COMPENDIUM OF PATENT STATISTICS

2008

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where the governments of 30 democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The Commission of the European Communities takes part in the work of the OECD.

FOREWORD

The OECD Compendium of Patent Statistics 2008 provides a snapshot of the latest available internationally comparable data on patents. The patent indicators presented in this compendium are specifically designed to reflect recent trends in inventive activities across a wide range of OECD member and non-member countries.

Patent-based statistics reflect the inventive performance of countries, regions and firms, as well as other aspects of the dynamics of the innovation process (*e.g.* co-operation in innovation or technology paths). Patent indicators, along with other science and technology indicators, thus contribute to our understanding of the innovation system and the factors that support economic growth. For example, using the inventors' address, indicators can be developed to monitor the internationalisation of (and international collaboration in) science and technology (S&T) activities. Patent indicators are also affected by patent laws and the patenting strategy of firms, and therefore need to be interpreted carefully.

Statistics reported in this compendium differ from data published in other sources, such as patent office data. This is mainly due to methodology. The OECD's patent indicators are designed to reflect inventive activity, whereas patent data presented in the annual reports of patent offices are intended to reflect their own activity and are primarily for administrative purposes (*e.g.* budget planning).

The OECD's work in the area of patents is not limited to the development of patent indicators; efforts are also made to develop methodologies and guidelines for compiling and interpreting patent indicators, and to improve accessibility of such information for users. Within this framework, the OECD will soon publish the 2008 Patent Manual, an in-depth revision of the first edition released in 1994. The new manual aims to provide basic information about patent data used in the context of S&T measurement, construction of indicators of technological activity, and guidelines for the compilation and interpretation of patent indicators in this context.

The 2008 edition of the OECD Compendium of Patent Statistics is the seventh in an annual series, in a continuing effort to provide new or improved patent indicators for international comparisons. Extended use was made of the "Worldwide Statistical Patent Database" (October 2007) of the European Patent Office (EPO) and "REGPAT", a new OECD database on patents by region (May 2008). A series of new indicators was devised to report patenting activities in key technology fields such as nanotechnologies, environmental technologies and patenting by industries. Patenting activity by region is detailed in the first two sections of this document. The electronic version, together with spreadsheets containing the data used in charts and graphs, is available on the OECD patent statistics web site:

www.oecd.org/sti/ipr-statistics

The results presented in this compendium reflect the efforts of the OECD, the EPO and the OECD task force on patent statistics to improve the quality and availability of patent statistics for researchers and policy makers. The OECD's patent statistics task force includes representatives from Eurostat, the EPO, the Japan Patent Office (JPO), the US National Science Foundation (NSF), the US Patent & Trademark Office (USPTO) and the World Intellectual Property Organization (WIPO). OECD activity on patent statistics benefited notably from strong support from the JPO.

This edition was prepared by Hélène Dernis of the OECD Directorate for Science, Technology and Industry (DSTI), with contributions from Dominique Guellec and Maria-Pluvia Zuniga-Lara, also of DSTI.

HIGHLIGHTS

- After the surge in patenting in the 1990s, the increase in patent applications slowed at most patent offices in the early 2000s. Both the number of triadic patent families (patents taken at the EPO, the USPTO and the JPO to protect the same invention) and the number of patent applications filed under the Patent Co-operation Treaty (PCT) increased respectively by 3% and 6% a year on average between 2000 and 2005[1]. National patent offices report similar trends, with the notable exception of China, where the number of filings grew at an average pace of 22% a year over the last ten years.
- The United States, Japan and the European Union[2] demonstrate similar inventive performance, contributing to almost 90% of total triadic patent families in 2005. Patenting activity is concentrated in a set of countries (*e.g.* the United States, Japan, Germany, Korea, France and the United Kingdom). However, patenting intensity is skewed: Japan has the highest ratio of patent families per population, whereas the ratio is lower than the OECD average for the European Union.
- New indicators on patenting at the regional level show that patenting activity is even more highly concentrated than population in most OECD countries. In the United States, four regions out of 179 contributed to 34% of patents filed under the PCT by US residents in 2003-05 (and 12% of all PCT filings); these regions are located in California and the northeast. Over the same period, Tokyo led in the patenting of Japanese inventions (28%), and ranked as the most active region in PCT filings. The regions of Seoul and Gyeonggi-do in Korea ranked fifth in 2003-05. In the European Union, patenting activity is distributed between France (the Ile de France region), Germany (Stuttgart, Oberbayern), the Netherlands (Noord-Brabant) and the United Kingdom (South East of England).
- Analysing patenting activity at the regional level offers a different perspective, highlighting the technological strength of certain countries. Tokyo and the San Jose/San Francisco region in California are by far the leaders in ICT-related patenting, and the region of Noord-Brabant (in the Netherlands) contributes to the largest share of ICT patents amongst European Union countries. Most nanotechnology patents are due to American or Japanese residents from just a few regions. Seven regions of the United States are in the top ten for biotechnology patenting, along with two Japanese regions and Denmark. Denmark also took the largest number of patents in renewable energy technologies in 2003-05. German regions show their strength in patenting automobile equipment for reducing car emissions.
- Over 2003-05, 4% of all international applications were filed by universities. The proportion of patents owned by universities has increased markedly since the mid-1990s in a large number of countries, notably in Japan and some European countries (such as France, Ireland, Italy, Spain, etc.). The government sector owned less than 2% of all PCT filings. Almost 80% of patents originated from the private sector, and half of these related to high-technology industries in 2003-05.
- Data on international filings show an increase in the level of internationalisation and international collaboration in inventive activities. Among patents owned by Luxembourg, Chinese Taipei and Israel, a large majority concerned inventions made abroad. At the opposite end of the scale, Japan and Korea have far fewer internationalised inventive activities. In 2003-05, nearly half of the patent portfolios of Belgium and Switzerland were the result of international co-inventions.
- Trends in patents filed to national/regional or international patent offices reflect to some extent the attractiveness of countries. Patents are most frequently taken in the country of residence of the inventor (or applicant). Furthermore, patents filed by residents of the United States or the European Union in their own jurisdiction are more likely to be extended to other countries than JPO patents filed by Japanese residents. Chinese inventors tend to file for protection mainly in China; however, an increasing share of inventions protected on the Chinese market is due to foreign residents.

1. Unless otherwise specified, all data reported in this compendium refer to the priority date (first filing date of a patent application worldwide). Due to delays in the publication of patent documents, although the data refer to priority year 2005, all indicators are based on data available up to mid-2008.
2. European Union figures refer to the EU27.

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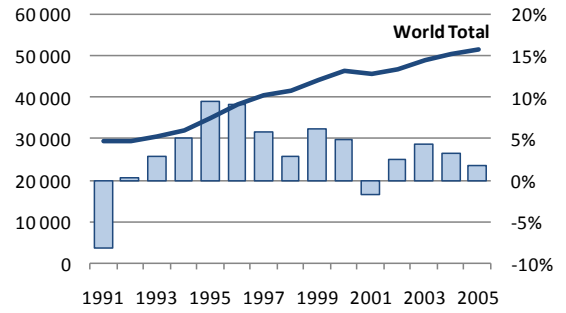
1. PATENTING PERFORMANCE OF COUNTRIES AND REGIONS

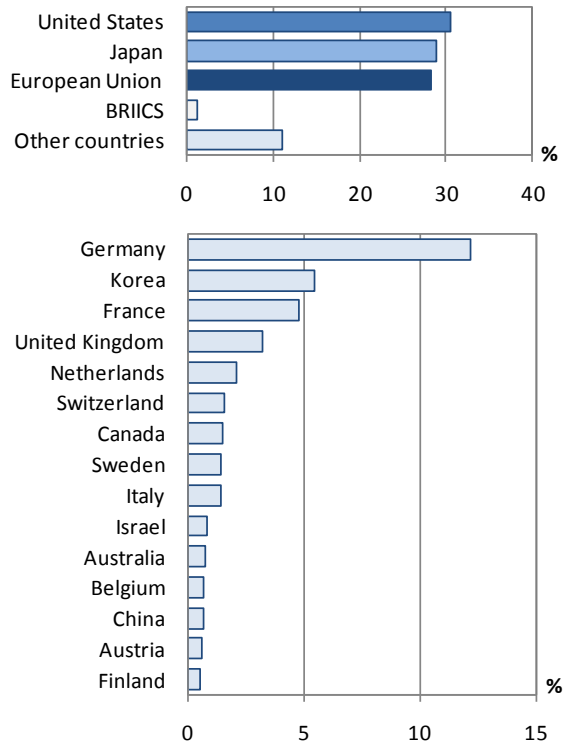
1.1. Triadic patent families

- The number of triadic patent families — sets of patents taken at the European Patent Office (EPO), the Japan Patent Office (JPO) and the US Patent and Trademark Office (USPTO) — has more than doubled since the mid-1980s. In 2005, the OECD estimated this number at nearly 52 000. Triadic patent families grew at an average rate of 5.8% per year between 1995 and 2000, but the beginning of the 21st century was marked by a slowdown, with an average growth rate of 3% a year until 2005.
- Similar trends are observed from the mid-1990s at the country level: the European Union, Japan and the United States altogether account for 88% of triadic patent families, with respective shares of 28%, 29% and 31%. However, OECD countries show contrasting trends: whereas most countries have followed a relatively steady growth rate since 1995, Finland, the Netherlands and the United Kingdom have shown a decline since the early 2000s.
- The most spectacular growth has occurred in Asian countries. Germany still ranks in third place and is Europe's strongest inventive performer as measured by patent families. Korea reached fourth position in 2005, just ahead of France and the United Kingdom, having gained eight relative positions compared to its 1995 ranking. This upsurge is also observed in China and India, with respective average growth of 33% and 26% a year between 1995 and 2005. China entered the top 15 patenting countries in 2005.
- When triadic patent families are normalised using total population, Japan, Switzerland, Sweden, Germany and the Netherlands appear as the five most inventive countries in 2005. Japan has the highest number of patent families by population (117), closely followed by Switzerland (108). Ratios for Finland, Israel, Korea, Luxembourg and the United States are above the OECD average of 43 patent families per million habitants.
- Most countries' propensity to patent has increased since 1995, with the exceptions of Belgium, Finland and the Netherlands. By size, China and India have among the lowest patenting propensity, with fewer than 0.3 triadic patent families per million population, but this proportion is increasing rapidly.

Number of triadic patent families and growth rate



Share of countries[1] in triadic patent families 2005

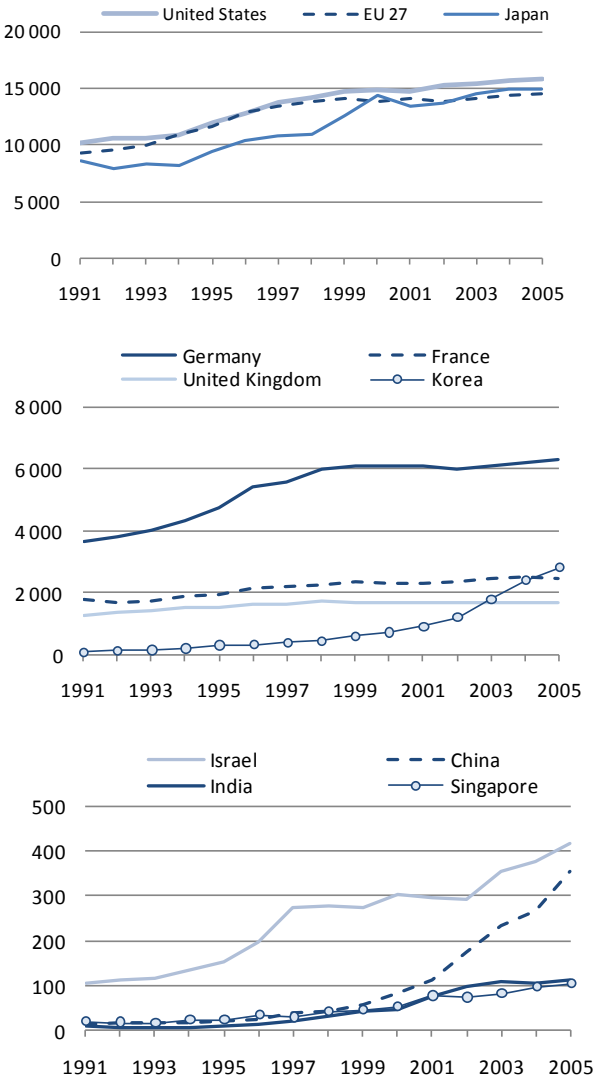


➔ Patent counts are based on the earliest priority date, the inventor's country of residence and use fractional counts. Data mainly derive from EPO Worldwide Statistical Patent Database (October 2007). Figures from 1999 onwards are estimates.

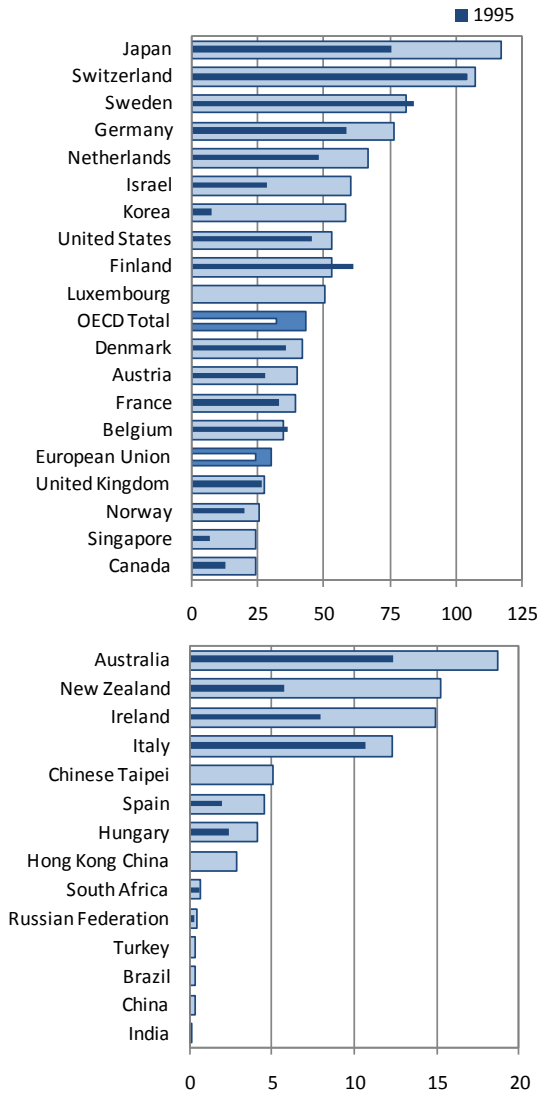
1. BRIICS refers to Brazil, China, India, Indonesia, the Russian Federation and South Africa.

Source: OECD, Patent Database, June 2008.

Trends in triadic patent families



Triadic patent families per million population[1] 2005



➔ Data mainly derive from EPO's Worldwide Statistical Patent Database (October 2007). Figures from 1999 onwards are estimates.

1. Only countries/economies with more than 20 families are included in the graph.

Source: OECD, Patent Database, June 2008.

Triadic patent families are defined at the OECD as a set of patents taken at the European Patent Office (EPO), the Japan Patent Office (JPO), and granted by the US Patent and Trademark Office (USPTO), to protect the same invention (Dernis and Khan, 2004). In terms of statistical analysis, indicators on triadic patent families improve the international comparability of patent-based statistics (no "home advantage"). Furthermore, patents that belong to the family are typically of higher value (as regards additional costs and delays involved in extending protection to other countries).

The criteria for counting triadic patent families are the earliest priority date (first application of the patent worldwide), the inventor's country of residence, and fractional counts. Owing to time lag between the priority date and the availability of information (especially for USPTO grants), 1999 is the latest year for which triadic patent families are almost completely available. Therefore, data for the latest years are OECD estimates based on more recent series (Dernis, 2007).

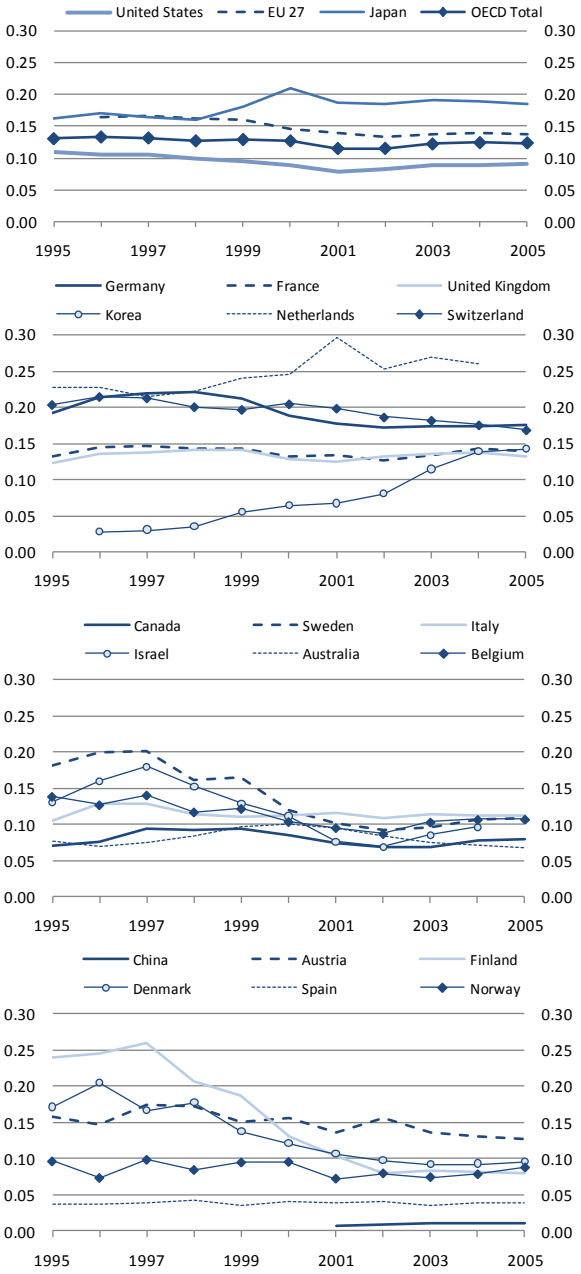
- The patent intensity of the main OECD regions follows a more stable pattern than the number of families in the three major regions, among which Japan has had the highest patent intensity since the end of the 1990s, when a peak was observed. Previously, its patenting intensity was similar to that of the European Union.
- In contrast, the patent intensity of the United States is below the OECD average. This is due to a greater increase in industry-financed R&D than in triadic patent families, especially in the late 1990s. In the European Union, the number of patent families increased at a slower pace than R&D expenditure. Conversely, in Japan the number of triadic patent families increased more rapidly than R&D expenditures by the industry sector.
- Between 1995 and 2005, Germany, France, the Netherlands, Switzerland and the United Kingdom remained at the highest level of patent intensity, above the OECD average. The Netherlands performs on top, with more than 260 patent families per billion USD of R&D expenditure. The ratio is rising rapidly in Korea, with growth of triadic patent families four times higher than that of R&D expenditures.
- Canada, France, Germany and the United Kingdom maintained stable levels of patent intensity over the period 1995-2005. However, this indicator shows a strong decrease in Denmark, Finland, Israel and Sweden since the mid-1990s due to a slowdown in the number triadic patent families originating from these countries, compared to the evolution of R&D expenditures spent between 1994 and 2004.

