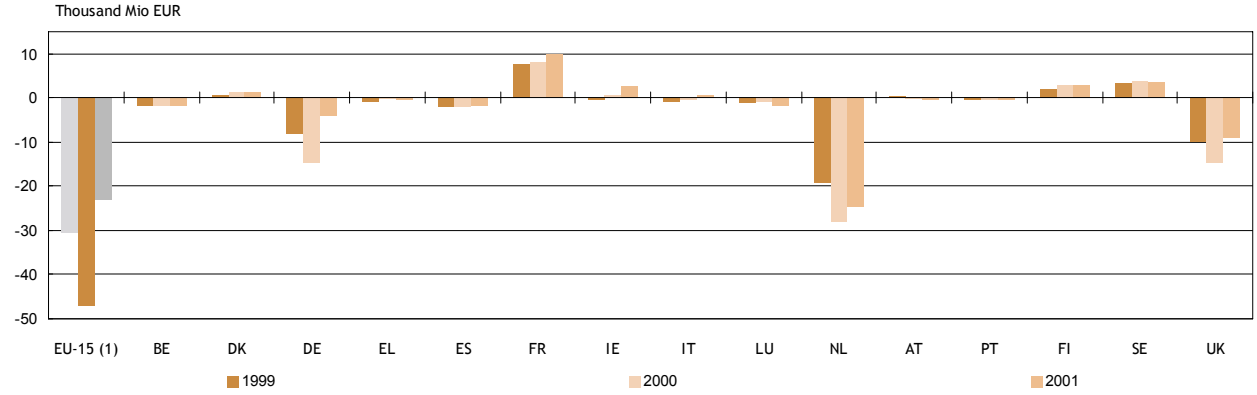
Table 6.14. **Distribution of high tech exports and imports by selected partner**
EU-15
1999 to 2001

		High tech exports			High tech imports		
		1999	2000	2001	1999	2000	2001
Total in thousand Mio EUR (1)		353.4	455.9	466.3	360.7	471.9	455.2
Of which by partner in %	Intra EU	59.3	58.9	58.1	51.6	50.3	52.0
	JP	1.7	1.9	1.8	5.8	6.0	5.0
	US	11.3	11.4	12.1	18.2	17.6	17.0
	Other	27.7	27.9	28.1	24.4	26.1	26.0
Extra EU in thousand Mio EUR		143.9	187.4	195.5	174.5	234.7	218.6
Of which by partner in %	JP	4.1	4.6	4.2	12.1	12.0	10.5
	US	27.8	27.6	28.8	37.5	35.4	35.3
	Other	68.1	67.8	67.0	50.4	52.6	54.2

(1) Total includes both intra and extra EU trade.

Sources: Eurostat, Comext; UN, Comtrade.

Figure 6.18. **Extra-EU high tech trade balance**
EU-15
1999 to 2001



(1) EU-15 aggregate as well as data for EU Member States include extra-EU trade only.

Sources: Eurostat, Comext; UN, Comtrade.

Table 6.15. **High tech exports and imports EU-15, Candidate Countries, Iceland, Norway, Japan and the United States 2001**

	High tech exports		High tech imports	
	Thousand Mio EUR	As a % of total exports	Thousand Mio EUR	As a % of total imports
EU-15 (1)	195.5	19.8	218.6	21.3
BE	5.4	10.2	7.0	11.6
DK	3.4	17.4	2.1	12.9
DE	48.1	16.8	52.3	21.5
EL	0.5	6.8	1.0	7.0
ES	2.7	7.3	4.6	8.1
FR	45.8	32.4	35.8	28.0
IE	12.7	37.2	9.9	51.3
IT	11.9	9.5	11.1	9.8
LU	0.2	13.3	1.9	66.5
NL	13.0	23.7	37.6	33.4
AT	5.1	16.7	5.5	20.7
PT	0.8	15.1	1.5	13.3
FI	5.5	24.8	2.5	18.7
SE	7.8	20.3	4.2	17.3
UK	32.4	25.1	41.6	22.4
ACC	14.5	9.7	25.8	13.8
CZ	3.4	9.2	6.1	15.0
EE	0.7	14.6	0.6	11.0
CY	0.0	1.5	0.5	10.9
LV	0.1	2.2	0.3	8.5
LT	0.1	2.9	0.6	7.8
HU	7.0	20.7	7.7	20.5
MT	1.2	59.4	1.1	34.7
PL	1.0	2.6	6.5	11.6
SI	0.5	4.8	0.9	8.2
SK	0.5	3.7	1.5	9.1
BG (2)	0.1	1.6	0.6	8.3
RO	0.6	5.0	1.9	10.7
TR	1.1	3.2	5.4	11.6
IS	0.0	1.3	0.1	12.7
NO	2.6	3.9	3.2	15.8
JP	111.2	24.7	72.0	18.5
US	233.8	28.6	243.3	18.5

(1) EU-15 aggregate as well as data for EU MS include extra-EU trade only.
(2) **Exception to the reference year 2001**
BG: 2000.

Sources: Eurostat, Comext; UN, Comtrade.

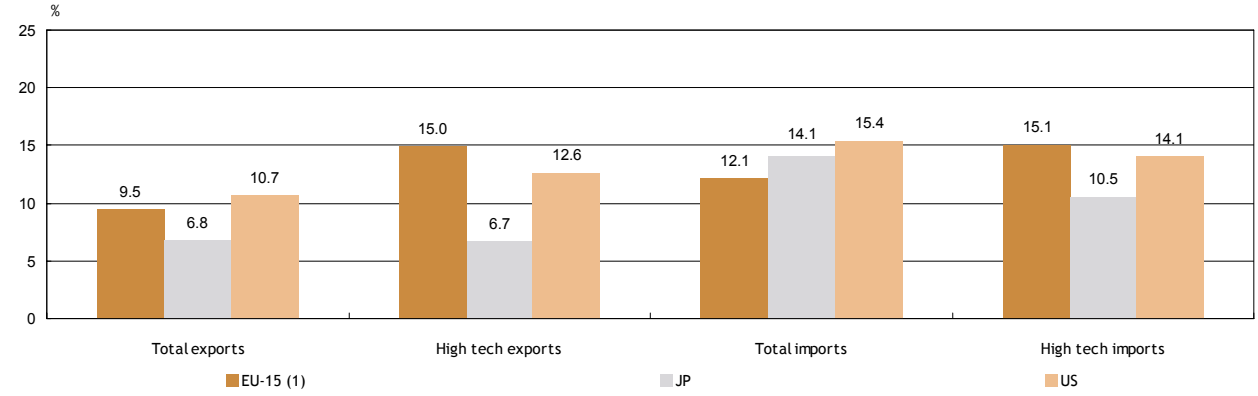
In 2001, the United States had the highest percentage (28.6%) of its total exports accounted for by high tech products – Table 6.15. This was followed by Japan (24.7%), the EU (19.8%) and the Acceding Countries aggregate (9.7%). In terms of extra-EU trade at the EU Member State level, high tech products in Ireland and France accounted for the highest proportions, as they amounted to 37.2% and 32.4% of their total exports, respectively. The United Kingdom, Finland and the Netherlands followed with around a quarter of their total exports being high tech products.

Examining the high tech component of total imports in 2001, the EU has the highest proportion (21.3%) of high tech goods, but very closely followed by Japan and the United States both with 18.5% of their respective total imports. 13.8% of the goods imported by Acceding Countries were high tech products.

Among the EU countries and considering extra-EU trade only, high tech imports in Luxembourg accounted for almost two-thirds of its total imports in 2001. Over half of the total imports in Ireland and a third in the Netherlands were high tech products that year, whereas 28% of French imports were accounted for by high tech products.

Figure 6.19. shows that between 1996 and 2001, high tech trade grew faster than total trade in the EU, which retained the highest high tech export growth with an annual average growth rate of 15.0%. Whilst the United States grew at 12.6% per annum, high tech exports from Japan increased at a rate of 6.7%. In Japan high tech exports and imports grew below their respective totals. While high tech exports increased above total exports in the United States, the growth of imports of high tech products was below that of total imports.