Patent intensity

Alongside other science and technology (S&T) indicators such as research and development (R&D) expenditures and personnel, innovation surveys, etc., patents provide a uniquely detailed source of information on inventive activity. Patent statistics are frequently viewed as an indicator of R&D output.

There is a strong positive correlation between the number of triadic patent families and industry-financed R&D expenditures (R2 = 0.99). The more a country spends on R&D, the higher the propensity to patent. The patent intensity is defined here as the ratio of triadic patent families to industry-financed R&D, lagged by one year.

Ratio of triadic patent families to industry-financed GERD[1]



➔ Patent counts are based on the earliest priority date, the inventor's country of residence and use fractional counts. Data mainly derive from EPO Worldwide Statistical Patent Database (October 2007). Figures from 1999 onwards are estimates.

1. Gross domestic expenditure on R&D (GERD) financed by industry, millions of year 2000 USD using purchasing power parities, lagged by one year. Data for Italy refer to business enterprise expenditure on R&D, financed by industry.

Sources: OECD, Patent and R&D Databases, June 2008.

1.2. Patenting activity at regional level

- Empirical evidence shows that innovative activities are not distributed evenly within countries, with some regions being highly innovative while others demonstrate very little innovation. Analysing patents by region is a way to assess the concentration of inventive activities within countries. As an illustration, when broken down by region the number of patents filed under the Patent Co-operation Treaty (PCT) can point out inventive regions that act as important sources of the world's knowledge.
- The PCT offers the possibility to seek patent rights in a large number of countries by filing a single international application with a single patent office (receiving office). Applicants have an additional 18 months to decide whether to seek a national or regional (*e.g.* EPO) patent, and if they so wish, they must do so within 30 months of the priority date (an average of 60% of PCT filings enter the EPO regional phase). Due to the international dimension, counts of PCT applications provide an alternative indicator of countries' inventive activities.
- The PCT procedure is increasingly used for patent applications, with nearly 140 000 patents designating the EPO for the priority year 2005. This expansion is strongly correlated with the number of contracting states, which has doubled since the mid-1990s.
- Within countries, inventive activities are likely to be concentrated in a small number of regions. For most countries, the degree of concentration is much higher than that of population. Among OECD countries, Switzerland has the lowest concentration ratio (30), slightly lower than that of population (34). Inventive activities are the most highly concentrated in certain regions of large countries such as Canada (94), Australia (91) and Turkey (83).

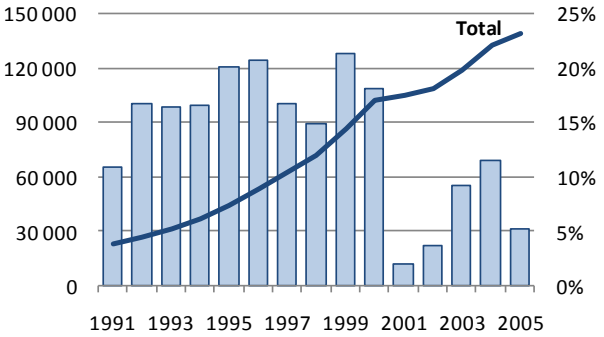
The geographic concentration index is defined for the variable y as:

$$\left[\sum_{i=1}^{N}\left|y_i - a_i\right| \Big/ 2\right] \times 100$$

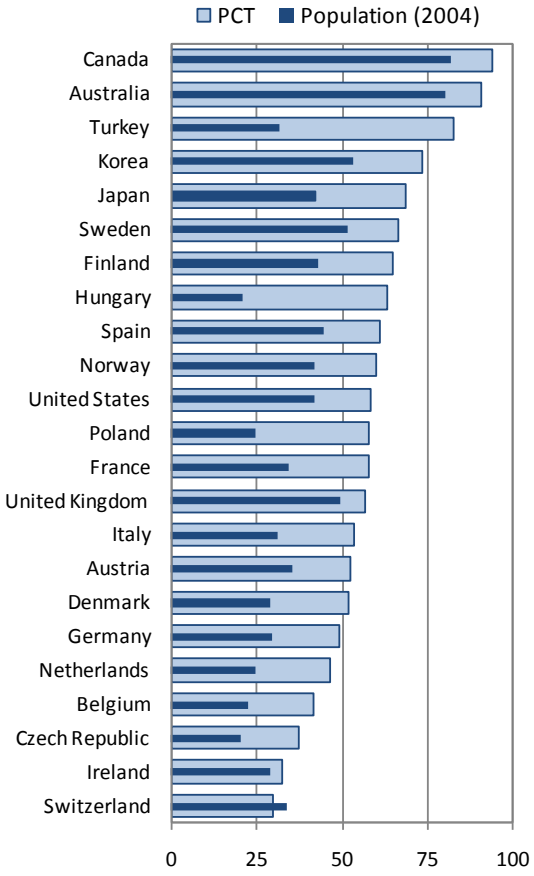
where y_i is the share of region i to the national total, a_i is the area of region i as a percentage of the country area and N stands for the number of regions. The index ranges from 0 (no concentration) to 100 (maximum concentration) in all countries and is suitable for international comparisons of geographic concentration.

The value of the geographic concentration index is affected by the size of regions. Consequently, differences in geographic concentration between countries may be partially due to differences in the average size of regions in each country.

Number of patent applications filed under the PCT and growth rate



Geographic concentration index[1] of PCT Regional level, 2005



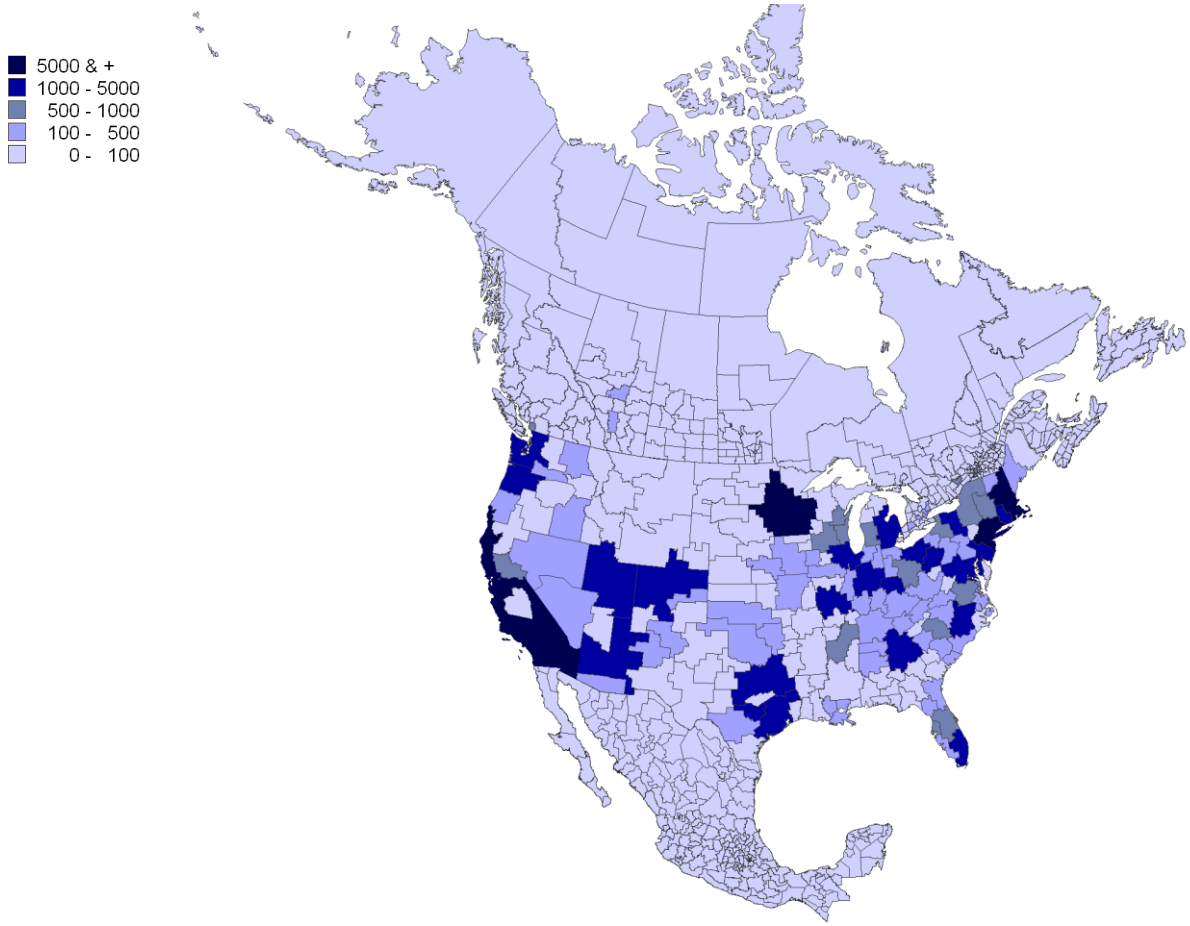
➔ Patent counts are based on the priority date, the inventor's country/region of residence and use fractional counts of PCT filings at international phase (EPO designations).

1. Only OECD member countries with more than 100 PCT applications in 2005 are included in the graph. The geographic concentration index is based on Territorial Level 3.

Sources: OECD, Patent and REGPAT Databases, June 2008; OECD Territorial database, 2008.

Number of patent applications filed under the PCT, 2003-2005

North America



➔ Patent counts are based on the priority date, the inventor's region of residence and use fractional counts on PCT filings at international phase (EPO designations). Data for Mexico are not yet available at regional level. Data are graphically presented according to level 3 of the Nomenclature of Territorial Units for Statistics (NUTS 3) for Canada, and use Territorial Level 3 for the United States.

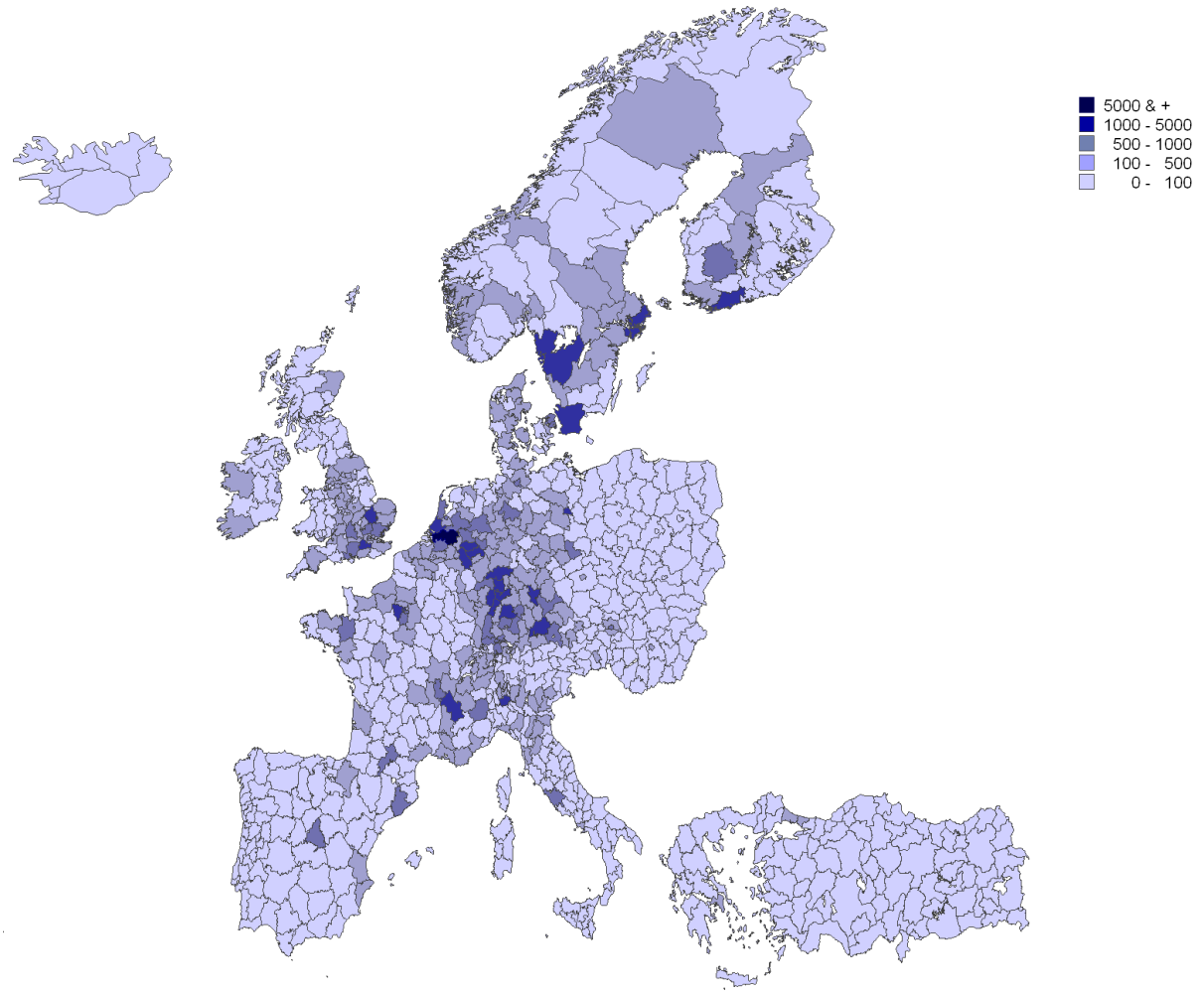
Sources: OECD, Patent and REGPAT Databases, June 2008.

- In the United States, most PCT filings come from just a few regions. Inventors from California contributed to nearly 22% of PCT filings originating from the United States between 2003 and 2005. The region of San José, San Francisco and Oakland as defined by the US Bureau of Economic Analysis (BEA) leads with over 15 500 applications, 11.7% of PCT applications filed by US residents. The BEA regions of New York/Newark/Bridgeport and Boston/Worcester/Manchester follow, accounting for 9.7% and 7.2% of PCT filings from the United States, respectively. These three regions represent almost 10% of all PCT filings.

- In Europe, the most patent-intensive regions are localised in the centre of Europe, in the Nordic countries and in the United Kingdom. Noord-Brabant in the Netherlands takes the lead in PCT filings, with nearly 5 400 applications in 2003-05. This represents 4.3% of PCT filings originating from the European Union, and more than half of PCT filings from the Netherlands. Four German regions are among the top five most inventive regions in the European Union, namely Stuttgart (4 265 applications), Munich (3 927), Düsseldorf (2 152) and the region of Rhein-Main (2 072). The regions of Stockholms län (Sweden) and Paris (France) rank just outside the top five, with 2 002 and 1 939 applications respectively in 2003-05.

Number of patent applications filed under the PCT, 2003-2005

Europe



➔ Patent counts are based on the priority date, the inventor's region of residence and use fractional counts on PCT filings at international phase (EPO designations). Data are graphically presented according to TL 3. Data for Iceland are not yet available at regional level.

Sources: OECD, Patent and REGPAT Databases, June 2008.

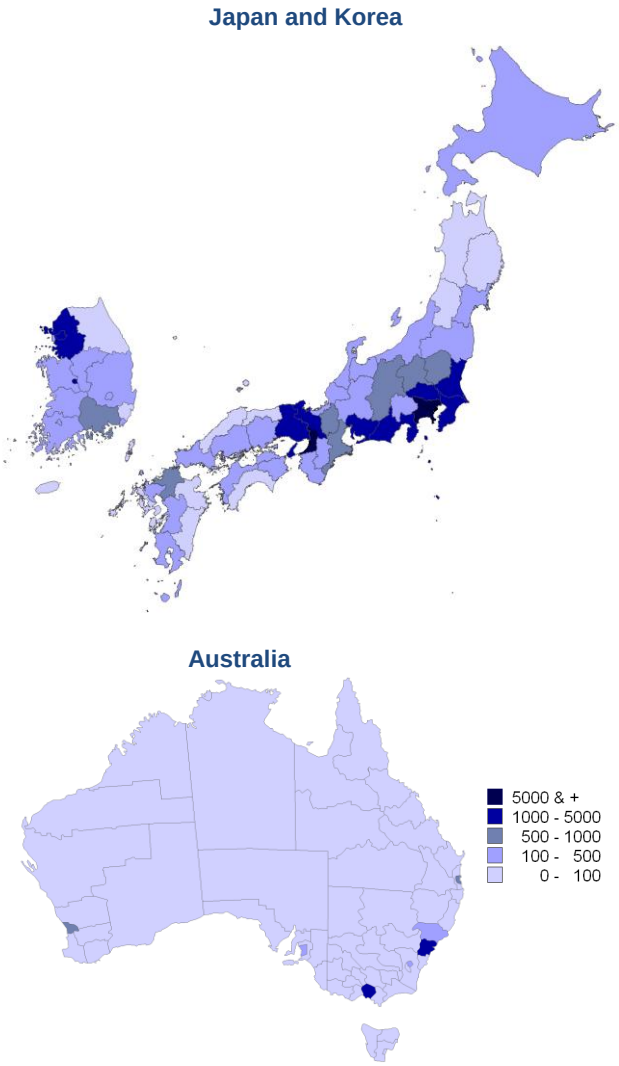
Patent data by regions allow for a broad range of analyses to address issues relating to the regional dimension of inventions. Patent data have been linked to regions by the OECD according to the address of the inventors (and applicants). The data have been regionalised at a very detailed level, so that over 5 000 regions are covered across most OECD countries, plus China and India (Maraut, S. *et al.*, 2008).

The regionalisation process is based on Eurostat's Nomenclature of Territorial Units for Statistics (NUTS) – a geo-code standard for referencing the administrative division of countries in the European Union for statistical purposes. NUTS splits into three levels. Furthermore, the OECD Territorial Database also uses another classification of regions within each member country, based on two territorial levels: the higher level (TL 2) consists of about 300 macro regions and the lower (TL 3) is composed of about 2 000 micro regions.

In early 2008, the OECD REGPAT database was built on the lowest level (NUTS 3), which corresponds to TL 3 for most countries. TL 3 differs from the NUTS 3 classification for Belgium, Greece and the Netherlands, where TL 3 corresponds to the NUTS 2 level. For Germany, TL 3 (97 spatial planning regions: *Groups of Kreise*) is an intermediate level between NUTS 2 and NUTS 3 (439 micro regions). Data for the United States are regionalised at county level (over 3 000 counties) whereas TL 3 derives from BEA definitions of regions (179 regions). Data for China and India are based on administrative regions.

- In the Asia-Pacific area, the majority of patent applications filed under the PCT originate from Japanese inventors principally located in the regions of Tokyo, Kanagawa and Osaka, altogether representing 50% of PCT filings from Japan and 8% of all PCT applications in 2003-05. Among all regions worldwide, Tokyo ranks first, with 4.5% of all PCT filings.
- In Korea, Seoul and the province of Gyeonggi-do each contributed to over 4 000 PCT applications, ranking the capital region of Korea fifth worldwide for patents over the period 2003-2005.
- In Australia, most inventive activities take place in the proximity of large cities. Sydney and Melbourne account for over 54% of patent applications for Australian inventions.
- The province of Guangdong in China (the city of Shenzhen in particular) is the top-ranked region among emerging countries with more than 2 300 PCT filings in 2003-2005, surpassing the cities of Beijing (1 074) and Shanghai (934). In India, inventive activities take place in the regions of Maharashtra (720 applications, mainly from Mumbai), Karnataka (497) and Andhra Pradesh (414).
- However, because of the skewed distribution of PCT patent applications by region, the ranking may change dramatically depending on the reference year used, except in regions with very high patenting activity (*e.g.* California, Tokyo, etc). The following section presents regional breakdowns of patenting in selected technology areas, providing another perspective of inventive activities.

Number of patents filed under the PCT, 2003-2005



➔ Patent counts are based on the priority date, the inventor's region of residence and use fractional counts on PCT filings at international phase (EPO designations). Data are graphically presented according to TL 3.

Sources: OECD, Patent and REGPAT Databases, June 2008.

Top 60 patenting regions[1] worldwide

Region		PCT filings	Share (%) in total filings	Share (%) in country's filings
Tokyo	JP	17 584	4.5	27.9
San Jose-San Francisco-Oakland	US	15 599	4.0	11.7
New York-Newark-Bridgeport	US	13 044	3.3	9.7
Boston-Worcester-Manchester	US	9 701	2.5	7.2
Capital region (Seoul - Incheon - Gyeonggi-do)	KR	8 608	2.2	67.5
Los Angeles-Long Beach-Riverside	US	7 304	1.9	5.5
Kanagawa	JP	7 032	1.8	11.2
Osaka	JP	6 961	1.8	11.1
île de France	FR	6 301	1.6	36.5
Minneapolis-St. Paul-St. Cloud	US	5 619	1.4	4.2
Stuttgart	DE	5 488	1.4	11.6
San Diego-Carlsbad-San Marcos	US	5 393	1.4	4.0
Noord-Brabant	NL	5 391	1.4	57.7
Oberbayern	DE	5 344	1.4	11.3
Chicago-Naperville-Michigan City	US	4 939	1.3	3.7
Israel	IL	4 894	1.3	100.0
Philadelphia-Camden-Vineland	US	4 627	1.2	3.5
South East (England)	GB	4 187	1.1	23.9
Aichi	JP	3 711	1.0	5.9
Washington-Baltimore-Northern Virginia	US	3 650	0.9	2.7
Detroit-Warren-Flint	US	3 522	0.9	2.6
Köln	DE	3 438	0.9	7.3
Seattle-Tacoma-Olympia	US	3 330	0.9	2.5
Ontario	CA	3 324	0.9	44.4
Denmark	DK	3 253	0.8	100.0
Houston-Baytown-Huntsville	US	3 232	0.8	2.4
Darmstadt	DE	3 151	0.8	6.7
East of England	GB	3 078	0.8	17.5
Rhône-Alpes	FR	2 940	0.8	17.0
Düsseldorf	DE	2 901	0.7	6.2
Saitama	JP	2 884	0.7	4.6
Karlsruhe	DE	2 801	0.7	5.9
Etelä-Suomi	FI	2 536	0.7	60.0
Raleigh-Durham-Cary	US	2 439	0.6	1.8
Shenzhen - Guangdong	CN	2 335	0.6	29.9
Lombardia	IT	2 303	0.6	29.4
Atlanta-Sandy Springs-Gainesville	US	2 300	0.6	1.7
Dallas-Fort Worth	US	2 281	0.6	1.7
New South Wales	AU	2 218	0.6	36.9
Chiba	JP	2 180	0.6	3.5
Kyoto	JP	2 143	0.5	3.4
Portland-Vancouver-Beaverton	US	2 136	0.5	1.6
Denver-Aurora-Boulder	US	2 089	0.5	1.6
Freiburg	DE	2 085	0.5	4.4
Rheinhessen-Pfalz	DE	2 016	0.5	4.3
Stockholm	SE	2 002	0.5	29.6
Ibaraki	JP	1 997	0.5	3.2
Cleveland-Akron-Elyria	US	1 982	0.5	1.5
Rochester-Batavia-Seneca Falls	US	1 937	0.5	1.4
Hyogo	JP	1 924	0.5	3.1
Chungcheong region	KR	1 883	0.5	14.8
Québec	CA	1 882	0.5	25.1
Mittelfranken	DE	1 823	0.5	3.9
Shizuoka	JP	1 809	0.5	2.9
Tübingen	DE	1 765	0.5	3.7
London	GB	1 751	0.4	10.0
Phoenix-Mesa-Scottsdale	US	1 666	0.4	1.2
Austin-Round Rock	US	1 653	0.4	1.2
Victoria	AU	1 642	0.4	27.3
Hartford-West Hartford-Willimantic	US	1 592	0.4	1.2

➔ Patent counts are based on the priority date, the inventor's region of residence and use fractional counts on PCT filings at international phase (EPO designations).

1. The regional breakdown is presented at NUTS 2 level, except for Japan (NUTS 3), the United Kingdom (NUTS 1) and the United States (TL 3). In this breakdown, smaller countries such as Denmark and Israel are treated as regions.

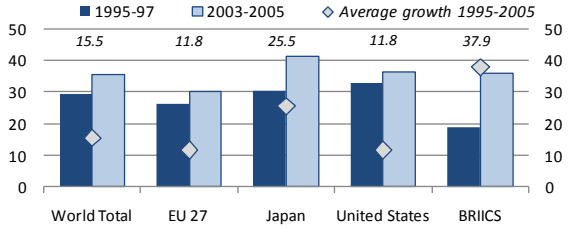
Sources: OECD, Patent and REGPAT Databases, June 2008.

2. PATENTING NEW TECHNOLOGIES

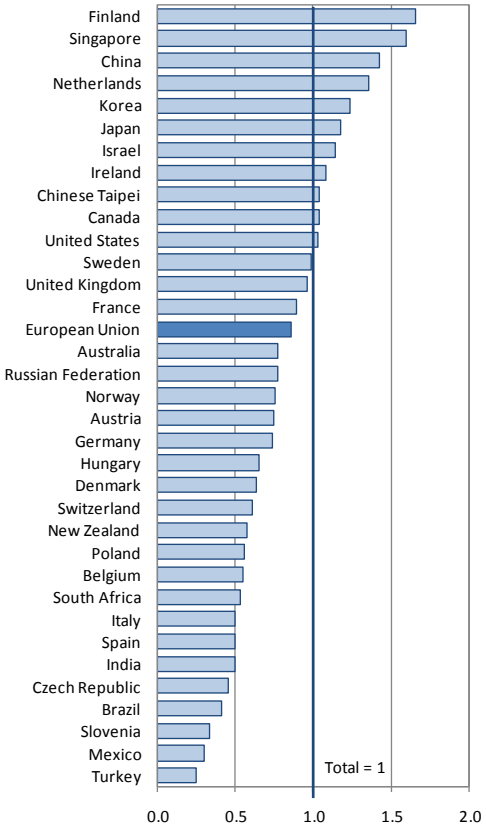
2.1. Patents in ICT

- The number of ICT-related patents grew steadily from the mid-1990s to 2005, at an average rate of 4.7% a year from 2000. In 2005, more than 50 500 international patent applications were filed under the PCT to protect inventions in ICT. The number of ICT-related patents increased more rapidly than the total number of PCT applications: on average, there is a larger proportion of ICT-related patents in countries' patent portfolios.
- The share of ICT-related patents in total patents taken by countries rose by five percentage points in 2003-05 as compared with the 1995-97 level. This proportion doubled in the BRIICS countries, where 36% of patents filed in 2003-05 were related to ICT. Finland, Singapore, China, the Netherlands, Korea and Japan had a large concentration of ICT-related patents compared to all countries, as depicted by the revealed technological advantage index. Over 2003-05, more than 50% of patents taken by China, Finland and Singapore concerned ICT, compared to an average of 35% of total patents.
- The United States (35%), Japan (18.6%) and Germany (7.7%) were the leaders in ICT-related patenting under the PCT in 2005. China (4.2%) and Korea (4.6%) were among the top five countries in ICT-related patents. The number of ICT patents has risen strongly in these two countries over the last ten years, with more than 2 000 patents in China and about 2 300 in Korea in 2005.
- Tokyo is the leading region for ICT-related inventions, contributing to nearly 9 400 ICT patents and 6.8% of all ICT-related patents filed under the PCT. Tokyo is followed by two regions in the United States — San Jose/San Francisco/Oakland in California and New York/Newark/Bridgeport on the east coast. Seoul and the province of Gyeonggi-do in Korea rank fourth, with 4 400 ICT-related patents. The Noord-Brabant region (Netherlands), Ile de France (France) and Oberbayern (Germany) are the top three European regions patenting in ICT. The city of Shenzhen in Guangdong province of China made a spectacular entrance into the top 15 ICT-related patenting regions in 2003-05, with 52% of the patents taken for ICT-related inventions made in China.

Share of ICT-related patents in total patents - *%*



Revealed technological advantage in ICT[1], 2003-05

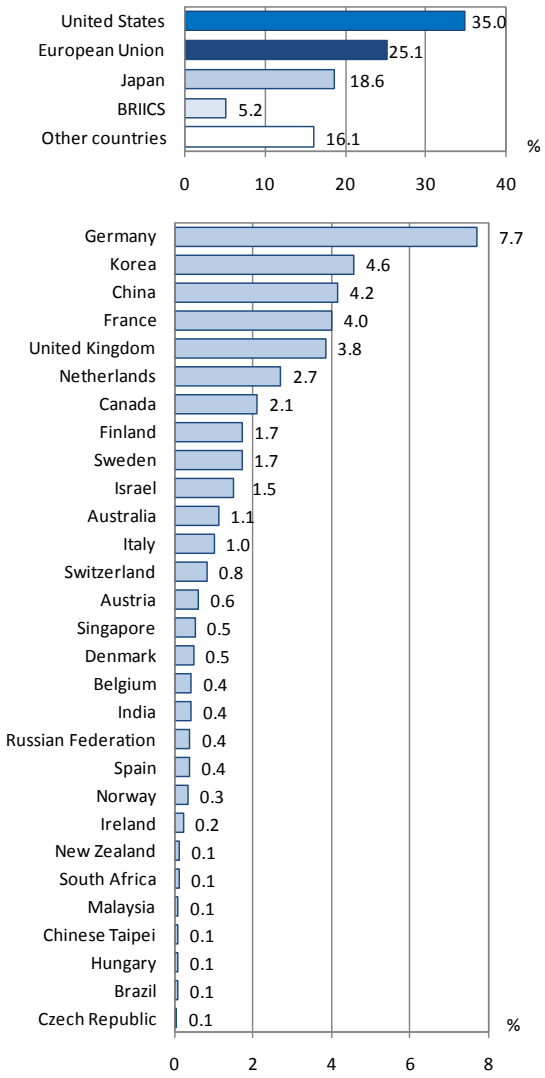


➔ Patent counts are based on the priority date, the inventor's country of residence and use fractional counts on PCT filings at international phase (EPO designations). BRIICS refers to Brazil, China, India, Indonesia, the Russian Federation and South Africa.

1. Share of ICT in the country's patents relative to the share of ICT in total patents. Only countries/economies with more than 250 patents over the period are included in the graph.

Source: OECD, Patent Database, June 2008;
EPO, Worldwide Statistical Patent Database, October 2007.

Share of countries/economies in ICT-related patents, 2005



Top 40 regions[1] in ICT-related patents 2003-2005

Region		ICT patents	Share *(%)* in total
Tokyo	JP	9 382	6.8
San Jose-San Francisco-Oakland	US	8 576	6.2
New York-Newark-Bridgeport	US	4 420	3.2
Capital region (Seoul - Incheon - Gyeonggi-do)	KR	4 412	3.2
Noord-Brabant	NL	3 801	2.8
Boston-Worcester-Manchester	US	3 579	2.6
Kanagawa	JP	3 390	2.5
San Diego-Carlsbad-San Marcos	US	2 788	2.0
Osaka	JP	2 701	2.0
Los Angeles-Long Beach-Riverside	US	2 687	2.0
île de France	FR	2 424	1.8
Oberbayern	DE	2 295	1.7
Shenzhen - Guangdong	CN	2 033	1.5
Seattle-Tacoma-Olympia	US	1 998	1.5
Israel	IL	1 974	1.4
Chicago-Naperville-Michigan City	US	1 935	1.4
South East (England)	GB	1 777	1.3
Minneapolis-St. Paul-St. Cloud	US	1 490	1.1
Etelä-Suomi	FI	1 457	1.1
Washington-Baltimore-Northern Virginia	US	1 447	1.1
Saitama	JP	1 424	1.0
Ontario	CA	1 423	1.0
Dallas-Fort Worth	US	1 295	0.9
Portland-Vancouver-Beaverton	US	1 248	0.9
Köln	DE	1 237	0.9
Raleigh-Durham-Cary	US	1 212	0.9
East of England	GB	1 207	0.9
Stuttgart	DE	1 196	0.9
Austin-Round Rock	US	1 179	0.9
Kyoto	JP	1 151	0.8
Philadelphia-Camden-Vineland	US	1 037	0.8
Stockholm	SE	957	0.7
Phoenix-Mesa-Scottsdale	US	917	0.7
Rochester-Batavia-Seneca Falls	US	866	0.6
Denver-Aurora-Boulder	US	863	0.6
Aichi	JP	774	0.6
Rhône-Alpes	FR	769	0.6
Chiba	JP	737	0.5
Singapore	SG	729	0.5
Denmark	DK	727	0.5

➔ Patent counts are based on the priority date, the inventor's country of residence and use fractional counts on PCT filings at international phase (EPO designations). BRIICS refers to Brazil, China, India, Indonesia, Russian Federation and South Africa.

1. The regional breakdown is presented at NUTS 2 level, except for Japan (NUTS 3), the United Kingdom (NUTS 1) and the United States (TL 3). In this breakdown, smaller countries such as Denmark and Israel are treated as regions.

Sources: OECD, Patent and REGPAT Databases, June 2008 and EPO Worldwide Statistical Patent Database, October 2007.

Patents in Information and Communication Technologies (ICT) are identified using the International Patent Classification (IPC) system: one or several classification codes are attributed to the patent during the examination process. For emerging technologies, however, a specific category or class might not yet be incorporated into the patent classification system, which makes it difficult to identify the patents related to these technologies *ex post*. Patents taken in the ICT sector can be split into four fields, based on the following list of IPC codes:

- **Telecommunications:** G01S,G08C,G09C,H01P,H01Q,H01S3/(025,043,063,067,085,0933,0941,103,133,18,19,25), H1S5,H03B,H03C,H03D, H03H,H03M,H04B,H04J,H04K,H04L,H04M,H04Q.
- **Consumer electronics:** G11B,H03F,H03G,H03J,H04H,H04N,H04R,H04S.
- **Computers, office machinery:** B07C,B41J,B41K,G02F,G03G,G05F,G06,G07,G09G,G10L,G11C,H03K,H03L.
- **Other ICT:** G01B,G01C,G01D,G01F,G01G,G01H,G01J,G01K,G01L,G01M,G01N,G01P,G01R,G01V,G01W,G02B6, G05B,G08G,G09B,H01B11,H01J(11/,13/,15/,17/,19/,21/,23/,25/,27/,29/,31/,33/,40/,41/,43/,45/),H01L.

For further details on the IPC, 8th edition, see: http://www.wipo.int/classifications/ipc/ipc8/?lang=en

2.2. Patents in nanotechnology

- Inventive activities in nanotechnology have increased substantially since the end of the 1990s: at 18%, the average annual growth rate in nanotechnology patents filed under the PCT surpasses that of overall PCT applications (12.1%) for the period 1995-2005.
- Most countries report a significant increase in their shares of nanotechnology in total national patenting in the mid-2000s as compared with the mid-1990s, although nanotechnology patenting remains relatively limited (1.1% of total patents on average). Efforts undertaken in Japan are highlighted by the rise in the number of nanotechnology patents in its portfolio (from 0.1% of all patents in 1995-97 to 1% in 2003-05).
- Singapore, Ireland, the United States, Japan and Israel have a higher concentration of nanotechnology patents than other countries, with a revealed technological advantage index in nanotechnology ranking from 2.7 (Singapore) to 1.1 (Israel).
- The European Union, Japan and the United States have contributed to 84% of all nanotechnology patents. The share of nanotechnology patents for inventions made in Japan tripled between 1995 and 2005, reaching 16.7% of all nanotechnology patents in 2005. Korea has also broadly invested in nanotechnology, and is now the fifth-ranked country in nanotechnology-related patenting.