Figure 6.19. **Annual average growth rates of total and high tech exports and imports in % EU-15, Japan and the United States 1996 to 2001**



(1) EU-15 includes extra-EU trade only.

Sources: Eurostat, Comext; UN, Comtrade.

Intra-EU trade of high tech products

Germany is the main export partner of high tech products in the EU

In terms of exports of high tech trade products within the EU in 2001, the three main export partners of the Member States were Germany, the United Kingdom and France — Table 6.16. Germany ranks first as it is the principal export partner for 9 countries and the second main export partner for another 5 countries. The second high tech exporter within the EU is the United Kingdom, which is the principal partner for three Member States and second biggest partner for six others. France is the third largest export partner of EU countries after Germany and the United Kingdom.

With regard to imports of high tech trade products within the EU in 2001 — Table 6.17., again Germany remains the largest supplier of high tech products to the Member States, followed by the United Kingdom. However, Netherlands is the third principal supplier. Neighbouring Belgium and Germany import 22.7% and 27.9% of high tech products from Netherlands, respectively. The Netherlands is also the second biggest supplier of high tech products to the United Kingdom (23.3%), Italy (19.2%), Greece (18.0%) and Austria (15.3%). France is the fourth largest import partner of EU countries. The highest intra-EU import ratio for high tech products was 68.0%, which represented the proportion of high tech imports by Ireland from the United Kingdom.

Table 6.16. **Distribution of intra-EU high tech exports in % 2001**

Reporting country	Partner country															
	BE	DK	DE	EL	ES	FR	IE	IT	LU	NL	AT	PT	FI	SE	UK	EU-15
BE	:	1.4	20.4	1.4	5.3	23.5	1.8	9.7	4.3	12.3	2.3	1.1	1.0	2.7	12.9	100
DK	2.1	:	28.4	0.8	3.4	7.0	4.0	5.1	2.9	8.4	1.3	0.7	4.3	15.1	16.4	100
DE	4.7	2.2	:	1.2	7.1	29.2	1.8	11.4	0.7	7.5	6.6	2.3	2.9	3.2	19.1	100
EL	2.5	5.6	16.1	:	0.3	14.7	9.3	6.2	0.0	13.5	0.7	0.4	0.2	2.1	28.4	100
ES	3.6	0.9	21.5	0.6	:	19.2	1.4	8.6	0.5	6.8	3.4	19.0	0.6	1.6	12.3	100
FR	7.9	1.2	30.5	0.6	8.0	:	3.4	10.3	2.5	6.0	1.4	6.9	1.5	3.0	16.8	100
IE	3.8	1.4	17.7	0.2	3.4	9.4	:	5.1	0.0	10.1	0.9	0.4	0.9	3.4	43.2	100
IT	17.5	1.3	19.4	2.7	8.2	23.6	3.9	:	1.6	5.3	2.9	1.4	0.7	1.6	9.8	100
LU	8.9	0.8	21.4	0.6	6.4	19.3	3.6	10.2	:	2.5	0.7	1.4	1.7	2.0	20.7	100
NL	6.3	2.6	27.6	1.0	6.6	14.8	2.0	10.2	0.5	:	1.9	1.4	2.1	3.7	19.3	100
AT	2.6	1.0	44.7	1.2	4.6	12.8	0.8	8.5	0.8	5.5	:	1.5	1.1	2.8	12.0	100
PT	3.2	1.0	54.2	0.3	18.8	5.8	0.4	2.6	0.0	7.7	0.5	:	0.1	0.8	4.6	100
FI	2.3	4.0	16.8	3.4	4.1	11.3	2.5	8.0	0.1	5.1	3.1	1.7	:	9.2	28.5	100
SE	5.4	9.8	21.4	2.2	5.9	9.6	1.6	10.2	0.1	6.2	2.3	1.5	9.0	:	14.9	100
UK	3.4	2.8	20.2	0.7	6.7	19.6	17.0	7.1	0.6	14.5	1.4	1.0	1.5	3.5	:	100

Source: Eurostat, Comext.

Table 6.17. **Distribution of intra-EU high tech imports in % 2001**

Reporting country	Partner country															
	BE	DK	DE	EL	ES	FR	IE	IT	LU	NL	AT	PT	FI	SE	UK	EU-15
BE	:	1.0	17.1	0.3	1.5	18.2	7.4	14.4	1.2	22.7	1.1	0.2	0.8	2.3	11.9	100
DK	2.3	:	22.8	0.2	1.0	10.9	6.1	2.3	0.3	15.8	0.8	0.2	3.9	10.4	23.0	100
DE	5.1	2.2	:	0.1	2.2	21.9	8.9	4.0	0.6	27.9	4.6	1.5	0.7	1.7	18.5	100
EL	4.5	0.5	27.8	:	1.2	8.9	1.9	9.2	0.6	18.0	0.7	0.2	6.6	9.0	10.9	100
ES	4.0	1.1	23.6	0.0	:	19.2	5.6	7.2	0.7	17.0	2.0	1.5	1.4	2.6	14.2	100
FR	7.7	1.2	33.2	0.3	2.8	:	4.6	7.1	2.5	14.2	2.0	5.9	1.3	1.2	16.0	100
IE	1.7	0.9	8.4	0.1	0.4	9.8	:	1.2	0.0	7.4	0.4	0.0	1.0	0.7	68.0	100
IT	5.1	1.0	27.7	0.2	1.9	16.5	5.6	:	1.2	19.2	2.1	0.3	1.7	3.1	14.4	100
LU	28.5	0.2	15.4	0.0	8.6	12.3	1.0	1.1	:	9.4	2.5	0.2	0.0	2.0	18.6	100
NL	4.7	1.2	22.5	0.1	2.7	10.2	13.4	3.9	0.9	:	1.8	0.4	2.0	2.3	33.9	100
AT	3.1	0.7	51.5	0.0	2.1	6.3	2.9	4.6	0.2	15.3	:	0.1	4.1	1.7	7.3	100
PT	3.5	0.6	26.1	0.0	24.5	10.2	2.0	3.6	0.5	14.8	2.7	:	1.3	3.6	6.6	100
FI	2.0	3.7	27.9	0.0	1.7	14.1	7.7	3.8	0.0	7.5	1.3	0.4	:	9.5	20.3	100
SE	3.6	6.0	21.6	0.0	1.2	12.6	10.2	1.5	0.5	17.4	1.6	0.2	4.6	:	19.0	100
UK	4.3	1.5	23.6	0.2	2.2	13.9	16.3	3.1	0.7	23.3	2.6	0.2	4.9	3.3	:	100

Source: Eurostat, Comext.

High tech trade flows in the Acceding Countries

45.5% of high tech exports from Acceding Countries went to the EU

Between 1996 and 2001, the high tech exports from Acceding Countries quadrupled in value from EUR 3.4 thousand million to EUR 14.5 thousand million, while its high tech imports tripled from EUR 9.4 thousand million to EUR 25.8 thousand million — Table 6.18. The EU was by far the largest high tech trade partner of the Acceding Countries. In 1996, Acceding Countries exported EUR 1.5 thousand million of high tech products to the EU, which represented 45.9% of its total high tech exports. By 2001, high tech exports rose to EUR 10.2 thousand million, 70.0% of its high tech exports. High tech exports of Acceding Countries grew at an annual average growth rate of 33.9% during the 1996-2001 period. During this period, exports of Acceding Countries to the EU and the United States grew at annual average growth rates of 45.5% and 34.9%, respectively. High tech imports with these two large partners grew slower, registering annual average growth rates of 18.9% with the EU and 20.2% with the United States.