Nanotechnology patents

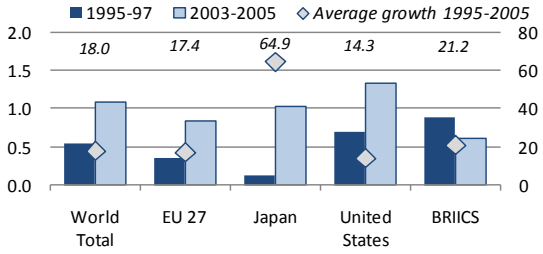
To reflect the increasing interest and importance of nanotechnology in patents, the EPO, the JPO and the USPTO have made intensive efforts to improve their respective classification systems and to collect all nanotechnology-related patents within a single class.

The EPO defines nanotechnology as follows: "the term nanotechnology covers entities with a controlled geometrical size of at least one functional component below 100nm in one or more dimensions susceptible to make physical, chemical or biological effects available which are intrinsic to that size. It covers equipment and methods for controlled analysis, manipulation, processing, fabrication or measurement with a precision below 100nm".

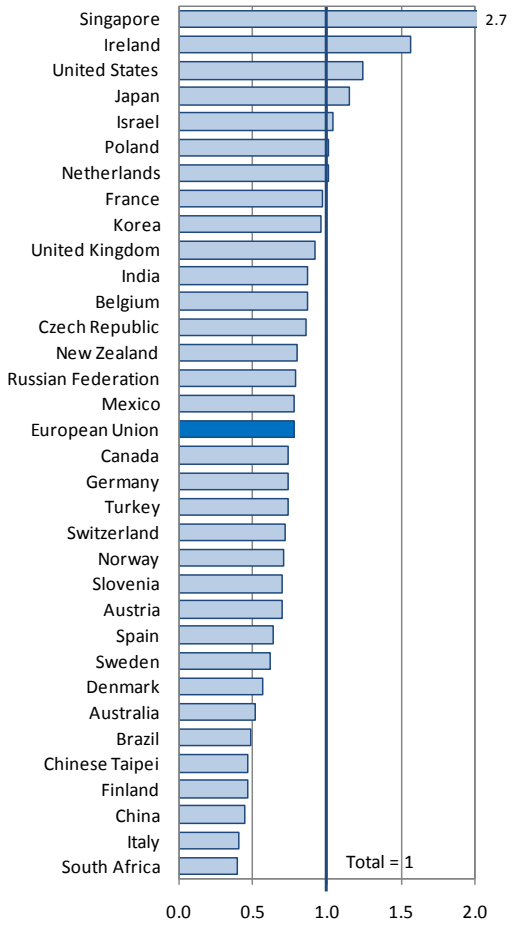
In 2003, a nanotechnology working group was created in the EPO to establish a definition and to identify nanotechnology patents through keyword searches, consultation with EPO experts in the field, and peer reviews by external experts. As a result of these endeavours, about 90 000 out of 20 million patents and non-patent literature documents were tagged to class Y01N.

For further information, see *Scheu et al.* (2006) and *Igami and Okazaki* (2007).

Share of nanotechnology patents in total patents - %



Revealed technological advantage in nanotechnology[1], 2003-05

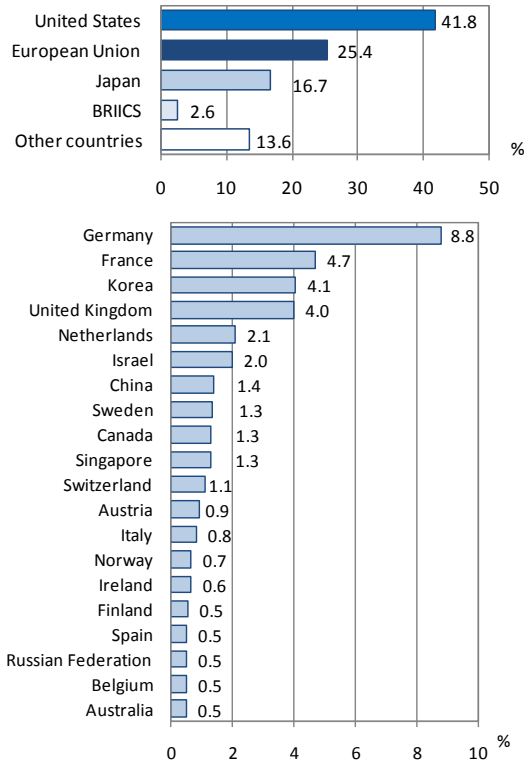


➔ Patent counts are based on the priority date, the inventor's country of residence and use fractional counts on PCT filings at international phase (EPO designations). BRIICS refers to Brazil, China, India, Indonesia, Russian Federation and South Africa.

1. Share of nanotechnology in the country's patents relative to the share of nanotechnology in total patents. Only countries/economies with more than 250 patents over the period are included in the graph.

Source: OECD, Patent Database, June 2008.

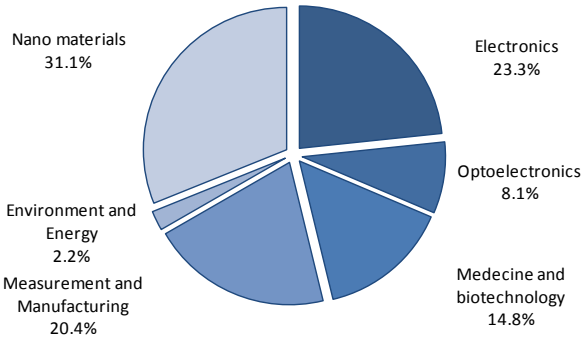
Share of countries in nanotechnology patents 2005



Top 30 regions[1] in nanotechnology patents 2003-2005

Region		Nanotechnology patents	Share *(%)* in total
San Jose-San Francisco-Oakland	US	285	6.8
Tokyo	JP	226	5.4
Boston-Worcester-Manchester	US	217	5.2
Kanagawa	JP	114	2.7
New York-Newark-Bridgeport	US	109	2.6
Los Angeles-Long Beach-Riverside	US	109	2.6
Capital region (Seoul - Incheon - Gyeonggi-do)	KR	72	1.7
Noord-Brabant	NL	72	1.7
Minneapolis-St. Paul-St. Cloud	US	70	1.7
Austin-Round Rock	US	67	1.6
Rhône-Alpes	FR	61	1.5
Ile de France	FR	58	1.4
Ibaraki	JP	57	1.4
Osaka	JP	57	1.4
Philadelphia-Camden-Vineland	US	56	1.3
Israel	IL	55	1.3
Washington-Baltimore-Northern Virginia	US	49	1.2
San Diego-Carlsbad-San Marcos	US	44	1.1
Chicago-Naperville-Michigan City	US	43	1.0
South East (England)	GB	42	1.0
Houston-Baytown-Huntsville	US	42	1.0
East of England	GB	40	1.0
Rochester-Batavia-Seneca Falls	US	39	0.9
Darmstadt	DE	39	0.9
Singapore	SG	37	0.9
Detroit-Warren-Flint	US	36	0.9
Oberbayern	DE	36	0.9
Köln	DE	35	0.8
Albany-Schenectady-Amsterdam	US	35	0.8
Ontario	CA	32	0.8

Nanotechnology patents by application fields[2], 2003-2005



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1. The regional breakdown is presented at NUTS 2 level, except for Japan (NUTS 3), the United Kingdom (NUTS 1) and the United States (TL 3). In this breakdown, smaller countries such as Denmark and Israel are treated as regions.
2. Nanotechnology patent applications are categorised into application fields using the IPC (see *Igami and Okazaki*, *2007*).

Sources: OECD, Patent and REGPAT Databases, June 2008.

- The Californian region of San Jose/San Francisco/ Oakland and, on the east coast, the regions of Boston and New York City contributed to almost 15% of all nanotechnology patents filed under the PCT. The Tokyo and Kanagawa regions of Japan are ranked second and fourth respectively in nanotechnology patenting. Noord-Brabant (Netherlands), Rhône-Alpes (France) and Ile de France (France) are the three leading European regions in nanotechnology patenting.

- Nanotechnology covers technologies developed through a *top-down* process in which nano-structures are created by the miniaturisation of existing technologies (*e.g. electronics* and *opto-electronics*); and technologies developed through a *bottom-up* process (*e.g. nanomaterials*).

2.3. Patents in biotechnology

- After steady growth in the 1990s, the number of biotechnology patents filed under the PCT started to decrease from more than 10 000 applications in 2000 to almost 7 200 in 2005 (-7.5% on average over 2000-05, compared to +20.2% on average between 1995 and 2000). Patenting of inventions in biotechnology followed a reverse trend to that of total PCT patent applications, which continued to increase by an average of 4.7% from 2000.
- The surge in the late 1990s was partly due to a flow of patent applications pertaining to the human genome, while the recent decrease is often explained by patent offices' more stringent criteria for granting patents on genetic material. Consequently, the relative weight of biotechnology in all international patent filings decreased between the mid-1990s and the early 2000s in many countries. On average, biotechnology patents represented 5.8% of countries' patent portfolios over 2003-05, compared to 9.4% in the mid-1990s.
- Denmark remains an active country in biotechnology patenting. Its share of patents in biotechnology (12.1%) is over double the total share of biotechnology patents taken between 2003 and 2005. Singapore, Belgium, Canada and New Zealand follow with over 8% of their patents being taken in biotechnology.
- In 2005, the United States contributed to 40.6% of all biotechnology patents; Japan and Germany followed with respective shares of 17% and 7%.

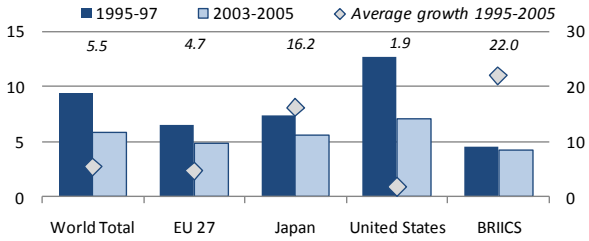
Biotechnology patents

The OECD developed both a single definition and a list-based definition of biotechnology. The single definition of biotechnology is deliberately broad. It covers all modern biotech but also many traditional or borderline activities. For this reason, the single definition should **always** be accompanied by the list-based definition. The single definition is: "*The application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services.*"

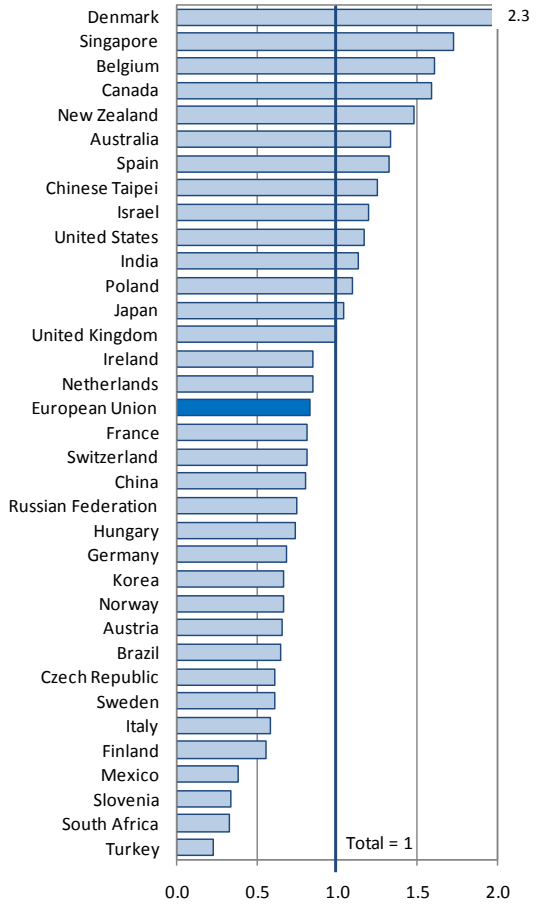
The OECD list-based definition of biotech includes seven categories, and respondents are usually given a write-in option for new biotechnologies that do not fit into any of the categories. A firm that reports activity in one or more of the categories is defined as a biotech firm. See van Beuzekom and Arundel (2006) for the list-based definition.

Patents in biotechnology are currently identified using the following list of IPC codes:
A01H1/00, A01H4/00, A61K38/00, A61K39/00, A61K48/00, C02F3/34, C07G(11/00,13/00,15/00), C07K(4/00,14/00,16/00,17/00,19/00), C12M, C12N, C12P, C12Q, C12S, G01N27/327, G01N33/(53*,54*,55*,57*,68,74,76,78,88,92)].

Share of biotechnology patents in total patents - %



Revealed technological advantage in biotechnology[1], 2003-05



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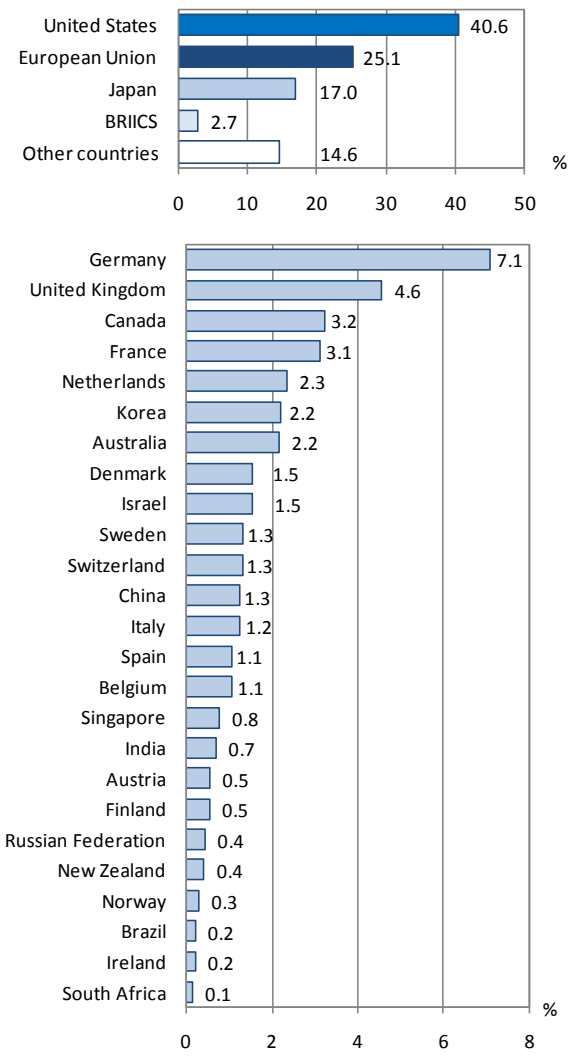
1. Share of biotechnology in the country's patents relative to share of biotechnology in total patents. Only countries/economies with more than 250 patents over the period are included in the graph.

Sources: OECD, Patent Database, June 2008;
EPO Worldwide Statistical Patent Database, October 2007.

Share of countries in biotechnology patents 2005



Top 40 regions[1] in biotechnology patents 2003-2005

Region		Biotechnology patents	Share *(%)* in total
San Jose-San Francisco-Oakland	US	1 284	5.7
Boston-Worcester-Manchester	US	1 148	5.1
New York-Newark-Bridgeport	US	869	3.8
San Diego-Carlsbad-San Marcos	US	720	3.2
Tokyo	JP	699	3.1
Washington-Baltimore-Northern Virginia	US	665	2.9
Los Angeles-Long Beach-Riverside	US	445	2.0
Philadelphia-Camden-Vineland	US	443	1.9
Kanagawa	JP	414	1.8
Denmark	DK	395	1.7
Israel	IL	364	1.6
Raleigh-Durham-Cary	US	326	1.4
île de France	FR	319	1.4
Osaka	JP	308	1.4
Düsseldorf	DE	307	1.4
Capital region (Seoul - Incheon - Gyeonggi-do)	KR	276	1.2
Ontario	CA	254	1.1
Ibaraki	JP	253	1.1
Oberbayern	DE	250	1.1
East of England	GB	223	1.0
Köln	DE	207	0.9
South East (England)	GB	202	0.9
Kyoto	JP	190	0.8
Seattle-Tacoma-Olympia	US	189	0.8
Berlin	DE	181	0.8
Minneapolis-St. Paul-St. Cloud	US	178	0.8
Québec	CA	173	0.8
Houston-Baytown-Huntsville	US	173	0.8
Denver-Aurora-Boulder	US	169	0.7
Madison-Baraboo	US	164	0.7
Chicago-Naperville-Michigan City	US	154	0.7
St. Louis-St. Charles-Farmington	US	152	0.7
Rhône-Alpes	FR	149	0.7
London	GB	142	0.6
Detroit-Warren-Flint	US	142	0.6
Victoria	AU	140	0.6
Chiba	JP	139	0.6
Hyogo	JP	133	0.6
Atlanta-Sandy Springs-Gainesville	US	128	0.6
New South Wales	AU	125	0.6

➔ Patent counts are based on the priority date, the inventor's country of residence and use fractional counts on PCT filings at international phase (EPO designations). BRIICS refers to Brazil, China, India, Indonesia, Russian Federation and South Africa.

1. The regional breakdown is presented at NUTS 2 level, except for Japan (NUTS 3), the United Kingdom (NUTS 1) and the United States (TL3). In this breakdown, smaller countries such as Denmark and Israel are treated as regions.

Sources: OECD, Patent and REGPAT Databases, June 2008 and EPO Worldwide Statistical Patent Database, October 2007.

- In 2003-05, four US regions shared the lead in biotechnology patenting: in California, the areas of San Jose/San Francisco (1 284 patents) and San Diego (1 148), and on the east coast, the regions of Boston (869) and New York City (720). These four regions account for more than 17% of all international applications in biotechnology and 42% of the biotechnology patents originating from the United States.
- Tokyo is the top-ranking region in Japan with almost 700 patents taken over the period 2003-05, and is fifth among all biotechnology patenting regions. The prefectures of Kanagawa and Osaka contributed to 414 and 308 biotechnology patents, respectively. In the European Union, Denmark (considered as one region) had nearly 400 biotechnology patents, followed by Ile de France and the German region of Düsseldorf with over 300 patents each.