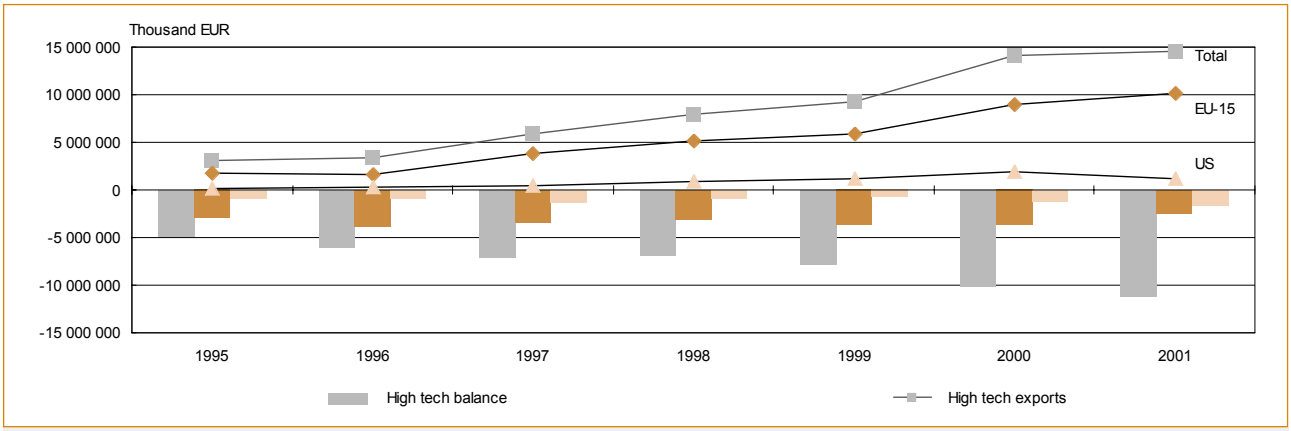
Between 1995 and 2001, the high increase of high tech exports from Acceding Countries was largely determined by the increase in its exports to the EU. However, throughout this period, the Acceding Countries experienced a trade deficit, which more than doubled from nearly EUR 5 thousand million in 1995 to EUR 11 thousand million in 2001 — Figure 6.20. This deficit arises mainly from a great increase in imports from other countries, which grew at annual average growth rates of 30.3%. The main supplier of high tech products for the Acceding Countries is the EU, which accounted for 49.3% of the high tech imports in 2001.

Table 6.18. **Distribution of high tech trade by main partner Acceding Countries 1996 to 2001**

High tech exports					High tech imports				
Partners		1996	2001	AAGR in % 1996-2001	Partners		1996	2001	AAGR in % 1996-2001
Total in thousand Mio EUR		3.4	14.5	33.9	Total in thousand Mio EUR		9.4	25.8	22.3
Of which by partner in %	EU-15	45.9	70.0	45.5	Of which by partner in %	EU-15	57.0	49.3	18.9
	ACC	12.4	4.7	10.5		ACC	3.5	2.9	17.8
	JP	1.6	0.9	19.3		JP	4.8	5.6	26.2
	US	7.6	8.0	34.9		US	12.0	10.9	20.2
	Others	32.5	16.3	18.5		Others	22.7	31.2	30.3

Sources: Eurostat, Comext; UN, Comtrade.

Figure 6.20. **High tech trade exports and balance by selected partner Acceding Countries 1995 to 2001**



Sources: Eurostat, Comext; UN, Comtrade.

Distribution by product group

'Electronics' account for the highest proportion of high tech trade in the EU, Acceding Countries, Japan and the United States

Looking at the distribution of high tech trade by product group in Table 6.19., 'Electronics' are by far the most traded goods, followed by 'Computer & office machinery' products and 'Aerospace'.

'Electronics' contribute to at least 30% of high tech exports and imports in the EU, Acceding Countries, Japan and the United States. The next highest export categories are 'Aerospace' products in the EU and the United States, and 'Computer & office machinery' in the Acceding Countries and Japan.

With regards to high tech imports, 'Computer & office machinery' makes up the second largest category in the EU, Acceding Countries, the United States and Japan, as this group contributes to at least a quarter to a third of their high tech imports.

Table 6.19. **High tech trade exports and imports in % by product group EU-15, Acceding Countries, Japan and the United States 2001**

	High tech exports in %				High tech imports in %			
	EU-15 (1)	ACC	JP	US	EU-15 (1)	ACC	JP	US
Aerospace	25.0	3.4	1.1	20.6	17.8	2.6	5.1	11.9
Armement	0.7	1.3	0.1	1.3	0.3	0.9	0.4	0.4
Chemicals	3.3	1.7	1.0	2.1	2.2	4.8	3.8	2.0
Computers & office machinery	13.8	28.1	24.2	18.3	26.5	25.2	31.6	31.1
Electrical machinery	2.4	5.4	6.0	1.9	3.4	4.9	4.0	2.3
Electronics	30.9	47.2	48.4	35.4	32.5	43.4	37.7	37.3
Instruments	11.8	6.1	12.9	13.3	9.5	8.0	11.4	9.2
Non electrical machinery	4.6	4.1	5.3	3.9	3.4	4.5	2.6	2.8
Pharmaceuticals	7.3	2.7	1.0	3.1	4.4	5.5	3.5	3.0
Total high tech in thousand Mio EUR	195.5	14.5	111.2	233.8	218.6	25.8	72.0	243.3

(1) EU-15 includes extra-EU trade only.

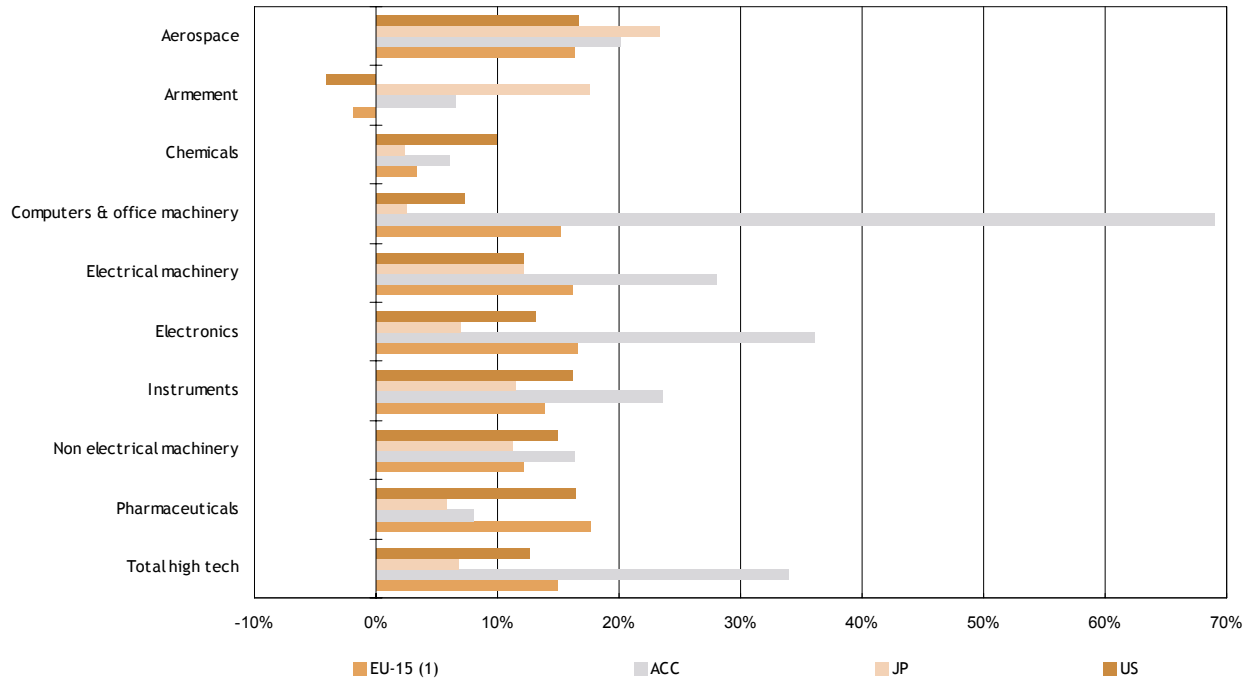
Sources: Eurostat, Comext; UN, Comtrade.

Examining the annual average growth rates — AAGR — of total high tech exports in Figure 6.21., the Acceding Countries have experienced the highest growth rates (33.9%) between 1996 and 2001, compared to EU (15.0%), Japan (6.7%) and the United States (12.6%). For the Acceding Countries, high growth rates of exports were observed in 'Computers and office machinery' (69.0%), and 'Electronics' (36.0%). Growth rates were more consistent and lower for the high tech product groups in EU, Japan and the United States. In the EU, the annual average growth rates were highest in 'Pharmaceuticals', 'Electronics', 'Aerospace' and 'Electrical machinery'.