2.4. Patents in environment-related technologies

- Investment in "clean" technologies can help achieve a wide range of environmental objectives, from mitigating climate change, to controlling air and water pollution, and enhancing resource efficiency in general. Patents taken in renewable energy technologies or in techniques for controlling automobile emissions contribute to the development of clean technologies.

- Patenting of inventions related to renewable energy has grown continuously, especially since the mid-1990s. On average, the proportion of PCT filings to protect renewable energy technologies in all patents increased in most countries, especially the European Union and Japan. However, the level of patenting in renewable energy remains low: about 700 international patent applications were filed in 2005.

- Three generations of renewable energy technologies can be distinguished (International Energy Agency, 2006): first-generation technologies, which have already reached maturity (hydropower, biomass combustion, geothermal energy); second-generation technologies, which are rapidly evolving (solar energy, wind power, etc.); and third-generation technologies, which are currently under development (*e.g.* concentrating solar power, ocean energy, improved geothermal systems, etc.).

Patents in environment-related technology

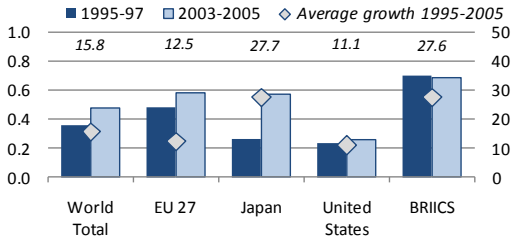
Based on an intensive review of literature, a set of keywords were identified and used to determine appropriate IPC codes which relate directly to **renewable energy** in (Johnstone *et al.*, 2008):

- **Wind:** F03D(1/*, 3/*, 5/*, 7/*, 9/*, 11/*), B06L8/00, B63H13/00
- **Solar:** F03G6/*, F24J2/*, F25B27/00, F26B3/28, H01L31/042, H02N6/00, E04D13/18, B60L8/00
- **Geothermal:** F24J003/*, F03G4/*, H02N10/00
- **Ocean:** F03B13/(12-24), F03G7/(05, 04), F03B7/00
- **Biomass:** C10L5/(42-44), F02B43/08, C10L1/14, B01J41/16
- **Waste:** C10L5/(46-48), F25B27/02, F02G5/*, F23G4/46, F01K25/14, C10J3/38, F23G7/10, H01M8/06

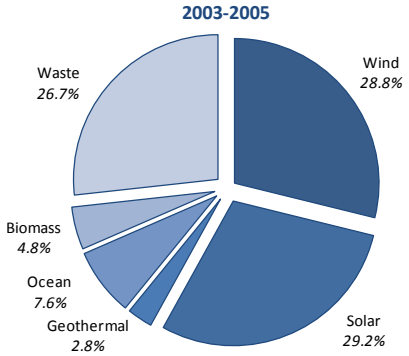
Automobile pollution control technologies comprise all technologies that are used to reduce pollutants produced and released into the atmosphere by automobiles. A total of 65 different IPC classes were identified that dealt with the purification of gases and emissions control. If three of these IPC classes are generic (B01D53/00, B01J23/00 and F01N11/00), they also include patents that are specific to automobile emissions control. Three major technology groups were categorised (Johnstone and Hascic, 2007b):

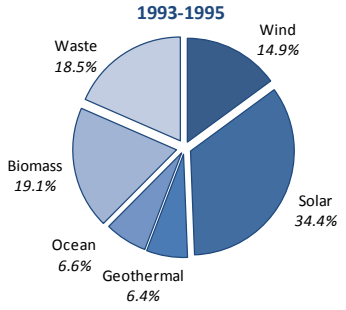
- improvements in engine (re)design (fewer emissions);
- treating pollutants produced before they are released into the atmosphere;
- reduce evaporative emissions.

Share of patents relating to renewable energy in total patents - %

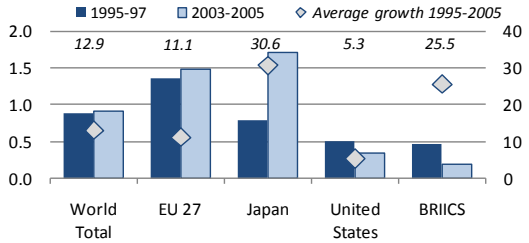


Patents relating to renewable energy by technologies





Share of patents relating to automobile pollution control technologies in total patents



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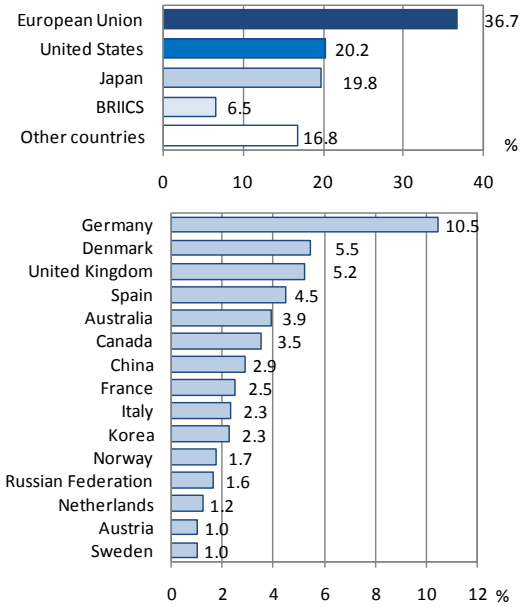
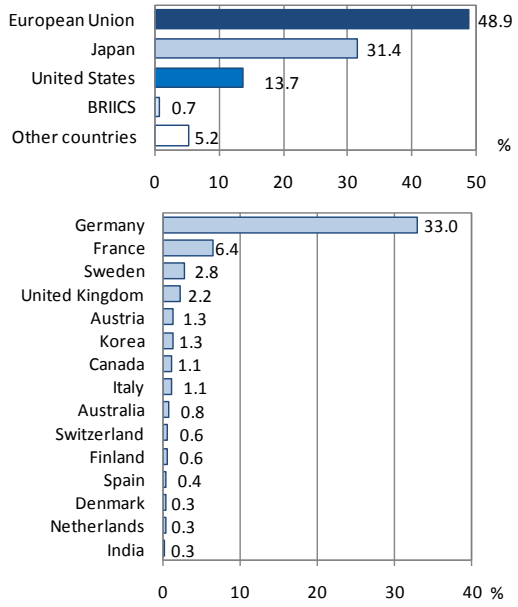
Source: OECD, Patent Database, June 2008 and EPO Worldwide Statistical Patent Database, October 2007.

Share of countries in renewable energy patents, 2005



Share of countries in patents for automobile pollution control technologies, 2005



Top 10 regions[1] in patents relating to renewable energy, 2003-2005

Region		Renewable energy patents	Share in total
Denmark	DK	161	8.7
Tokyo	JP	88	4.8
New South Wales	AU	79	4.3
Weser-ems	DE	68	3.7
Ontario	CA	54	2.9
Schlewig-Holstein	DE	53	2.9
Aichi	JP	48	2.6
San Jose-San Francisco-Oakland	US	46	2.5
Kanagawa	JP	45	2.4
Osaka	JP	44	2.4

Top 10 regions[1] in patents relating to automobile pollution control technologies, 2003-2005

Region		Car emissions control patents	Share in total
Stuttgart	DE	1 344	37.4
Aichi	JP	1 019	28.3
Saitama	JP	337	9.4
île de France	FR	311	8.6
Oberpfalz	DE	301	8.4
Kanagawa	JP	265	7.4
Tokyo	JP	194	5.4
Köln	DE	118	3.3
Oberbayern	DE	112	3.1
Gifu	JP	107	3.0

➔ Patent counts are based on the priority date, the inventor's country of residence and use fractional counts on PCT filings at international phase (EPO designations). BRIICS refers to Brazil, China, India, Indonesia, Russian Federation and South Africa.

1. The regional breakdown is presented at NUTS 2 level, except for Japan (NUTS 3), the United Kingdom (NUTS 1) and the United States (TL3).

Sources: OECD, Patent Database, June 2008 and EPO Worldwide Statistical Patent Database, October 2007.

- Large countries such as Germany, Japan and the United States have the highest number of patents in renewables. However, relative to the size of the economy, a number of smaller patenting countries appear as significant inventors in renewable energy: Denmark is the leading region with 161 patents taken between 2003 and 2005, focusing on wind energy.

- In automotive emissions control technologies, there has been a shift toward the use of more "*integrated*" abatement technologies that reduce emissions by improving fuel efficiency or by preventing emissions at the source, in a move away from post-combustion technologies such as catalytic converters and particulate filters.

- The share of automobile pollution control technologies patents in all applications has remained stable over the last ten years. However, in Japan it has more than doubled, reaching 1.7% of international patents originating from Japan. Japan is now the second-ranked patenting country in this specific technology field, behind Germany, which contributes to one-third of patent applications for automotive emissions control. Most German inventions were located in the Stuttgart region.

2.5. Patents in nuclear energy

- The number of international patents taken in nuclear energy technologies has grown at a slower pace than total applications filed under the PCT. Consequently, the relative proportion of nuclear energy patents has decreased in most countries' patent portfolios. Significant growth in nuclear energy patents was observed in Japan, the number of applications jumping from less than 20 in 1995 to nearly 130 in 2005. However, the number of patents taken in nuclear energy is low, representing less than 0.5% of all filings in 2003-05.

- The European Union contributed to nearly 35% of nuclear energy patents in 2005, followed by the United States (27%) and Japan (13%). The Russian Federation reached the sixth position, just behind Germany, France and the United Kingdom.

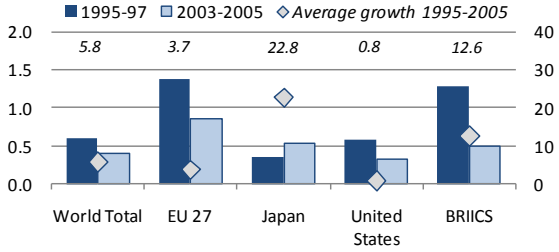
- Nuclear energy patenting can be split into two main technical fields: nuclear reactor-related technologies and technologies based on radiation acceleration or detection. Over the last ten years, most of the growth in nuclear energy patenting was in applications related to radiation acceleration/ deceleration techniques — about 75% of nuclear energy patents in 2005, against 55% in 1995.

Nuclear energy patents are identified using the following list of IPC codes:

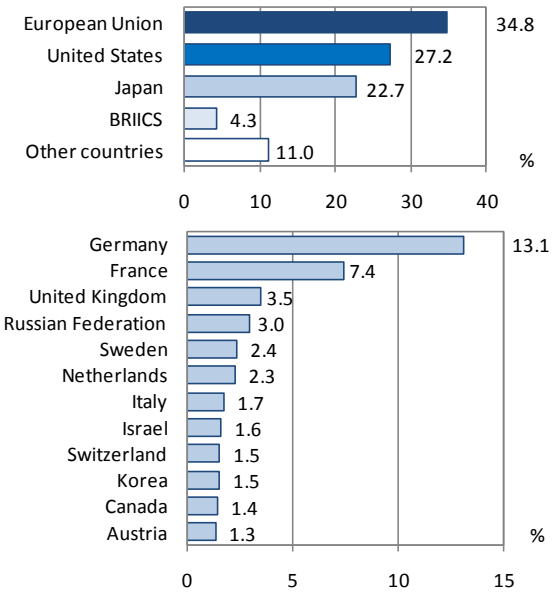
- Patents in **nuclear reactor techniques**: G21B (fusion reactors); G21C (nuclear reactor); G21D (nuclear power plant); G21F (protection against radiation).
- Patents in **radiation acceleration/detection techniques**: G01T (measurement of nuclear or x-radiation); G21G (radioactive sources); G21H (obtaining energy from radioactive sources); G21J (nuclear explosives); G21K (radiation filters); and H05H (plasma technique and acceleration of neutral molecular or atomic beams).

For further details on the IPC, 8th edition, see:
http://www.wipo.int/classifications/ipc/ipc8/?lang=en

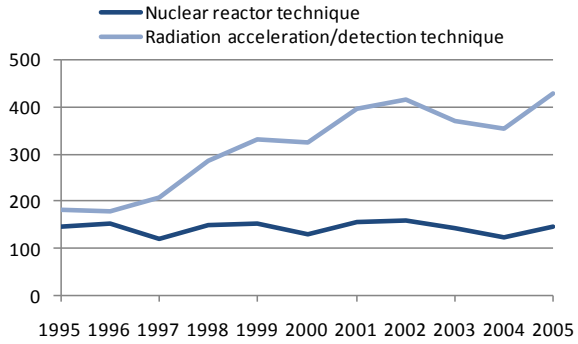
Share of nuclear energy patents in total patents - %



Share of countries in nuclear energy patents 2005



Nuclear energy patents by technical fields



➔ Patent counts are based on the priority date, the inventor's country of residence and use fractional counts on PCT filings at international phase (EPO designations). BRIICS refers to Brazil, China, India, Indonesia, Russian Federation and South Africa.

Source: OECD, Patent Database, June 2008;
EPO Worldwide Statistical Patent Database, October 2007.

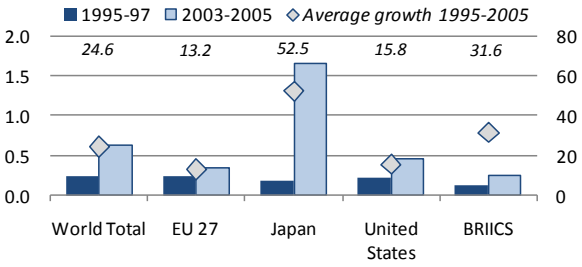
2.6. Patents in fuel cells

- About 850 patent applications in fuel cell technologies were filed by countries in 2005. There has been a sharp increase in the number of patents filed under the PCT to protect inventions on fuel cells since the mid-1990s, at an average pace of 25% a year between 1995 and 2005.

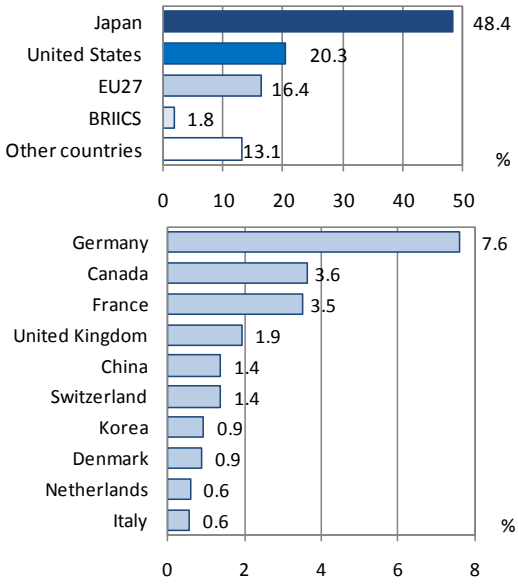
- Growth was strongest in Japan, which now contributes to the majority of patents in fuel cells. In 2005, 48% of fuel cell patents originated from Japan. Japan surpassed the United States and the European Union, which shared the lead in the mid-1990s. Germany's share in fuel cell patenting dropped from 34% in 1995 to under 8% in 2005.

- A large majority of fuel cell patents are considered as *"pure"* fuel cells (73%) — fuel cells being the main patent classification. However, fuel cells are also associated with other technologies, such as batteries (8.5% of patents), hydrogen, chemical processes, etc.

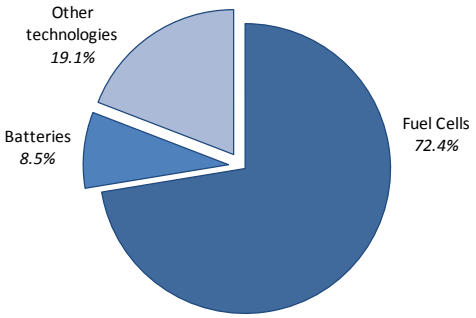
Share of fuel cells patents in total patents - %



Share of countries in fuel cells patents 2005



Share of fuel cells patents by associated technical fields, 2003-2005



Fuel cells patents are categorised by the set of IPC codes H01M8/00-24 (Fuel cells; Manufacture thereof).

Different technologies associated with fuel cells were identified according to the main IPC code listed in the fuel cells patents:

- **Fuel cells** (H01M8 as the main IPC);
- **Batteries** - unclassified Fuel cells (H01M2,4,6,10,12);
- **Other technologies**, mainly: Separation (B01D); Chemical or physical processes (B01J); Electric equipment or propulsion of electrically-propelled vehicles (B60L); Hydrogen (C01B3); Lime, Magnesia, Slag, Cements (C04B); General processes of compounding (C08J); Electrolytic or electrophoretic processes (C25B); Cables, Conductors, Insulators (H01B1).

For further details on the IPC, 8th edition, see: http://www.wipo.int/classifications/ipc/ipc8/?lang=en

➔ Patent counts are based on the priority date, the inventor's country of residence and use fractional counts on PCT filings at international phase (EPO designations). BRIICS refers to Brazil, China, India, Indonesia, Russian Federation and South Africa.

Source: OECD, Patent Database, June 2008 and EPO Worldwide Statistical Patent Database, October 2007.