As shown in Figure 6.22. with respect to high tech imports, the Acceding Countries again had the highest annual average growth rate of 22.3% between 1996 and 2001. This was followed by the EU, the United States and Japan. Product groups with the highest annual average growth rates for imports in the Acceding Countries were 'Electrical machinery', 'Non electrical machinery' and 'Computers and office machinery'. In the case of the United States, 'Aerospace' products had the highest rate which mounted to 30.0%. The EU observed the highest annual average growth rates in the imports of 'Electronics' and 'Aerospace'.

Figure 6.21.

**Annual average growth rates of high tech exports by product group in %
EU-15, Acceding Countries, Japan and the United States
1996 to 2001**

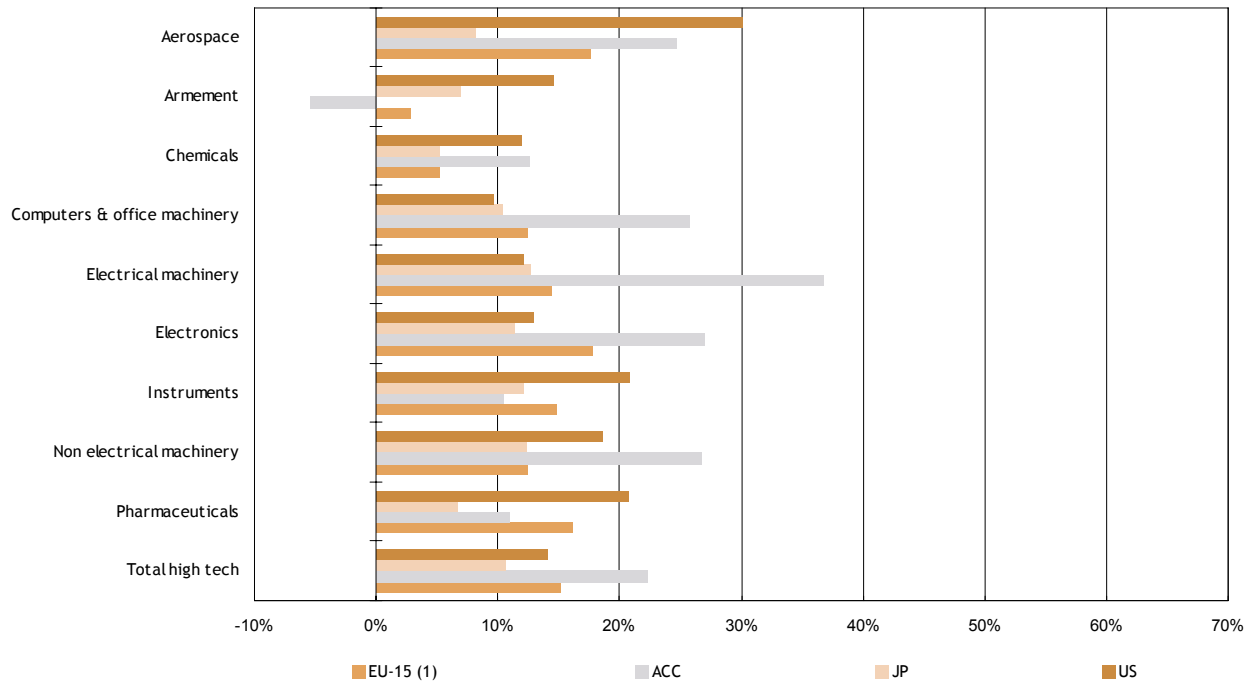


(1) EU-15 includes extra-EU trade only.

Sources: Eurostat, Comext; UN, Comtrade.

Figure 6.22.

**Annual average growth rates of high tech imports by product group in %
EU-15, Acceding Countries, Japan and the United States
1996 to 2001**



(1) EU-15 includes extra-EU trade only.

Sources: Eurostat, Comext; UN, Comtrade.

Methodological notes

This part presents in some detail, the methodology used for the data presented in this publication. After giving some general information, specific details are given for the following domains: Government budget appropriations or outlays for R&D — GBAORD, R&D expenditure and personnel, Human Resources in Science and Technology — HRST, Patents, employment in high technology sectors, value added and external trade of high tech products.

1. General information

Currencies

Series in current EUR, have been calculated by using current exchange rates.

Data measured in constant 1995 Purchasing Power Standard — PPS — are first corrected for inflation using the GDP deflator — *a Paasche index with 1995 = 100 as a base* — of the country in question before applying the 1995 PPS exchange rate.

Regional data

Regional data presented throughout this publication are treated at Eurostat according to the guidelines established by *The Regional Dimension of R&D and Innovation Statistics and Experimental Development — Regional Manual*, European Commission, 1996.

Nomenclature of territorial units for statistics — NUTS

The regional data presented in this publication are broken down according to the *Nomenclature of Territorial Units for Statistics* — NUTS — classification, 1998 version. The NUTS was established by the Statistical Office of the European Communities, in co-operation with the Commission's other departments, to provide a single, uniform breakdown of territorial units for the production of regional statistics for the European Union.

The NUTS is a five-level hierarchical classification comprising three regional and two local levels. In this way, NUTS subdivides each Member State into a whole number of NUTS 1 regions, each of which is in turn subdivided into a whole number of NUTS 2 regions, and so on. In the present publication most data are presented at NUTS 2 level on the basis of the NUTS 1998 version. The exceptions have been indicated in the tables or figures.

For Denmark and Luxembourg the national level coincides with the NUTS 2 level, which explains their potential presence amongst the regional rankings in this publication.

Iceland and Norway are not included in the NUTS classification but do have similar statistical regions. As for Denmark and Luxembourg, Iceland is also classified at the statistical region level 2.

Acceding Countries — ACC — and Candidate Countries

The Acceding Countries aggregate — ACC — comprises Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic and Slovenia. Exceptions to the countries included are specified in the corresponding tables or figures.

The term Candidate Countries refers to all Acceding Countries, Bulgaria, Romania and Turkey.

Annual average growth rates — AAGR

Annual average growth rates in this publication are calculated according to the following formula:

$$AAGR = \left(\left[(X_n - X_{n-t}) / X_{n-t} \right]^{1/t} - 1 \right) \times 100$$

2. Specific methodological notes by domain

Government budget appropriations or outlays for R&D — GBAORD

Definition

Government budget appropriations or outlays on 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. 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.

GBAORD data do not consider the amount of money actually spent, but are rather based on budget provisions, and so should be seen as intentions of spending. 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 in most cases are obtained from national budget statistics. The difficulty is due more specifically 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.

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.

Methodological discrepancies and exceptions

Despite all efforts, the concepts and methods used by the individual Member States of the EU-15, the United States and Japan for collecting data on government R&D appropriations are not completely harmonised.

Details on each country's methodology can be found in:

- *Statistics on Science and Technology: Annual Statistics — data 1991-2001* or in
- Eurostat's reference database *NewCronos*, Theme 9, Domain *GBAORD*.

No GBAORD data exist for Luxembourg before 2000 and therefore EU-15 totals exclude Luxembourg before that year. EU-15 totals include Luxembourg for the years from 2000 onwards unless otherwise stated in the chapter.

United States 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.

The figures for Japan are estimates made by the OECD Secretariat and recognised as official data by the Japanese Government. They underestimate expenditure on the social and human sciences and are thus only to some extent comparable with the data for other countries. Moreover, data are in general underestimated because the R&D portion of military contracts is excluded.

Breakdown by socio-economic objectives — NABS

Government R&D appropriations are broken down by socio-economic objective on the basis of the *Nomenclature for the analysis and comparison of scientific programmes and budgets* — NABS, 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, 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 the following chapters of the NABS:

- 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.

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, Table 8.2. of the *Frascati Manual*, 2002.

For a more user friendly presentation, socio-economic objectives may be grouped in various categories, which are defined as follows:

Grouped socio-economic objectives	NABS chapters
Research financed from General University Funds (GUF)	10
Technological objectives	1 + 5 + 7 + 9
Defence	13
Non-oriented research	11
Human and social objectives	2 + 3 + 4 + 8
Agricultural production and technology	6
Other civil research	12

For further information on the breakdown by socio-economic objectives of GBAORD data, please refer to Chapter 8.7. of the *Frascati Manual*, OECD 2002.

Time series

The analysis in Chapter 1 covers the period 1992 to 2002, with 2002 data being provisional.

Sources

- Eurostat, *NewCronos*; Theme 9, Domain *GBAORD* and Domain *RD_CEC*;
- United States and Japan: OECD, *Main Science and Technology indicators* — MSTI 2002/2.

National reports on their specific GBAORD performance are available for various countries at Eurostat. For these reports and further information on definitions and explanatory notes, see:

- Metadata in Eurostat's reference database *NewCronos*, Theme 9, Domain GBAORD or in
- *Statistics on Science and Technology: annual statistics — Data 1991-2001.*

R&D expenditure and personnel

The basic concepts, guidelines for collecting data and the classifications to be used in compiling statistics on research and experimental development are given in the *Frascati Manual* (1). Regional data are collected according to the standards defined by the *Regional Manual* (2)

Research and experimental development — R&D

Research and experimental development (R&D) activities comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications. There are two basic statistical variables in this domain, namely R&D expenditure and R&D personnel.

R&D indicators for R&D expenditure

R&D expenditure corresponds to the measurement of 'intramural' expenditure, i.e. all expenditure for R&D performed within a statistical unit or sector of the economy during a specific period, whatever the source of funds (3).

- R&D intensity

R&D intensity represents the R&D expenditure as a percentage of GDP. It is the ratio of R&D expenditure in current EUR for the sectors and years in question to GDP.

- Fields of science

Data on R&D expenditure may be broken down by field of science. The classification of fields of science is based on the nomenclature suggested by Unesco: *Recommendation concerning the International Standardisation of Statistics on Science and Technology* — See the *Frascati Manual*, Sections 4.4., 3.6.2. and 3.7.2.

R&D indicators for 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. Those providing indirect services, such as canteen and security staff, should be excluded — *Frascati Manual*, § 294-296.

- Researchers

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 — *Frascati Manual*, § 301.

- Full-time equivalent — FTE

One FTE may be thought of as one person-year. For instance, a person who normally spends 40% of his time on R&D and the rest of it on other work (e.g. lecturing, university administration, guidance) should be counted as only 0.4 FTE — *Frascati Manual*, Section 5.3.3.

(1) ***Standard method for surveys on R&D and experimental development — Frascati Manual***, OECD 2002.

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

(3) ***Standard method for surveys on R&D and experimental development — Frascati Manual,*** OECD 2002, § 358.

- Personnel by number of individuals — HC

The number of individuals who are employed mainly or partly on R&D — *Frascati Manual*, Section 5.3.2.

- Labour force

The labour force is the active population, this is the sum of employed and unemployed persons as defined by the EU Labour Force Survey. Persons in employment are those who during the reference week did any work for pay or profit, or were not working but had jobs from which they were temporarily absent, including family workers. Unemployed persons comprise persons aged 15 to 74 who were:

- without work during the reference week, i.e. neither had a job nor were at work (for one hour or more) in paid employment or self-employment;
- currently available for work, i.e. were available for paid employment or self-employment before the end of the two weeks following the reference week;
- actively seeking work, i.e. had taken specific steps in the four weeks period ending with the reference week to seek paid employment or self-employment or who found a job to start later, i.e. within a period of at most three months.

Institutional classifications

Intramural R&D expenditure and R&D personnel may be broken down with reference to the four institutional sectors in which the R&D takes place.

- The business enterprise sector — BES

With regard to R&D, the business enterprise sector includes: 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 and the private non-profit institutions mainly serving them — *Frascati Manual*, § 163.

- The government sector — GOV

In the field of R&D, the government sector includes: 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) as well as PNPs controlled and mainly financed by government — *Frascati Manual*, § 184.

- The higher education sector — HES

This sector comprises: 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 — *Frascati Manual*, § 206.

- The private non-profit sector — PNP

This sector covers: non-market, private non-profit institutions serving households (i.e. the general public) and private individuals or households — *Frascati Manual*, § 194.

Nomenclature of territorial units for statistics — NUTS

In chapters 2 and 3 of the present Panorama, regional data are presented at NUTS 2 level on the basis of the NUTS 1998 version. The exceptions have been indicated in the tables or figures.

Data for United Kingdom are only available at NUTS 1 level.

European aggregates

For both R&D expenditure and personnel, EU totals are calculated as the sum of the national data by sector. If data are missing, estimates are first made for the country in question, reference period, institutional sector or relevant R&D variable, as appropriate. This method is not identically applied to the calculation of R&D personnel in head count (HC). The estimates for R&D personnel in full time equivalents (FTE) serve as a basis for the HC calculation. An FTE/HC ratio based on available FTE and HC personnel data at the national level is estimated for the EU aggregates, by institutional sector and by year. This ratio is then applied to the FTE data to calculate the EU totals in HC.

- EU-15 and EEA data are estimated values.
- ACC aggregates exclude Malta.
- EEA does not include Liechtenstein.

Time series

Chapter 2 and 3 present data for the period 1993-2002. However, data in NewCronos are available from 1981 onwards, but differences exist according to the variables and the institutional sectors. Not all years are completed, and therefore the latest year available for each country is presented in the analysis.

Sources

- Eurostat, *NewCronos*, Theme 9, Domain *RD_EX_P* and Domain *RD_CEC*
- Japan and the United States: OECD, *Main Science and Technology indicators* — MSTI 2002/2.

Methodology in the Candidate Countries

Most Candidate Countries have introduced Frascati methodology from 1994-98.

More detailed information regarding the specific developments of each country are available in Eurostat's Reference database *NewCronos*.

For these and further information on definitions and explanatory notes, see:

- Metadata in Eurostat's reference database *NewCronos*, Theme 9, Domain *RD_EX_P* and Domain *RD_CEC* or in
- *Statistics on Science and Technology: annual statistics — Data 1991-2001*.

Human Resources in Science and Technology — HRST

Data on Human Resources in Science and Technology — HRST — can improve our understanding of both the demand for, and supply of, highly qualified personnel. The data in this publication focuses on two main aspects: stocks and flows. The former serves to show the needs and the current situation of the labour force and the latter indicates to what degree this demand is likely to be met in the future by looking at the current participation and graduation output of the educational systems.

The general recommendations for the collection of HRST data are laid down in the ***Canberra Manual*** ([4]), where HRST is defined as a person fulfilling one of the following conditions:

- successfully completed education at the third level in a S&T field of study (ISCED '97 version levels 5a, 5b or 6) or;
- are not formally qualified as above but are employed in a S&T occupation where the above qualifications are normally required (ISCO '88 COM codes 2 or 3).

The conditions of the above educational or occupational requirements are considered according to internationally harmonised standards:

- the *International Standard Classification of Education* — ISCED;
- the *International Standard Classification of Occupation* — ISCO ([5]).

Stocks

Stocks provide information on the number of HRST at a particular point in time. In this publication, stock data relate to the employment status as well as the occupational and educational profiles of individuals in quarter 2 of any given year.

HRST stock data and their derived indicators are extracted and built up using data from the EU Labour Force Survey. The EU Labour Force Survey, like all surveys, is based upon a sample of this population. Therefore, the results are subject to the usual types of errors associated with sampling techniques as well as a number of other non-sampling errors, for example, non-response, miscoding, etc. All results conform to Eurostat guidelines on sample-size limitations and are therefore not published if the degree of sampling error is likely to be high.

([4]) *Manual on the Measurement of Human Resources devoted to S&T — **Canberra Manual,*** OECD, Paris, 1994.

([5]) Education data follow the ***International Standard Classification for Education*** — ISCED, whilst occupation data follow the ***International Standard Classification for Occupation*** — ISCO.