3. DEVELOPMENT AND OWNERSHIP OF INVENTIONS

3.1. Patents by institutional sectors

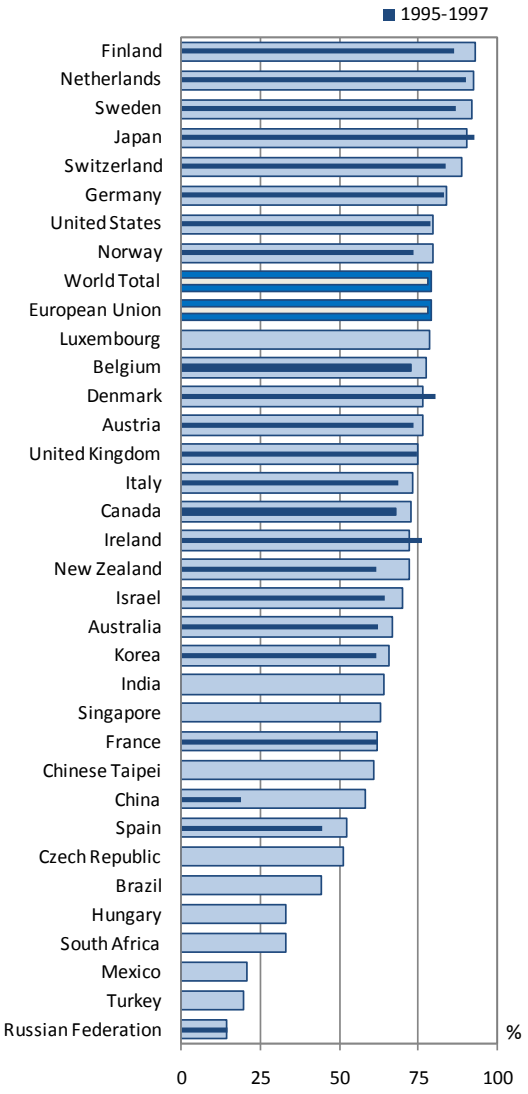
- The attribution of patents to institutional sectors confirms the domination of the private sector in patent ownership: nearly 80% of patents were owned by the business enterprise sector on average over 2003-05. The proportion is much lower in Korea (66%), France (62%) and in Spain (52%). In China, 60% of patents taken over the period 2003-05 were owned by companies, a large increase compared to 19% in the mid-1990s.
- The share of public institutions (government laboratories and universities) in the ownership of patents reflects both the strength of their technological research and the legal framework. In Sweden and, until recently, in Germany and Japan, university professors have been entitled to their own patents resulting from their research. The patents are thus registered as belonging to individuals or businesses rather than to public institutions.
- Public institutions owned 6% of all international patents filed under the PCT between 2003 and 2005. In the United States, 8% of patent applications were owned by public institutions compared to around 4% in the European Union. In Singapore, 24% of all PCT filings were owned either by the government or the higher education sector.
- Among OECD countries, Ireland had the highest proportion of patenting by universities (9.5% in 2003-05), a notable increase over the mid-1990s when universities owned less than 3%. In Belgium, Israel, Spain, the United Kingdom and the United States, the higher education sector accounts for 6 to 9% of all PCT filings.

Allocation of patents by institutional sectors

Methods for allocating an institutional sector to patents were developed in a recent project led by Eurostat, in line with the *Frascati Manual* (2002). These methods consist mainly of analysing a set of keywords ("clues" to identify the sector) in the name of the patent applicant (*Magerman et al.*, *2006*). However, the matching of name characteristics to different categories is not clear-cut for certain types of organisations and some countries.

The algorithm for sector attribution enables allocating patent documents to individuals, private enterprises, government, universities, hospitals or private non-profit organisations. A separate category for hospitals was included, as the governance under which they operate is not always straightforward.

Share of patents owned by industry,[1] 2003-2005

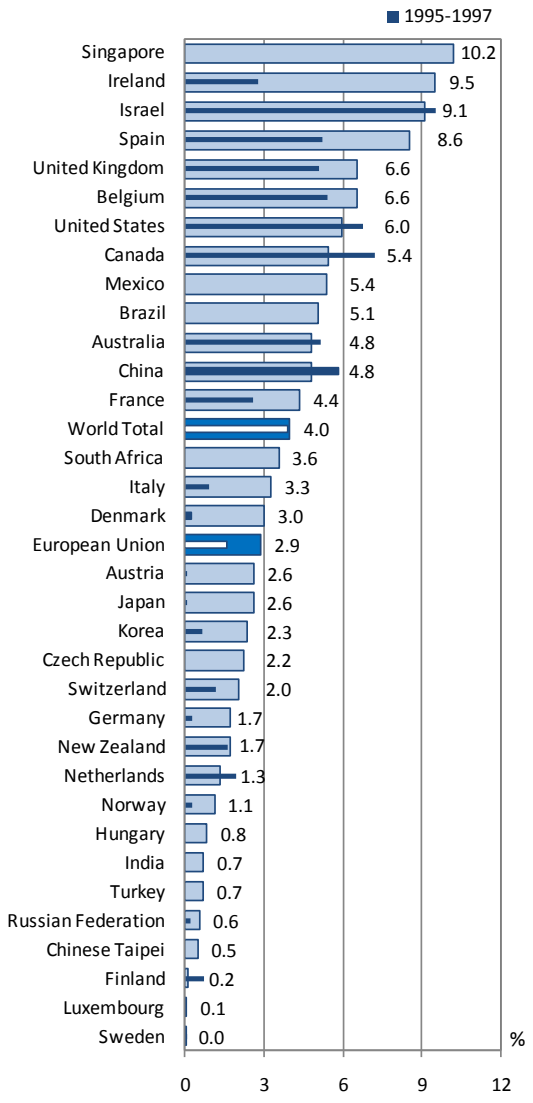


➔ Patent counts are based on the priority date, the applicant's country of residence and use fractional counts on PCT filings at international phase (EPO designations).

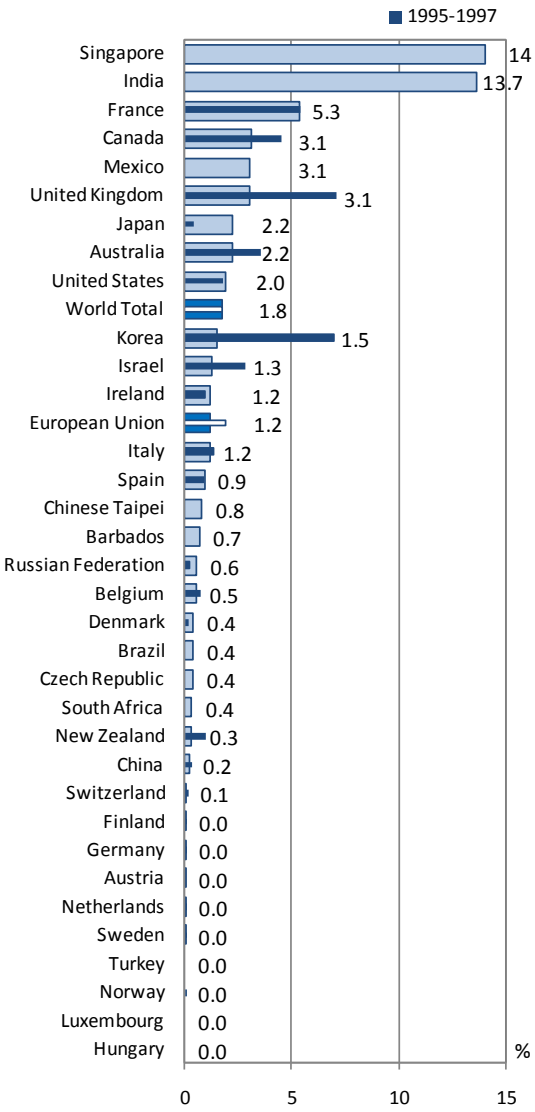
1. Patent applications are attributed to institutional sectors using an algorithm developed by Eurostat. Only countries/economies with more than 300 patents over the period are included in the graph.

Source: OECD, Patent Database, June 2008;
EPO Worldwide Statistical Patent Database, October 2007.

Share of patents owned by universities,[1] 2003-2005



Share of patents owned by government,[1] 2003-2005



➔ Patent counts are based on the priority date, the applicant's country of residence and use fractional counts on PCT filings at international phase (EPO designations).

1. Patent applications are attributed to institutional sectors using an algorithm developed by Eurostat. Only countries/economies with more than 300 patents over the period are included in the graph.

Source: OECD, Patent Database, June 2008 and EPO Worldwide Statistical Patent Database, October 2007.

- Between the mid-1990s and early 2000s, the share of patents filed by universities decreased slightly in Australia, Canada, China, Israel, Finland, the Netherlands and the United States. It increased markedly in Japan and the European Union, and most notably in Denmark, France, Italy and Ireland, as a direct result of policy changes in these countries in the early 2000s.
- In terms of patents owned by government agencies, India and Singapore take the lead, with 13.7% and 14% respectively. France leads among OECD countries with 5.3% of French patents owned by the government. In Japan, this proportion has risen significantly since the mid-1990s, whereas it decreased dramatically by more than four percentage points in Korea and the United Kingdom to levels below 4%.

3.2. Patents by industry

- As a measure of output of S&T activities, patenting by industry provides valuable information about industries' technological strengths. Patents by industry make it possible to see the link between technology and industries' economic performance.
- Most countries have comparable patent portfolios in technology industries: high-technology industries represented 50% of patents filed under the PCT in 2003-05, against 35% for medium-high technology industries. In the European Union, medium-high R&D-intensive industries are more important in total patenting than in Japan and the United States, where patenting in high-technology industries is stronger.
- On the other hand, breaking down countries' patent portfolios by industry shows the emergence of new producers of high technology. China, Israel and Singapore report the highest share of patenting activity in high-technology industries, notably "office accounting and computing machinery", "radio, television and communication equipment" and "pharmaceuticals". However, the concordance table used did not allow to evaluate the number of patents taken in the "aircraft and spacecraft" industries, which belong to the list of high-technology industries.

Linking technology to industry in patents

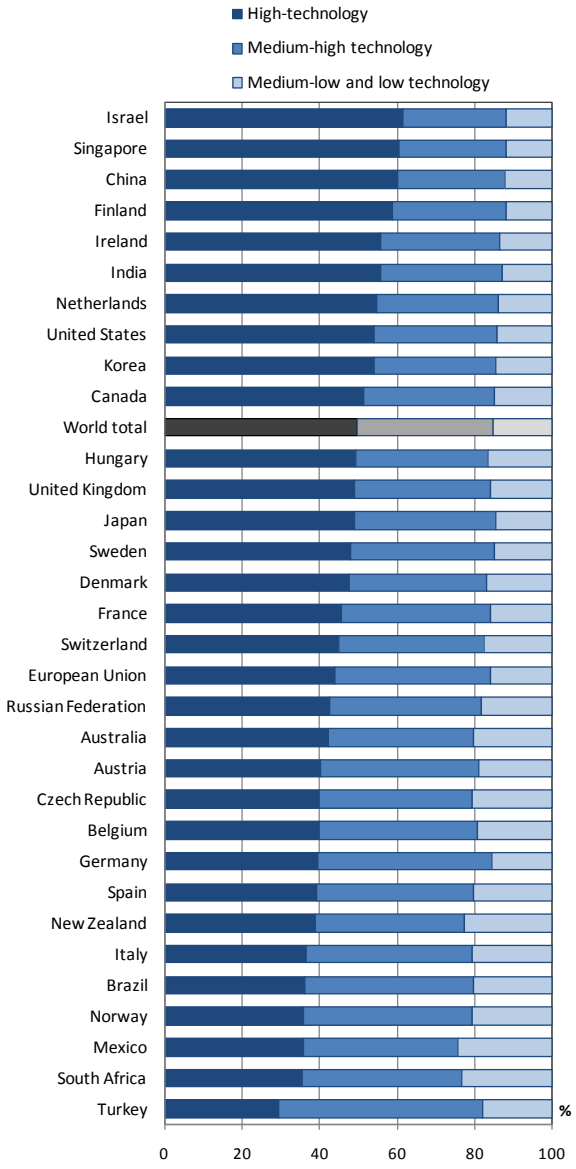
Because patents are classified according to the IPC and based on technological categories, they cannot be directly translated into industrial sectors. In order to establish a link between technology patenting and industries (using NACE, ISIC, etc.), different concordance tables have been developed.

As explained by Schmoch *et al.* (2003), a reliable concordance must meet the following conditions: international comparability; adequate level of disaggregation; strong empirical basis; and easy applicability to specific problems.

In addition, as technologies change and industries find new uses for them, the concordance table would need to be updated regularly. The concordance table used in this section was developed by Schmoch *et al.* in 2003.

However, many efforts are currently being undertaken to match patent data with company level data. This involves cleaning company names, identification and matching with company-level databases (*e.g. Amadeus, Compustat*). Matching firm-level databases will allow to properly identify the industrial sector code of patentees, opening the door to further improvement of existing concordance tables (see *Hall, Jaffe and Trajtenberg* (2001 and 2005) and *Thoma et al.* (2008).

Share of industries in patenting, 2003-2005



➔ Patent counts are based on the priority date, the inventors' country of residence and use fractional counts on PCT filings at international phase (EPO designations).

1. Only countries/economies with more than 350 patents over the period are included in the graph.

Source: OECD, Patent Database, June 2008.

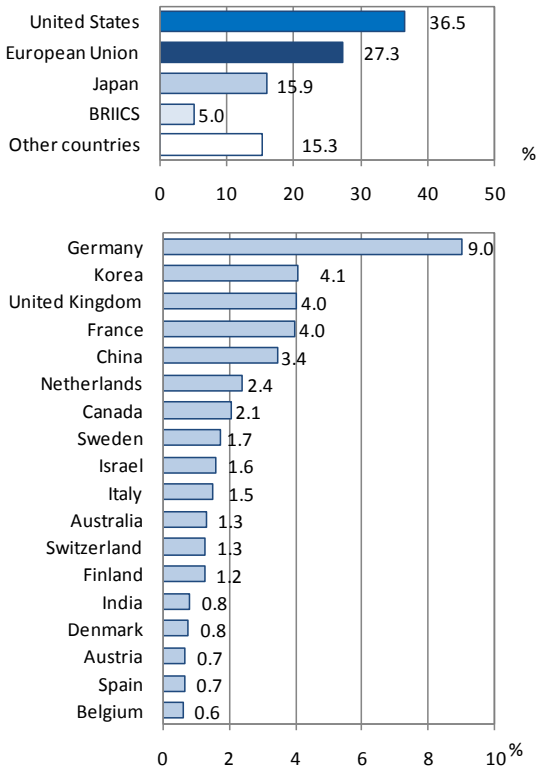
- The United States was the leader in patenting activities in high-technology industries in 2005, with 36.5% of all patents relating to this field. The European Union and Japan followed with 27% and 15%, respectively. Germany ranks as the third country for patenting in high-technology industries. The contributions of the United States and the European Union have decreased in comparison to their relative shares of 47% and 36% in 1995.

- The proportion of patents in high-technology industries has risen significantly since the mid-1990s in Asian countries. China, India, Japan and Korea report higher country shares in patenting in high-technology industries than in 1995. In 2005, almost 8% of patenting in high-technology industries was due to China and Korea, compared to less than 1% in 1995.

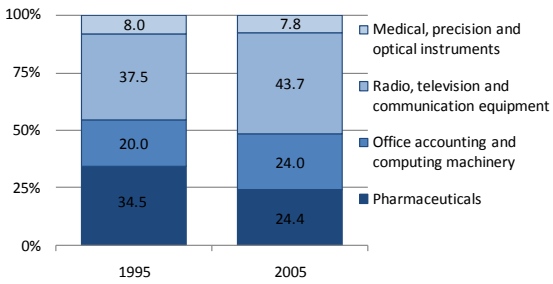
- The increase of patenting in high technology can mainly be explained by the surge in communication equipment industries, which represented nearly 44% of high-technology industries patenting in 2005. This figure compares to 38% in the mid-1990s. Patenting by pharmaceutical industries grew at a slower pace than other high-technology industries, by 9% a year on average between 1995 and 2005, whereas growth of 13% to 15% a year was estimated for other industries.

- China, India, Korea and Japan report the highest growth of patenting in the "radio, television and communication equipment" and "office accounting and computing machinery" industries since the mid-1990s, ranging from around 25% in Japan to more than 50% for both industries in China and in India. In the European Union and the United States, patenting in these two industries rose by 10-12% a year over the same period.

Share of countries in high-technology manufacturing industries, 2005



Share of high-technology patenting by industries



➔ Patent counts are based on the priority date, the inventors' country of residence and use fractional counts on PCT filings at international phase (EPO designations). BRIICS refers to Brazil, China, India, Indonesia, Russian Federation and South Africa. Breakdown by industry is based on Schmoch *et al.* (2003) concordance with IPC codes.

Source: OECD, Patent Database, June 2008.

4. INTERNATIONAL CO-OPERATION IN PATENTING ACTIVITIES

4.1. Cross-border ownership

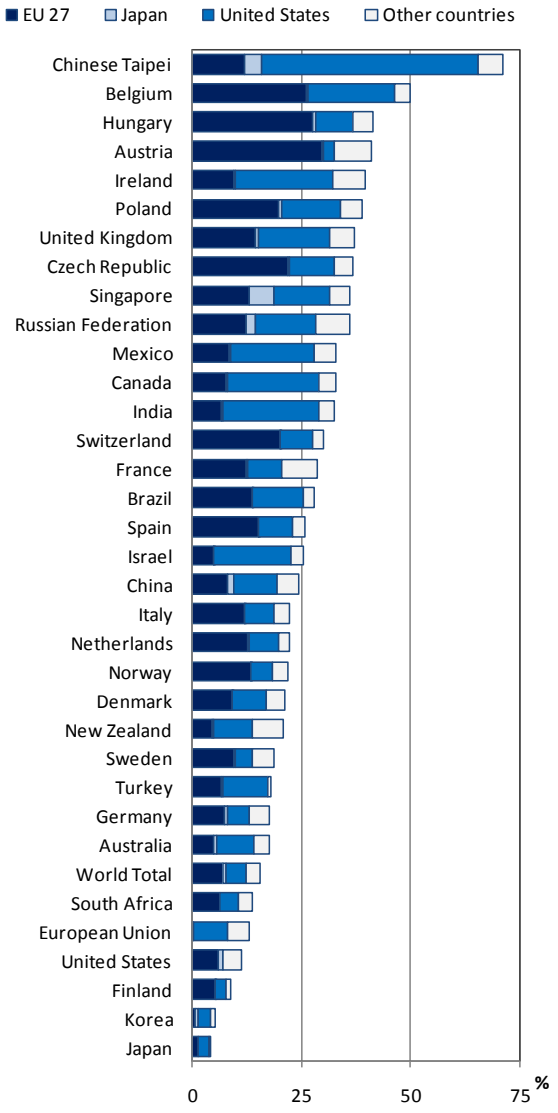
- The technological activities of multinational firms are increasingly internationalised. In the search for new technological competences, better adaptation to markets and lower research and development costs, companies are moving research activities overseas more intensively.
- On average, 15.7% of all patent applications filed under the PCT were owned or co-owned by a foreign resident in 2003-05, two percentage points higher than the level of 1993-95. The extent of internationalisation as reflected in foreign ownership of patents varies substantially across countries/economies. In Chinese Taipei and in Belgium, over 50% of patents for local inventions belong to foreign residents. Korea and Japan report the lowest ratios in 2003-05 (5.4% and 4.4%, respectively).
- The United States is the preferred foreign patent owner for many countries, such as Canada, India and Israel, with over 60% of foreign ownership of patents due to the US. Inventions originating from European countries are mostly owned by other European countries.