The basic categories of HRST are as follows:

Category	*People that have/are*
• **HRST**: Human Resources in Science and Technology	• successfully completed education at the third level in an S&T field of study (6) — ISCED '97 version levels 5a, 5b or 6 — **or** • are not formally qualified as above but are employed in an S&T occupation where the above qualifications are normally required (ISCO '88 COM codes 2 or 3).
Sub-categories of HRST	***People belonging to HRST that have/are***
• **HRSTO**: Human Resources in Science and Technology — Occupation	• employed in an S&T occupation (ISCO '88 COM codes 2 or 3).
• **HRSTE**: Human Resources in Science and Technology — Education	• successfully completed education at the third level in an S&T field of study (6) — ISCED '97 version levels 5a, 5b or 6.
• **HRSTC**: Human Resources in Science and Technology — Core	• successfully completed education at the third level in an S&T field of study (6) — ISCED '97 version levels 5a, 5b or 6 — **and** are employed in a S&T occupation (ISCO '88 COM codes 2 or 3).
• **S&E**: Scientists and Engineers	• physical, mathematical and engineering occupations (ISCO '88 COM code 21); • life science and health occupations (ISCO '88 COM code 22).
• **HRSTU**: Human Resources in Science and Technology — Unemployed	• successfully completed education at the third level in an S&T field of study (6) — ISCED '97 version levels 5a, 5b or 6 — **and** are unemployed.
• **NHRSTU**: Unemployed non-HRST	• unemployed and without successfully completed education at the third level in a S&T field of study (6) (ISCED '97 version levels 5a, 5b or 6).

Inflows

HRST inflows are the number of people who do not fulfil any of the conditions for inclusion in HRST at the beginning of a time period but gain at least one of them during the period.

The number of graduates from a country's higher education system represents the main inflow into the national stock of HRST.

HRST education inflow data are extracted from the Eurostat Education database and are collected via the Unesco/OECD/Eurostat questionnaire on education, the conditions of which are considered according to the *International Standard Classification of Education* — ISCED.

(6) Note that according to the ***Canberra Manual***, the seven broad S&T fields of study are 'Natural sciences', 'Engineering and technology', 'Medical sciences', 'Agricultural sciences', 'Social sciences', 'Humanities' and 'Other fields', ***Canberra Manual***, § 71.

The International Standard Classification of Education — ISCED 97

Levels of tertiary education

- **ISCED level 5A**
  - programmes that are largely theoretically based and are intended to provide sufficient qualifications for gaining entry into advanced research programmes and professions with high skill requirements.
- **ISCED level 5B**
  - programmes that are generally more practical/technical/occupationally specific than ISCED 5A programmes.
- **ISCED level 6**
  - this level is reserved for tertiary programmes that lead to the award of an advanced research qualification. The programmes are devoted to advanced study and original research.

S&E (field of study)

Title	*Short name*	*Description*	*ISCED subject codes*
Science and Engineering	S&E	Life sciences, Physical sciences, Mathematics and statistics, Computing, Engineering and engineering trades, Manufacturing and processing, Architecture and building.	42, 44, 46, 48, 52, 54, 58

The International Standard Classification of Occupations — ISCO (S&T occupations)

- **ISCO 2** (professionals)
  - occupations whose main tasks require a high level of professional knowledge and experience in the fields of physical and life sciences, or social sciences and humanities.
- **ISCO 3** (technicians and associate professionals)
  - occupations whose main tasks require technical knowledge and experience in one or more fields of physical and life sciences, or social sciences and humanities.

The user should note that definition of S&T occupations constitutes a certain deviation from the recommendations laid down in the Canberra Manual. In addition to ISCO major groups 2 and 3 the Canberra Manual proposes to also consider as HRST: production and operations managers, other specialist managers, managers of small enterprises (ISCO 122, 123 and 131) that may work in the field of S&T but are not included in the term HRST as used here (but they are included in HRST(E) if they have successfully completed third level education). The limitation applied here is however justified as a pilot survey conducted in 1995 tested the validity of the original definitions for HRST and the results indicated that, for the EU, including these certain managerial occupations distorted the results significantly, due to variations between countries in the treatment and classification of managers.

Non-national students

As a foreign student is defined as someone not having the citizenship of the country in which he/she is educated, overestimation of non-national students may exist in some countries where permanently resident second generation migrants with foreign nationalities constitute an important group of students.

Breakdown by sector of activity

HRST data by sector of activity are collected according to the *Statistical classification of economic activities in the European Community* — NACE Rev. 1.1.

According to their global technological intensity, the OECD and Eurostat have agreed on a classification of manufacturing sectors. Although the agreed classification defines each sector using up until the third digit level of the NACE, the *EU Labour Force Survey* only allows reporting of NACE at the 2 digit level. Following a similar logic as for manufacturing, Eurostat proposes the classification of services sectors in various categories by looking at their knowledge intensity and within that their high technology usage and their market orientation.

Therefore, the sector groups used in Chapter 4 are defined as follows:

Description	*NACE Rev 1.1 codes (1)*
• Agriculture, hunting, forestry, fishing, mining and quarrying	• 01 to 14
• Utilities and construction	• 40, 41 and 45
• Low technology	• 15 to 22 and 37
• Medium-low technology	• 23, 25 to 28 and 36
• Medium-high tech manufacturing	• 24, 29, 31, 34 and 35
• High tech manufacturing	• 30, 32 and 33
• Knowledge-intensive high technology services	• 64, 72 and 73
• Knowledge-intensive market services (excl. financial intermediation and high tech services)	• 61, 62, 70, 71 and 74
• Knowledge-intensive financial services	• 65, 66 and 67
• Other knowledge-intensive services	• 80, 85 and 92
• Less-knowledge-intensive market services	• 50, 51, 52, 55, 60 and 63
• Other less-knowledge-intensive services	• 75, 90, 91, 93, 95 and 99.

(1) See definitions of each code in ***Statistical classification of economic activities in the European Community*** — NACE Rev. 1.1.

Time series

Data are available in many countries from 1994 onwards, but differences exist and certain years are missing. Users should note that the existence of data in this *NewCronos* domain further depends on their reliability.

Sources

- Eurostat, *NewCronos*, Theme 9, Domain **HRST,**
- *Third European Report on Science and Technology Indicators*, Directorate-General for Research, 2003.

For further data and additional methodological notes please refer to:

- Eurostat's reference database ***NewCronos*****,** Theme 9, Domain **HRST**.

Patents

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.

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.

Eurostat's patents database contains data on patent applications to the European Patent Office — EPO — and patents granted by the United States Patent and Trademark Office — USPTO. In addition Chapter 5 looks at data on triadic patent families, which originate from the *OECD's MSTI database*. Due to methodological differences in the manner of processing the data, no cross sectional comparisons are advisable between the EPO, USPTO and patent family data. Methodological issues specific to each type of data are explained below:

Patent applications to the EPO by year of filing

Data in Eurostat's EPO database refers to patent applications to the EPO by year of filing, which include both applications filed directly under the European Patent Convention and applications filed under the *Patent Co-operation Treaty* and designating the EPO — Euro-PCT — for protection. The regional distribution of patent applications is assigned according to the inventor's place of residence. If one application has more than one inventor, the application is divided equally among all of them and subsequently among their regions, thus avoiding double counting.

Data in this collection are given broken down according to the *International Patent Classification* — IPC, which assigns an invention to an IPC-class according to its function or intrinsic nature or its field of application. If a patent is assigned to more than one IPC code, the application is equally divided among all the IPC-sub-classes in order to avoid double counting. Regional data are given according to the *Nomenclature of Territorial Units for Statistics — NUTS* classification, 1998 version.

The EPO collection contains data not only for total patent applications but also for applications in 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 (1999). Here, six technical fields are defined as high technology and are constructed by aggregating the following IPC codes:

1. Computer and automated business equipment: B41J+G06+G11C,
2. Micro-organism and genetic engineering: C12M+C12N+C12P+C12Q,
3. Aviation: B64,
4. Communication technology: H04,
5. Semi-conductors: H01L,
6. Lasers: H01S.

EPO data are available from 1989 to 2001, 2001 data being provisional.

For further information on definitions and explanatory notes concerning EPO patent data see:

- Metadata in Eurostat's reference database *NewCronos*, Theme 9, Domain **PATENTS**, Collection PAT_EU and
- *Statistics on Science and Technology: annual statistics — Data 1991-2001*.

Patents granted by the USPTO by year of publication

Data on patents granted by the USPTO refer to patents granted, and not to applications as is the case for data coming from the EPO. Also, the reference year corresponds to the year of publication as opposed to the year of filing used for EPO data. In this context, data in these two collections are not comparable. USPTO data are available from 1991 to 2001.

For further information on definitions and explanatory notes concerning USPTO patent data see:

- Metadata in Eurostat's reference database *NewCronos*, Theme 9, Domain **PATENTS**, Collection **PAT_US** and
- *Statistics on Science and Technology: annual statistics — Data 1991-2001*.

Triadic Patent families by priority year

Triadic Patent families data was obtained from the *OECD's MSTI database*. The patent families presented in this publication refer to *triadic* families: i.e. a patent is a member of the patent families if and only if it has been applied for and filed at the *European Patent Office* — EPO — and the *Japanese Patent Office* — JPO — and if it has been granted by the *US Patent & Trademark Office* — USPTO. Patent families, as opposed to patents, are provided with the intention of improving international comparability (the *home advantage* is suppressed, the values of the patents are more homogeneous).

It has to be noted that data on triadic patent families is presented by priority year, i.e. the year of the first international filing of a patent. This increases the drawback of traditional patent counts with respect to timeliness and therefore latest available data refers to 1998 only.

For further methodological notes please refer to:

- Compendium of Patent Statistics, OECD, 2003.

Employment in high technology in Europe

Sources

Employment data presented in Chapter 6 originate from Eurostat's *Employment in High Tech database* — EHT. Eurostat's EHT database includes data on employment in high technology and medium-high technology manufacturing sectors, knowledge-intensive service — *KIS* — sectors, high technology service sectors, other KIS sub-sectors and reference sectors. Employment in high tech data and derived indicators are extracted and built up using data from the *EU Labour Force Survey*.

The database covers a time series from 1994 onwards, but differences exist and certain years are missing. Existence of data further depends on their reliability. Data are currently available at the national and regional levels — NUTS '99 levels 1 and 2 — for the 15 Member States of the European Union. Data at the national level are also available for some Acceding and Candidate Countries, Iceland, Norway and Switzerland.

The data presented are based on the *Statistical classification of economic activities in the European Community*, NACE Rev.1.1, 1996 both at the national and regional levels. Regional data are presented according to the *Nomenclature of Territorial Units for Statistics*, 1998, developed by Eurostat at the NUTS levels 1 and 2.

Classification of high tech and knowledge-intensive sectors

As for chapter 4 on HRST, high technology sectors in manufacturing are defined according to their global technological intensity, following the classification agreed between the OECD and Eurostat. Similarly, Eurostat's proposed classification of services sectors is also followed in the employment in high tech database. As the employment in high tech data presented in Chapter 6, Section 6.2. is also based on the *EU Labour Force Survey* data, the group of sectors are defined also at the 2 digit level of the NACE.

The groups of sectors presented in this chapter are defined below:

Description	*NACE Rev 1.1 codes (1)*
• Total	• All sectors
• Manufacturing	• Section D
• High tech and medium-high tech manufacturing	• 30, 32, 33, 24, 29, 31, 34 and 35
• High tech manufacturing	• 30, 32 and 33
• Services	• Sections G to Q
• Knowledge-intensive services	• 61, 62, 64, 65, 66, 67, 70, 71, 72, 73, 74, 80, 85 and 92
• Knowledge-intensive high technology services	• 64, 72 and 73.

(1) See definitions of each code in ***Statistical classification of economic activities in the European Community*** — NACE Rev. 1.1.

Due to the lack of employment data at the 2-digit level, employment in high tech and knowledge-intensive sector indicators for MT, PL and TR may not be calculated and therefore are not presented in this publication.

Quality of the data

The guidelines on the sample size reliability of the data established by the *EU Labour Force Survey* are applied to the EHT database and therefore regions for which reliability levels do not permit publication appear as not available and are flagged as unreliable. Regions for which reliability levels define the data as unreliable but allow for publication are included in the rankings and flagged as unreliable.

For further methodological notes please refer to:

- Eurostat's reference database ***NewCronos***, Theme 9,
  Domain *Employment in high and medium-high technology sectors — EHT*.

Value added and Labour productivity

Source

Data on value added and labour productivity in Chapter 6 were obtained from Eurostat's *Structural Business Statistics — SBS —* database.

Value added at factor cost

Value added at factor cost is the gross income from operating activities after adjusting for operating subsidies and indirect taxes.

Labour productivity

Labour productivity refers to the gross value added per person employed.

Classification of high tech and knowledge-intensive sectors

SBS data are available at the three-digit level and therefore indicators based on this source follow the strict definitions of high tech and medium-high tech manufacturing sectors agreed by the OECD and Eurostat. In this sense, high tech manufacturing indicators on Table 6.12. include Classes 24.4 — Manufacture of pharmaceuticals, medicinal chemicals and botanical products — and 35.3 — Manufacture of aircraft and spacecraft, whereas high tech and medium-high tech manufacturing indicators exclude Class 35.1 — Building and repairing of ships and boats.

High tech trade

High tech products

In order to analyse the competitive and trade performance of high tech trade markets, two main approaches (by sector and product) are used to identify the technology-intensive industries and products.

In the sectoral approach, the OECD currently identifies four high tech industry groupings based on R&D intensity:

- Aerospace,
- Computers and Office Machinery,
- Electronics-telecommunications, and
- Pharmaceuticals.

However it should be noted that not all high tech industry products are high tech products — some of them may be medium or low tech products.

A product approach was recently devised to complement the sectoral approach. It opens the way to far more detailed analysis of trade and competitiveness. The product list is based on the calculations of R&D intensity by groups of products (R&D expenditure/total sales covering six countries). The products classified as high technology products are listed on table below. The exports and imports of these products comprise high tech trade.

For the purposes of this chapter, the product approach is used to analyse the evolution of high tech trade which makes up a considerable proportion of total trade in many advanced economies.

High technology products are defined as listed below:

List of high technology Products	*SITC Rev.3*
• Aerospace	• 7921+7922+7923+7924+7925+79293+(714-71489-71499)+87411
• Computers-office machines	• 75113+75131+75132+75134+(752-7529)+75997
• Electronics-telecommunications	• 76381+76383+(764-76493-76499)+7722+77261+77318+77625+7763+7764+7768+89879
• Pharmacy	• 5413+5415+5416+5421+5422
• Scientific Instruments	• 774+8711+8713+8714+8719+87211+(874-87411-8742)+88111+88121+88411+88419+89961+89963+89967
• Electrical machinery	• 77862+77863+77864+77865+7787+77844
• Chemistry	• 52222+52223+52229+52269+525+57433+591
• Non-electrical machinery	• 71489+71499+71871+71877+72847+7311+73135+73144+73151+73153+73161+73165+73312+73314+73316+73733+73735
• Armament	• 891

Source: OECD, STI working paper 1997/2.

Units

Imports and exports are expressed in current Euro. In the absence of an appropriate trade deflator it was decided to use trade data at current prices. Figures reported for the total European Union exclude the intra-EU trade. Nevertheless, for the individual EU countries intra-EU trade is included.

Sources

All high tech trade data relating to the EU countries are based on data extracted from the *COMEXT* database — Eurostat's database of official statistics on EU's external trade and trade between EU Member States. This database includes imports and exports data flows with Member States and third countries as reported by the EU countries only. Trade data reported by third countries, including the Acceding Countries — ACC, were extracted from the UN statistical office's *Comtrade* database. The information from the latter is used to calculate the world total trade flows and high tech trade as well as high tech market shares. It should be noted that in calculating the world total trade flows, the trade data reported by the EU countries in the *COMEXT* database were added to the trade data reported by third countries in the *Comtrade* database to obtain the world total trade.