Patents as indicators of the internationalisation of S&T activities - Patent documents indicate the names of inventor(s) and applicant(s) — the owner(s) of the patent at the time of application — along with their address(es) and thus their country or countries of residence. In most cases, the applicant is an institution (generally a firm, university or public laboratory), but sometimes an individual.

An increasing share of patent applications is owned or co-owned by applicants whose country of residence is different from the country of residence of the inventor(s). The growing cross-border ownership of inventions basically reflects two motivating factors for companies to internationalise their S&T activities (Guellec and van Pottelsberghe, 2001): the need to adapt products and processes to host markets ("asset-exploiting" strategies) and to acquire new knowledge assets ("asset-seeking" strategies). Cross-border ownership is mainly a result of the activities of multinationals; the applicant is a conglomerate and the inventors are employees of a foreign subsidiary. Patent data thus make it possible to track the international circulation of knowledge from "inventor" countries to "applicant" countries.

The internationalisation measures (of S&T activities) presented here relate to foreign ownership of domestic inventions and its mirror image — domestic ownership of inventions made abroad. The first evaluates the extent to which foreign firms control domestic inventions. The second assesses the extent to which domestic firms control inventions made by residents of other countries.

Foreign ownership of domestic inventions[1]
2003-2005



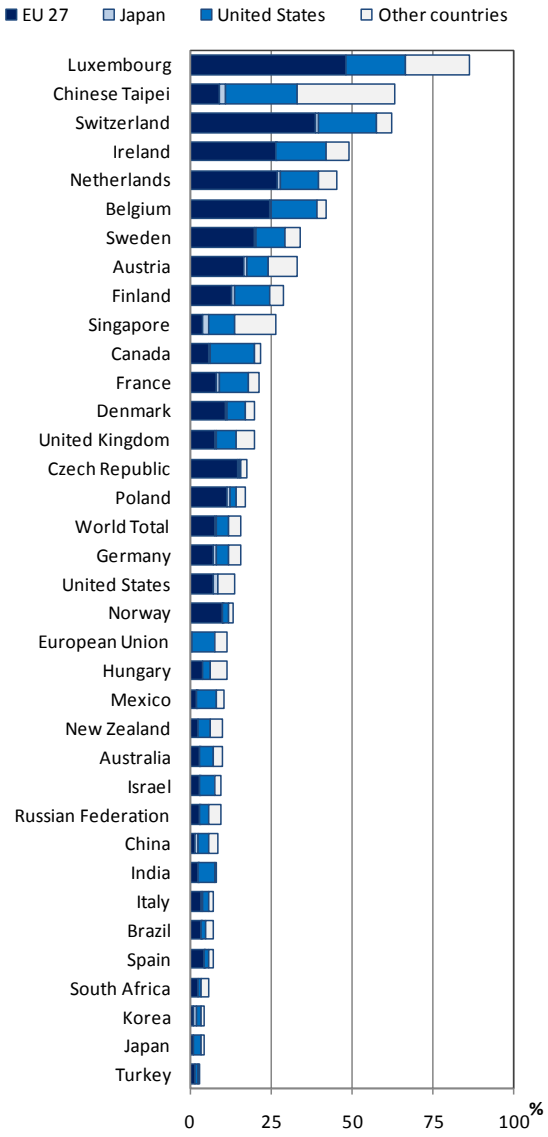
➔ Patent counts are based on the priority date, the inventor's country of residence and use simple counts on PCT filings at international phase (EPO designations).

1. Share of PCT filings owned by foreign residents in total patents invented domestically. Only countries/economies with more than 300 patents over the period are included in the graph. The EU is treated as one country; intra-EU co-operation is excluded.

Source: OECD, Patent Database, June 2008.

- The indicator on domestic ownership of inventions made abroad evaluates the extent to which local firms control inventions made by residents of other countries. In the early 2000s, most economies became more strongly involved in cross-border inventive activity.
- The share of foreign inventions in patents owned by domestic companies rose nearly two percentage points in 2003-2005, as compared to the mid-1990s. The share has more than doubled in Finland and Sweden. A significant rise was also reported for Belgium, France, Germany and New Zealand.
- Between 2003 and 2005, 86% of patents owned by Luxembourg concerned inventions made by foreign inventors. The proportion is above 60% in Chinese Taipei and Switzerland. Japan, Korea and Turkey report the smallest shares of inventions made abroad (less than 5%).
- As regards main locations, 44% of inventions with cross-border ownership in 2003-05 were by inventors located in the European Union, twice the number of inventions by inventors in the United States. The breakdown by country shows that geographical and cultural proximity are important in the choice of location for the partner's research facilities. European countries own inventions in other European countries more frequently than elsewhere. When intra-European co-operation is excluded, the United States is the leading location.
- Non-European countries — notably Australia, Canada, China, India, Israel and Mexico — own more patents with inventors from the United States than with European inventors. Exceptions are Brazil and South Africa, where over 40% of patents were invented in the European Union. 14% of patents owned by Korea were invented in Japan between 2003 and 2005.

Domestic ownership of inventions made abroad,[1] 2003-2005



➔ Patent counts are based on the priority date, the applicant's country of residence and use simple counts on PCT filings at international phase (EPO designations).

1. Share of PCT filings invented abroad in total patents owned by country residents. Only countries/economies with more than 300 patents over the period are included in the graph. The EU is treated as one country; intra-EU co-operation is excluded.

Source: OECD, Patent Database, June 2008.

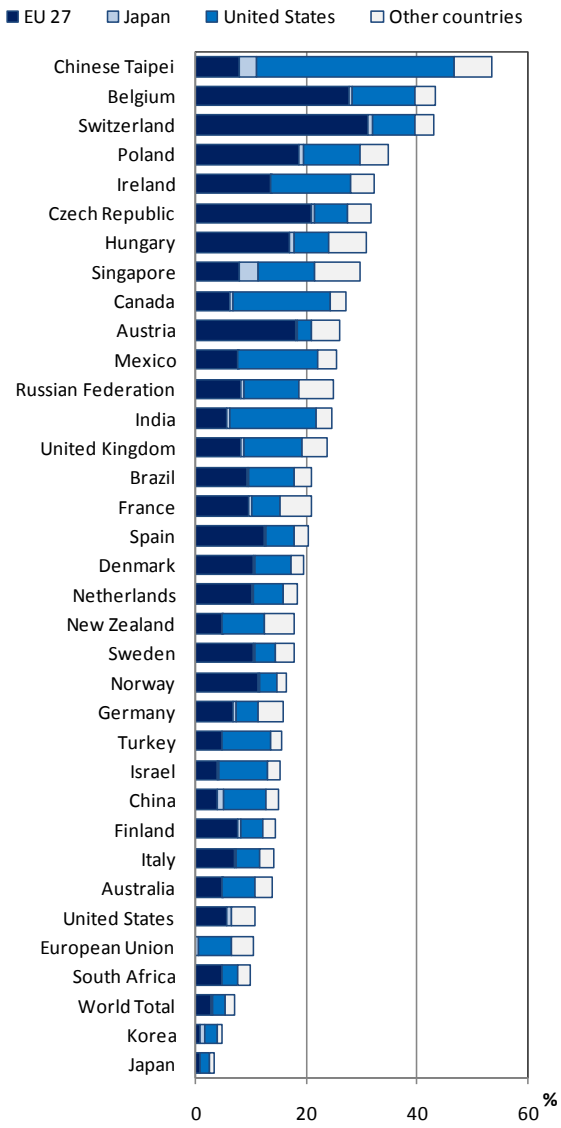
4.2. International co-inventions

- International co-operation is a particular aspect of the globalisation of research activities. The world share of patents involving international co-inventions increased from 5.8% in the mid-1990s to more than 7% in 2003-05.
- The extent of international co-operation differs significantly between small and large countries. Co-invention levels are particularly high in Belgium, the Czech Republic, Ireland, Hungary and Poland, with more than 30% of patents co-invented with a foreign inventor. On average, small and less developed countries engage more actively in international collaboration, reflecting their need to overcome limitations due to the size of internal markets and/or a lack of necessary infrastructure to develop technology.
- In large countries, the level of co-operation varies. France, Germany, the United Kingdom and the United States report international collaboration ranging from 11% (United States) to 27% (United Kingdom). The degree of co-operation has increased markedly in these countries when compared with the mid-1990s. In the United Kingdom, the share of patents for international co-inventions rose by 10 percentage points, reaching nearly 24% over 2003-05. Japan and Korea have the smallest shares of international co-inventions, lower than in the mid-1990s.
- Breaking down collaboration by main partner country reveals similar patterns to those reported for cross-border ownership. On one hand, European countries tend to co-operate the most with other European countries. On the other hand, Australia, Canada, China, India, Israel, Japan Korea, Mexico and New Zealand co-operate mainly with the United States. The United Kingdom has almost the same level of collaboration with European countries as with the United States.

International co-inventions in patenting

Another measure of international co-operation relates to the share of patents involving inventors with different countries of residence. As inventors in different countries also differ in their specialisation and knowledge assets, they look for knowledge beyond national boundaries to overcome a lack of technological resources. International collaboration by researchers can take place either within a multinational corporation (providing research facilities in several countries) or through a research joint venture among several firms or institutions (collaboration between universities or public research organisations).

Share of patents with foreign co-inventors,[1] 2003-2005



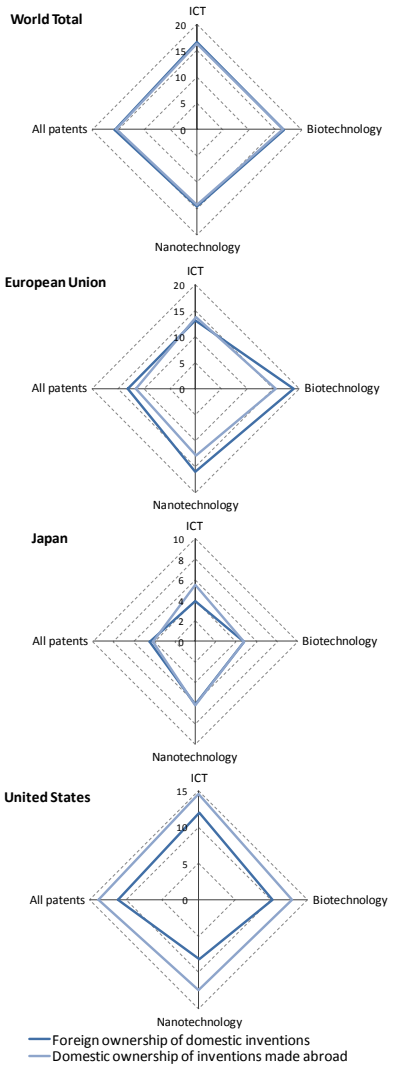
➔ Patent counts are based on the priority date, the inventor's country of residence and use simple counts on PCT filings at international phase (EPO designations).

1. Share of PCT filings with at least one foreign co-inventor in total patents invented domestically. Only countries/economies with more than 300 patents over the period are included in the graph. The EU is treated as one country; intra-EU co-operation is excluded.

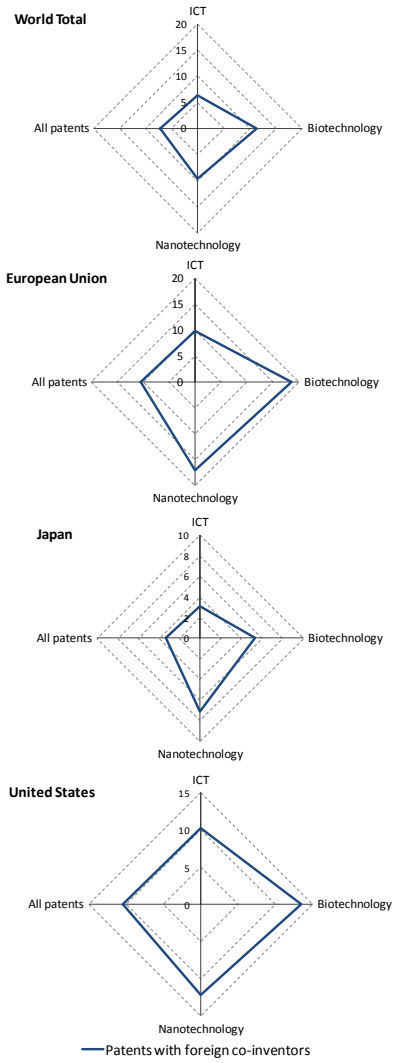
Source: OECD, Patent Database, June 2008.

4.3. Internationalisation of patenting activity by technology fields

Cross-border ownership of patents[1] *(%)* 2003-2005



Patents with foreign co-inventors[1] *(%)* 2003-2005



➔ Patent counts are based on the priority date, the inventor's (resp. applicant's) country of residence and use simple counts on PCT filings at international phase (EPO designations).

1. Indicators are defined on pages 28-30. Definitions of the technology fields are given in section 2. The EU is treated as one country; intra-EU co-operation is excluded.

Source: OECD, Patent Database, June 2008.

- The average level of cross-border ownership is equally distributed regardless of technology field. However, at country level specific behaviours come to light. In the European Union, the rate of cross-border ownership is the strongest in biotechnology patenting, whereas Japan co-operates more in the nanotechnology field. In the United States, the ICT sector reports the highest share of locally owned patents for foreign inventions.
- International co-inventions are more frequent in fields such as biotechnology and nanotechnology than in ICT-related patents. Over 18% of biotechnology patents from the European Union are the result of international co-operation, whereas this concerns only 10.5% of all EU patents and 9.8% of ICT patents originating from the EU.
- Japan is among the leading countries in nanotechnology patents, of which over 7% were co-invented with foreign researchers. This collaboration ratio is more than double Japan's average co-invention share (3%).

5. PROTECTION OF INVENTIONS

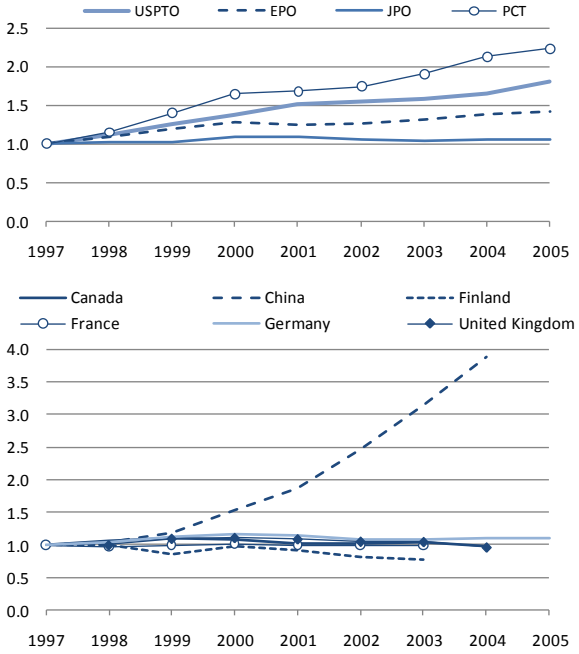
5.1. Trends in national patenting

- The number of patent applications filed to the four major patent offices worldwide has grown steadily since the mid-1990s. Patents filed under the PCT represent the largest increase (10% a year on average between 1997 and 2005), whereas the EPO and USPTO report an increase in number of filings of 5% and 8%, respectively. The number of JPO patents remains stable, with growth of less than 1% observed over the last ten years.
- Over the same period, there has been a surge in patent requests in China. In 2004, the number of patents filed to the State Intellectual Property Office of People's Republic of China (SIPO) exceeded 150 000, whereas about 40 000 applications were filed in 1997. Patenting activity in intellectual property offices in Europe remains at a stable level when the number of EPO designations to these countries is not added to patent counts.
- At national patent offices, a majority of patents are taken by residents of the country. In the early 2000s, 55% of patent applications filed at the USPTO originated from US residents. In Japan, local residents accounted for 73% of JPO filings. Canada and China are exceptions. In Canada, only 12% of patents are taken by residents; due to the proximity of the US market, Canadian residents tend to apply directly to the USPTO. In China, 60% of patents were filed by inventors from abroad, a large share due to the increasing weight of the Chinese market.

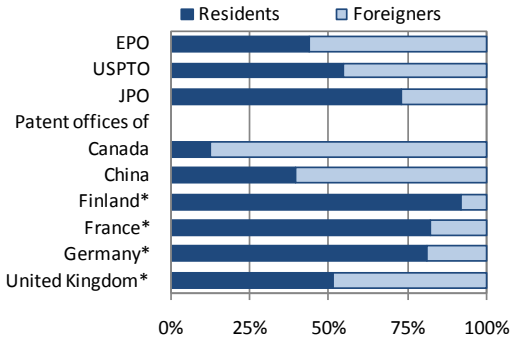
Patent indicators based on a single patent office

Indicators derived from the number of patents filed at a single patent office — whether national, regional or international — reflect to some extent the attractiveness of the region where the patent is filed. However, such indicators can have certain drawbacks that limit cross-comparisons of data from patent offices, in addition to the shortcomings described in Annex A. Patents applied for in different countries depend on the rules and regulations of the office where the protection is sought: certain technologies or innovations may not be patentable at one national intellectual property office, but may be recognised by others (*e.g.* software, genetic sequences, etc.). Furthermore, trend analyses are sensitive to changes in patent law over the years: the protection afforded to patentees worldwide and the growing list of technologies covered are likely to give companies more incentive to patent.

Trends in patent applications to selected national[1], regional or international offices 1997=1



Share of countries in patent offices[1], 2000-2005 or closest available years



➔ Patent counts are based on the priority date, the inventor's (or applicant's) country of residence by patent offices. JPO and USPTO data use the application date.