Time series

Trade data in Chapter 6 cover the reference period 1996-2001.

World totals

World totals used in this chapter in order to calculate world market shares are estimated. The world totals were calculated as the sum of the following list of 87 countries

- Belgium
- Denmark
- Germany
- Greece
- Spain
- France
- Ireland
- Italy
- Luxembourg
- the Netherlands
- Austria
- Portugal
- Finland
- Sweden
- United Kingdom
- Czech Republic
- Estonia
- Cyprus
- Lithuania
- Hungary
- Malta
- Poland
- Slovenia
- Slovak Republic
- Romania
- Iceland
- Norway
- Algeria
- Argentina
- Australia
- Bangladesh
- Barbados
- Bolivia
- Brazil
- Canada
- Chile
- China
- Colombia
- Costa Rica
- Croatia
- Ecuador
- Greenland
- Grenada
- Guadeloupe
- Guatemala
- Honduras
- Hong Kong
- India
- Indonesia
- Israel
- Jamaica
- Japan
- Jordan
- Kenya
- Kuwait
- Macao
- Madagascar
- Malawi
- Martinique
- Mauritius
- Maylasia
- Mexico
- Morocco
- New Zealand
- Nicaragua
- Oman
- Pakistan
- Paraguay
- Peru
- the Philippines
- Reunion
- Saudi Arabia
- Singapore
- St Kitts and Nevis
- St Lucia
- South Africa
- South Korea
- Sri Lanka
- Switzerland
- Taiwan
- Thailand
- Trinidad tbg
- Tunisia
- Turkey
- United States
- Uruguay
- Venezuela
- Zimbabwe.

Abbreviations and symbols

Statistical symbols and abbreviations

-	not applicable or real zero or zero by default
0	less than half of the unit used
:	not available
..	confidential data
%	percentage
p	provisional value
e	estimated value
s	Eurostat estimate
r	revised value
f	forecast
b	break in series
u	unreliable
:u	extremely unreliable data
fax	facsimile number
No	number
p.	page
Tel	telephone number
1990-92	period of several calendar years (e.g. from 1.1.1990 to 31.12.92)

Patents—High tech group titles

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

Abbreviations

A

AAGR	annual average growth rate
ACC	Acceding Countries
AGR	annual growth rate

B

BERD	expenditure on R&D in the Business enterprise sector
BES	Business enterprise sector
BMBF	Bundesministerium für Bildung, Wissenschaft, Forschung und Technologie — DE

C

CBS	Statistics Netherlands
CBSTII	Common Basis for Science, Technology and Innovation Indicators
CD-ROM	compact disc read-only memory
CEC	Commission of the European Communities
CEPS/INSTEAD	Centre d'Études de Populations, de Pauvreté et de Politiques Socio-Économiques/ International Networks for Studies in Technology Environment, Alternatives, Development — LU
CERIS	Instituto di ricerca sull'empresa e lo sviluppo — IT
CNR	Consiglio Nazionale delle Ricerche — IT

D

DG	directorate-general
DG RTD	Research Directorate-General
DTI	The Department of Trade and Industry

E

EC	European Community/Communities
EEA	European Economic Area
EHT	Employment in high tech
EPO	European Patent Office
ESA	European system of integrated accounts
EU LFS	European Union Labour Force Survey
EU/EU-15	European Union
EUR	Euro
EUR-12	Eurozone — BE, DE, EL, ES, FR, IE, IT, LU, NL, AT, PT, FI
Eurostat	Statistical Office of the European Communities

F

FhG-ISI . . . Fraunhofer Institut für Systemtechnik und Innovationsforschung

FP . . . Framework programme

FTE . . . full-time equivalent

G

GBAORD . . . Government budget appropriations or outlays on R&D

GDP . . . gross domestic product

GERD . . . gross domestic expenditure on R&D

GISCO . . . geographic information system for the Commission — Eurostat

GOV . . . government sector

GUF . . . General University Funds

H

HC . . . head count

HES . . . Higher education sector

HRST . . . Human resources in science and technology

HRSTC . . . Human resources in science and technology — Core

HRSTE . . . Human resources in science and technology — Education

HRSTO . . . Human resources in science and technology — Occupation

HRSTU . . . Human resources in science and technology — Unemployed

I

INE . . . Instituto Nacional de Estadística — ES

IPC . . . International patent classification

ISBN . . . international standard book number

ISCED . . . International standard classification for education

ISCO . . . International standard classification of occupations

ISTAT . . . Istituto Nazionale di Statistica — IT

IT . . . information technology

J

JPO . . . Japanese Patent Office

K

KIS . . . Knowledge-intensive services

L

LF . . . labour force

LFS . . . Labour Force Survey

M

MENRT . . . . . Ministère de l'éducation nationale, de la recherche et de la technologie — FR

Mio . . . . . million

Mio EUR . . . . . millions of euro

MSTI . . . . . Main Science and Technological Indicators — OECD

N

NABS . . . . . Nomenclature for the analysis and comparison of science budgets and programmes

NACE . . . . General industrial classification of economic activities within the European Communities

NESTI . . . . . National Experts on Science and Technology Indicators

NewCronos . . . . . Eurostat's statistical reference database

NHRSTU . . . . . unemployed non-HRST

NIFU . . . . . Norwegian Institute for Studies in Research and Higher Education

NUTS . . . . . Nomenclature of territorial units for statistics

O

OCT . . . . . Observatório das Ciências e das Tecnologia — PT

OECD . . . . . Organisation for Economic Cooperation and Development

ONS . . . . . Office for National Statistics — UK

OPOCE . . . . . Office for Official Publications of the European Communities

OST . . . . . Observatoire des Sciences et des Techniques — FR

P

PCT . . . . . Patent Cooperation Treaty

PhD . . . . . Philosophiae Doctor — doctor of philosophy

PNP . . . . . private non-profit sector

PPP . . . . . purchasing power parities

PPS . . . . . purchasing power standard

R

R&D . . . . . research and development

REIST-3 . . . . . Third European Report on Science and Technology Indicators

RSE . . . . . researchers

RSI . . . . . Relative specialisation index

RTD . . . . . research and technological development

- **S**

SBS . . . . . Structural Business Statistics

SITC . . . . . Standard international trade classification

STATEC . . . . . Service Central de la Statistique et des Études Économiques — LU

STI . . . . . Science, technology and innovation

S&E . . . . . Scientists and engineers

S&T . . . . . Science and technology

- **U**

UN . . . . . United Nations

UOE . . . . . Unesco/OECD/Eurostat

USPTO . . . . . United States Patent and Trademark Office

- **W**

WIPO . . . . . World Intellectual Property Organisation

- **Z**

ZEW . . . . . Zentrum für Europäische Wirtschaftsforschung — GmbH — DE

Countries

- **EU-15**

BE . . . . . Belgium

DK . . . . . Denmark

DE . . . . . Germany

EL . . . . . Greece

ES . . . . . Spain

FR . . . . . France

IE . . . . . Ireland

IT . . . . . Italy

LU . . . . . Luxembourg

NL . . . . . the Netherlands

AT . . . . . Austria

PT . . . . . Portugal

FI . . . . . Finland

SE . . . . . Sweden

UK . . . . . the United Kingdom

• Acceding Countries — ACC

CZ ..... Czech Republic
EE ..... Estonia
CY ..... Cyprus
LV ..... Latvia
LT ..... Lithuania
HU ..... Hungary
MT ..... Malta
PL ..... Poland
SI ..... Slovenia
SK ..... Slovak Republic

• Other Candidate Countries

BG ..... Bulgaria
RO ..... Romania
TR ..... Turkey

• Other countries

CA ..... Canada
CH ..... Switzerland
CN ..... China
ID ..... Indonesia
IS ..... Iceland
HK ..... Hong Kong
JP ..... Japan
KR ..... South Korea
LI ..... Liechtenstein
MX ..... Mexico
MY ..... Malaysia
NO ..... Norway
PH ..... Philippines
SG ..... Singapore
TH ..... Thailand
TW ..... Taiwan
US ..... United States