1. For a full picture of the national situation of EPO members (*), EPO filings designating these countries should be added to foreign filings to the national offices.

Sources: OECD, Patent database, June 2008;
EPO Worldwide Statistical Patent Database, October 2007;
USPTO patent statistics reports;
IIP Patent Database, 2006 and JPO annual reports.

5.2. Markets for protecting inventions

- EPO's Worldwide Statistical Patent Database makes it possible to track the routes taken by inventors to protect their inventions around the world. It is possible to identify priority filings (first application of a patent worldwide) and the national offices where additional protection was requested.
- However, the number of priority filings in the selected sample is biased towards Japan (almost 47% of priorities selected are due to Japan). Therefore the share of priorities for which protection is requested in Japan is extremely high (55%), whereas 22% are also filed to the USPTO and 19% to the EPO. The propensity to file for a patent under the PCT has increased since the mid-1990s (from 13% in 1997-98 to 19% in 2002-03).
- In 2002-03, North American residents tended to patent mostly with the USPTO, but also under the PCT (41% of US residents), with the EPO (34%) and the JPO (23%). China's SIPO received an increased share of requests from US residents (15%), against 8% in the late 1990s. Protection on the Korean market is also increasingly being sought.
- In Europe, protection of inventions made by residents of the European Union is mainly sought via the EPO (56%) or under the PCT (43%). The patent office of Germany received a large number of applications as compared with other European national patent offices. In 2002-03, 17% of inventions by European inventors were also patented in China. In contrast, inventions made in Asia are mainly protected on their own markets. Over 97% of priorities from Chinese or Korean inventors are only filed in the home country.

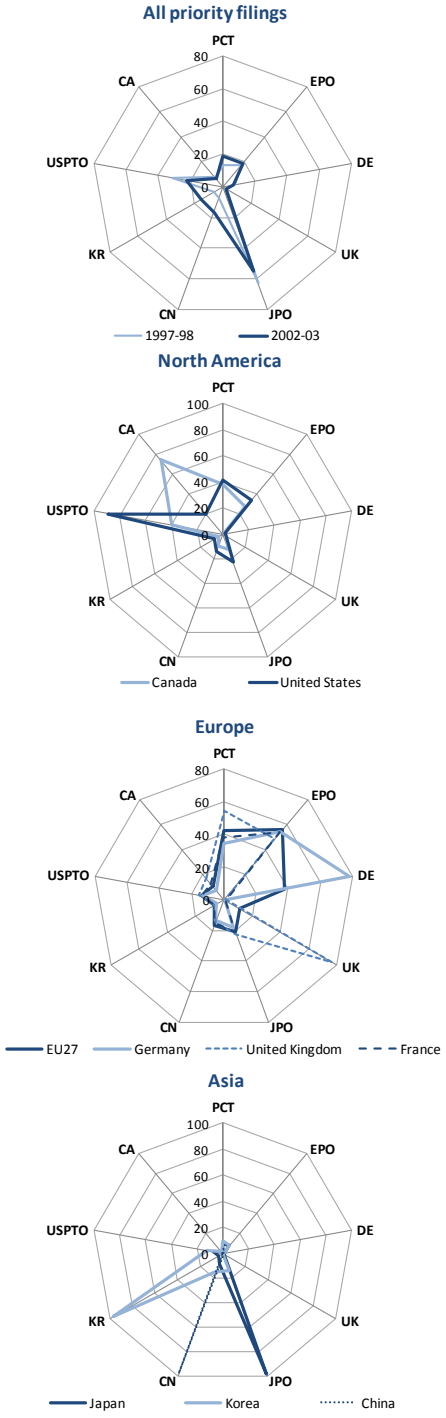
Identifying markets for protecting inventions

The statistics presented here are based on a set of priority applications extracted from the EPO's Worldwide Statistical Patent Database (October 2007). They refer to patents that were first filed or applied for at selected patent offices:

- **International**: PCT filings at the WIPO;
- **Regional**: patent applications to the EPO;
- **National**: patent applications filed at the JPO, the USPTO and national patent offices of Canada, China, Finland, France, Germany, Korea, the Netherlands, Sweden, Switzerland and the United Kingdom.

Patent offices were selected according to their level of availability and comprehensiveness in EPO's database. Counts are based on the number of priority patents of the selection that were also taken at one of the selected offices. Breakdown by country is based on inventors' country of residence. When the inventor country was missing, the applicant's country or the priority country (*e.g.* for Japan) were used as a proxy.

Share of priority filings for which protection was extended to national patent offices, average total and by inventor country, 2002-03



➔ Patent counts are based on the priority date, the inventor's or applicant's country of residence.

Source: EPO Worldwide Statistical Patent Database, October 2007.

ANNEX A. METHODOLOGICAL BACKGROUND

A patent is an intellectual property right issued by authorised bodies that gives its owner the legal right to prevent others from using, manufacturing, selling, importing, etc., in the country or countries concerned, for a period of up to 20 years from the filing date. Patents are granted to firms, individuals or other entities as long as the invention satisfies the conditions for patentability: novelty, non-obviousness and industrial applicability. In return for the rights, the applicant must disclose information relating to the invention for which protection is sought.

Patents as indicators of science and technology activities

Patent indicators convey information on the output and processes of inventive activities. Patent statistics allow to measure the inventiveness of countries, regions, firms, or individual inventors, under the assumption that patents are a reflection of inventive output and that more patents mean more inventions. They are also used to map certain aspects of the dynamics of the innovation process (*e.g.* co-operation in research, diffusion of technology across industries or countries, etc.), or of the competitive process (the market strategy of businesses); they are also used to monitor the patent system itself. Patents are also useful for tracking globalisation patterns. Patents can also be considered as an intermediate step between R&D (upstream) and innovation (which means that the invention is used in economic processes downstream). Patent data have advantages and disadvantages in their ability to reflect inventive activities, notably:

Advantages	Drawbacks
• Patents have a close (if not perfect) link to inventions; • Patents cover a broad range of technologies on which there are sometimes few other sources of data (*e.g.* nanotechnologies); • Each patent document contains detailed information on the inventive process; • Patent data are quite readily available (now electronically) from national and regional patent offices; • The coverage of patent data in terms of space and time is unique (nearly all countries in the world, back to the 19th century in most OECD countries).	• Not all inventions are patented; • The propensity to file patent applications differs significantly across technical fields; • The value distribution of patents is highly skewed: many patents have no industrial application, whereas a few are of very high value; • Differences in patent law and practice around the world limit the comparability of patent statistics across countries; • Changes in patent laws over the years call for caution when analysing trends over time; • Patent data are complex, as they are generated by complex legal and economic processes.

Most of the limitations outlined above can be overcome by applying appropriate methodologies to limit their impact. The OECD focuses on developing patent indicators that can be used to address various policy issues, in combination with other science and technology indicators. Most indicators presented in the 2008 Compendium of Patent Statistics provide a measure of inventive output, reflecting the inventive performance of countries, regions, technologies, etc. Additional indicators are used to measure the level of internationalisation and international collaboration across countries, and also to try to identify markets for technologies.

Criteria for counting patents

Patent statistics can only be interpreted in a meaningful way if there is adequate knowledge of the criteria and methodologies used to compile them. The decision to select one criterion over another is dependent on the phenomena that are to be measured, and also on user needs. The most common basic methodological choices concern the reference date and the country of attribution of the patent.

Reference date

• **Priority date:** first date of filing of a patent application, anywhere in the world, to protect an invention. It is the earliest and therefore closest to the invention date.	*This date does not depend on the administrative process of the patent office or the procedure used to file the patent application.*
• **Application date:** date when a patent is filed at a specific patent office. There is usually a 12-month lag between residents and foreigners. The lag extends up to 30 months for PCT procedures.	*Introduces bias between residents and foreigners. The latter usually first file a patent application at their domestic office (the priority office) and later in other countries.*
• **Publication date:** the time when information about the invention is disclosed to the general public and made available to statisticians.	*Occurs generally 18 months from the priority date, except for certain applications to the USPTO that were published only if/when granted.*
• **Grant date:** date when the patent rights are conferred to the applicant by the authorised body. Grant may occur on average after three years at the USPTO, five years at the EPO, but can take up to ten years in some cases.	*Introduces a time lag (and a bias) depending on the patent office. Furthermore, the information reported is old, and it refers to inventions from different years.*

Reference country

• **Applicant's country of residence:** designates the "ownership" or control of the invention.	*Reflects the innovative performance of a given country's firms, regardless of where their research facilities are located.*
• **Inventor's country of residence:** the address given in the patent document is usually the professional address of the inventor (laboratory etc.).	*Indicates the inventiveness of the local laboratories and labour force of a given country.*
• **Priority office:** country where the first application was filed, before protection is extended to other countries.	*Indicates the attractiveness of a country's patenting process, the quality of intellectual property regulations, the reputation of the patent office and general economic features (*e.g. *market size).*

Most indicators in this compendium are presented according to the priority date and the country of residence of the inventors. The applicant's residence country is used for measuring patenting by type of institution and cross-border analysis. When patents have multiple inventors from different countries, these patents are either partly attributed to each country mentioned *(fractional count)* or fully attributed to every relevant country *(simple count)*, thus generating multiple counting at an aggregate level. In general, fractional counting procedures are used to compute counts by countries, but the alternative is sometimes preferable, as with indicators on international co-operation.

Nowcasting patent indicators

In spite of their value in providing a good measure of technology output, indicators based on patents are often criticised for being outdated. Using the priority date as a reference date might be considered to weaken the timeliness of the patent indicators for data users; this issue arises from a question of labelling of published statistics. While patent statistics based on the grant date may appear more up to date, they do not indicate the date of the invention.

The issue of timeliness arises because of the legal delays faced by a patent application before its content is publicly released. In most patent offices a patent application is usually published within 18 months of the priority date (with the exception of USPTO before 2001), or after 30 months for patent applications filed using the PCT procedure to enter the "national/regional" phase and another one to six months for the data to become available. Furthermore, with the surge in patent filings over the last ten years, patent offices are facing a heavier workload. The growing number of applications to be processed by patent examiners increases the delays in examination and patent processing, consequently generating a backlog of patent filings that have not been processed or published at the USPTO.

In order to improve the timeliness of OECD patent indicators, some patents statistics have been "now-casted" (*i.e.* estimated for the recent past) at an aggregate level for the latest years *(Dernis, 2007)*. EPO patent applications are estimated using the estimated transfer rate of PCT patents into the EPO regional phase. Triadic patent families are nowcasted up to 2005 with an econometric model based on the number of *biadic patent families* (patents filed to EPO and JPO that share the same priorities) until *t-2*, and on the number of patent applications to the EPO until *t*.

ANNEX B. PATENT DATABASES

Since the early 2000s, the OECD has been setting up a patent database that covers patent records (micro-data) for a large number of countries and patent offices. Data mainly derives from: EPO's worldwide statistical patent database; EPO Bibliographic Database and Abstracts (EBD); USPTO Patent Full-Text/APS File; and from the Japanese IIP Patent Database. A set of pre-defined indicators is regularly published on the OECD website.

Patent applications filed to patent offices worldwide

The worldwide statistical patent database, also known as "PATSTAT", was developed by the EPO in 2005, using their collection and knowledge of patent data. Much of the data is extracted from the EPO's master bibliographic database, DocDB, also known as the EPO Patent Information Resource. It includes bibliographic details on patents filed at more than 70 patent offices worldwide and covers more than 50 million documents. A broad number of fields included in patent documents are covered, such as application details (claimed priorities, application and publication), technology classes, inventors and applicants, title and abstract, patent citations and non-patent literature text, etc. However, depending on the patent office, the coverage of national data may be partial or delayed.

Source: EPO Worldwide Statistical Patent Database (PATSTAT), October 2007.

EPO patent applications and patent applications filed under the PCT, designating the EPO

All patents filed at the EPO, either directly or indirectly via the PCT procedure, are covered by this dataset, from 1978 onwards (application date). The database also provides details on patent applications filed under the PCT at international phase, designating the EPO. The data are downloaded on a weekly basis from EPO website (epoline® database), and is loaded into the OECD database system at least twice a year. This dataset includes bibliographic records on each patent document published by the EPO: priority, application, PCT when applicable, and publication data; patent status such as grant, refusal, withdrawal; list of IPC codes; English title; designated states; and inventors'/applicants' names, address and country of residence.

Source: EPO Bibliographic Database and Abstracts (EBD), May 2008.

USPTO patent grants

This dataset covers all patents that were granted by the USPTO, from 1976 onwards (date of grant). Data are downloaded weekly from USPTO's website, and major updates of the OECD patent database take place at least twice a year. This dataset includes bibliographic records on each USPTO grant: priority, application, PCT, when applicable, and publication data; list of IPC codes as well as US patent classification; title and abstract; number of claims; and inventors'/applicants' names, address and country of residence.

Source: USPTO. FTP Weekly Patent Bibliographic Raw Data, May 2007

JPO patent applications

The JPO provides the OECD with patent data on a regular basis. However, work is required to develop indicators based on the OECD methodology (*e.g.* counts based on priority date, residence of inventor, etc.). Furthermore, the IIP Patent Database was developed in 2006 jointly with the Institute of Intellectual Property of Japan (IIP) and the University of Tokyo. For further details, see Goto and Motohashi (2006).

Source: IIP, 2006.

Patents at regional level

In early 2008 the OECD set up the REGPAT database, in which patent data have been linked to regions according to the addresses of the applicants and inventors. The data have been regionalised at a very detailed level so that more than 5 000 regions are covered across OECD countries (according to the Nomenclature of Territorial Units for Statistics [NUTS] level 3 or equivalent for non-European countries). The first version of OECD REGPAT database covers patent applications to the EPO (derived from the October 2007 version of PATSTAT) and Euro-PCT patents at international phase (derived from the OECD Patent Database, May 2008). For further details on the underlying methodology, see Maraut *et al.* (2008).

Source: OECD REGPAT Database, May 2008.

European and international citation data tables

The data tables currently cover all patent applications published by the EPO and WIPO, under the PCT, from their introduction in 1978 up to July 2005. The data tables are available on CD-ROM, on request from OECD, for research use only. For further details refer to Webb *et al.* (2004).

Source: EPO.

OECD indicators on patents

A core set of indicators constructed from the OECD patent database is available on the OECD website at *www.oecd.org/sti/ipr-statistics* ("patent databases" section). The indicators are based on patents taken at the EPO, the USPTO and "triadic" patent families, as well as patents filed under the PCT. Data are broken down by main IPC classes or by selected technology fields, or by main USPC class (for USPTO and triadic patent families). Indicators of international co-operation are also provided on line: cross-border ownership of patents and international co-inventions. It is possible to extract the indicators according to different criteria: dates (priority, application, grant) and reference country (inventor and applicant country). More than 100 countries are covered, along with various zone totals. Patent indicators are also disseminated on a regular basis through various OECD publications (*e.g. Main Science and Technology Indicators; OECD Science, Technology and Industry Scoreboard,* etc.).

Source: OECD, Patent Database, May 2008.

REFERENCES

van Beuzekom, B. and A. Arundel (2006) "OECD Biotechnology Statistics – 2006", OECD, Paris.

Dernis, H. (2007) "Nowcasting Patent Indicators", *STI Working Paper* 2007/3, OECD, Paris.

Dernis, H., D. Guellec and B. van Pottelsberghe (2001) "Using Patent Counts for Cross-country Comparisons of Technology Output", *STI Review No. 27*, OECD, Paris

Dernis, H. and M. Khan (2004) "Triadic Patent Families Methodology", *STI Working Paper* 2004/2, OECD, Paris.

Griliches, Z. (1990) "Patent Statistics as Economic Indicators: A Survey", *Journal of Economic Literature*, 28(4).

Guellec D. and B. van Pottelsberghe (2001) "The Internationalisation of Technology Analysed with Patent Data", *Research Policy*, Vol. 30, Issue 8, 1253-1266.

Goto, A. and K. Motohashi (2006) "Construction of Japanese Patent Database for Research on Japanese Patenting Activities", http://www.iip.or.jp/e/patentdb/paper.pdf

Hall, B. H., A. Jaffe and M. Trajtenberg (2001) "The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools", *NBER Working Papers* 8498, National Bureau of Economic Research, Inc.

Igami, M. and T. Okazaki (2007) "Capturing Nanotechnology's Current State of Development via Analysis of Patents", *STI Working Paper 2007/4*, OECD, Paris.

International Energy Agency (2006) "Renewable Energy: R&D Priorities, Insights from the IEA Technology Programmes", IEA, Paris, France.

Johnstone, N. and I. Hascic (2007a) "Environmental Regulation and International Innovation in Automotive Emissions Control Technologies", OECD, Paris.

Johnstone, N. and I. Hascic (2007b) "Renewable Energy Policies and Technological Innovation: Empirical Evidence based on Patent Counts". OECD, Paris.

Johnstone, N. I. Hascic and D. Popp (2008) "Renewable Energy Policies and Technological Innovation: Evidence based on Patent Counts", *NBER Working Papers*, National Bureau of Economic Research, Inc.

Magerman, T., B. Van Looy and X. Song (2006) "Data Production Methods for Harmonized Patent Indicators : Patentee Name Harmonization", *Eurostat Working Paper and Studies*, Luxembourg.

Maraut, S., H. Dernis, C. Webb, V. Spiezia and D. Guellec (2008) "The OECD REGPAT Database : A Presentation", *STI Working Paper 2008/2*, OECD, Paris.

OECD (2008 *forthcoming*) *Patent Manual*, OECD, Paris.

OECD (2002) *Frascati Manual: Proposed Standard Practice for Surveys on Research and Development*, OECD, Paris.

Scheu M., V. Veefkind, Y. Verbandt, E. Molina Galan, R. Absalom and W. Förster (2006) "Mapping Nanotechnology Patents: The EPO Approach", *World Patent Information* 28, 204–211.

Schmoch, U., F. Laville, P. Patel and R. Frietsch (2003) "Linking Technology Areas to Industrial Sectors", Final report to the European Commission, DG Research, 2003.

Thoma G., *et al.* (2008 forthcoming) "Methods and Software for the HarmoniSation and Integration of Datasets: A test based on IP-related data and accounting databases with a large panel of companies at the worldwide level", *STI Working Paper*, OECD, Paris.